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CERGE-EI TACKLES TRANSITION

EDITED BY

Libor Dušek and Lubomír Lízal

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The Editors

To all those who have
believed in the ***dream****,*
created the ***reality****,*
and inspire the ***future***
that is ***CERGE-EI****.*

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INTRODUCTION

CERGE-EI Tackles Transition

Lubomír Lízal

Efficiency. Transition is about achieving efficiency. When the communist economies collapsed, there was no other option. The so-called transition countries had stocks of obsolete or even ruined capital and populations with mostly inadequate or even obsolete skills. There would be no miraculous new labor force or capital stock, no panacea. The task was to combine the existing capital and labor in a way that led to both more and higher quality output. The countries were engaged in a simultaneous search for improved allocative and X-efficiency with endowments they inherited from the failed system of the past.

The transition countries experienced between 40 and 70 years of command economic history. During that period, market forces were replaced with plans. Prices were nothing but a tool for accounting the uncountable and profit was an insult, if not a crime. In effect, the whole economy was nationalized. The private sector was virtually non-existent, and even the elderly did not know how a modern market economy worked. At best, there were distant pre-war memories of different times. Links between property and its owners were not just broken, they were forgotten. Reformers soon learned that while the rules of the game can be changed rapidly, the mindsets of people adjust slowly, if ever.

When the communists came to power, they implemented their economic, social, and political rules by brute force. Their opponents (and the descendants of their opponents) suffered in ways that our politically correct civilization can hardly imagine. Talents were wasted; ideology trumped common sense.

Mathematically, if the communist regime did X to the market economy, transition implied doing X^{-1}, the inverse. Yet, the inverse was not that simple even if it existed in its pure form. Some reform steps were easily implementable, some were not. Some were possible but hard, some even not available or applicable in a democratic society. The transition was, therefore, simultaneously a process of transforming a command economy into a market one with a broadly accepted social consensus regarding the main reform path as well as an enormous laboratory for political economy. There was no blueprint available, no prior example that could be simply copied. Everybody involved – the reformers, international advisors, local advisors, and the citizens themselves – had to learn on the fly. Therefore, transition also represents a lesson for the future: a lesson of the achievable, a lesson of the second best, and a lesson of errors. Yet, from today's perspective, it is also a lesson of success.

People do not agree on uniform measures of prosperity, and some have strong feelings about the transition process or its outcomes. Let me, however, provide just one comparison that suggests why, despite various critiques of the reforms, one must apply the word *"success"* to any characterization of the past 20 years, at least with respect to the countries that entered the European Union. The life expectancy at birth in the Czech Republic has risen from 68.1 years for men and 75.4 for women in 1989 to 74.2 and 80.1 years respectively in 2009. Nobody frowns at 6 extra years of life.

The "success-or-failure" debate regarding transition has been going on since the fall of the Berlin Wall. Much of this debate has been based on speculation, casual observation, and anecdotal evidence. It is easy to contrast individual failures and successes; yet the ability to draw general conclusions on the basis of such evidence is limited. Particular examples can illustrate but do not enable rigorous assessment. Did the highly different structures of financial markets in different countries matter for the economic performance of these countries? Did different privatization methods translate into different performance across the thousands of firms that were privatized? Did very different experiences with unemployment in early transition translate into different allocations of labor at the end? The search for scientifically well-grounded answers to such questions has occupied many economists in transition countries as well as in the West. They have been working with formal models, sophisticated econometric methods, and detailed micro data on firms, workers, and markets. An entire new field, the Economics of Transition, has sprung up. Twenty years on, the field has produced many lessons about transition as well as generated many new insights into fundamental questions of economics.

Much of the research on transition has been concentrated at CERGE-EI. Some of the lessons produced there are reproduced in this book, *CERGE-EI Tackles Transition*. The book is not a complete inventory of the knowledge produced at CERGE-EI. Rather, it should be taken as representative of the research interests and views of scholars based at CERGE-EI during the 20 years since the organization's founding.

The first chapter by Estrin, Hanousek, Kočenda, and Švejnar could just as well be the book's summary as it tries to decipher the effect of privatization, one of the cornerstones of the reform agenda. Overcoming the endogeneity of ownership was the major challenge to this research: one cannot say *a priori* whether good firms are good because a particular type of owner can properly manage them to get efficient outcomes, or whether a particular type of owner is better able to identify firms that would be more efficient irrespective of their owner. This survey paper carefully analyses a majority of the available studies (several by the authors themselves) and scrutinizes the results according to sample size, selection bias, region, time span after privatization, and treatment of endogeneity.

The results are not surprising, but they are well founded. First, privatization to foreign owners results in considerably better performance of firms virtually everywhere in the transition economies. Second, the performance effect of privatization to domestic owners has, on average, been less impressive and has varied significantly across regions, even being negative in some studies of Russia and other Commonwealth of Independent States (CIS) countries. The most important policy conclusion is that privatization *per se* does not guarantee improved performance unless accompanied by other reforms and a proper institutional framework.

The second chapter by Lízal, Singer, and Švejnar analyzes a very interesting period when markets had been liberalized, but enterprises were not yet privatized. In essence, there was a window of opportunity for the managers before new owners could institute effective governance. This lag enables an evaluation of the concept of "restructuring before privatizing", a strategy that was hotly discussed on the eve of transition. Several competing hypotheses attempted to explain the breakup of large State Owned Enterprises (SOEs). Breakups might have occurred either because top managers of SOEs discarded poorly performing divisions to improve the performance of the remaining part prior to privatization, or managers of divisions (subsidiaries) of SOEs spun off the more efficient units to themselves or their colleagues. Alternatively, given that firms created under communism were artificially large, the SOEs may have suffered diseconomies of scale such that the performance of their constituent units could be improved by unbundling. Finally, managers of subsidiaries might have benefited personally from being the top management of a firm even if their units performed worse as a result of the breakup.

After analyzing the performance of several hundred Czech companies in the early 1990s, we found that the effect of breakups on productivity was positive for small, medium, and slightly above average-sized spinoffs but negative for the very large ones. In sum, the positive, short-term effects on performance of both the master firms and the spun-off units are consistent with the hypothesis that the large SOEs suffered from inefficiencies due to firms being "too big". Because these positive effects dissipated later, however, the results are also consistent with increased competition and the appropriation of profits by managers.

Chapter 3, by Hanousek, Kočenda, and Švejnar, focuses on the issue of efficiency. Results reinforce those of the previous chapter. There are two key additional findings. First, concentrated foreign ownership (non-financial) yields superior performance in terms of growth of sales and, sometimes, profits. While the less visible effect in profits may be due to transfer pricing, the overall conclusion reflects the presence of strategic restructuring. Second, concentrated domestic ownership (in the hands of industrial companies and investment funds) reduces employment. This result can be explained by firms engaging in defensive restructuring. These findings are consistent with agency theory's prediction that concentrated ownership results in superior corporate performance and are inconsistent with theories stressing the positive effects of managerial autonomy.

The series of articles on the enterprise sector is concluded by Bena and Hanousek's study (Chapter 4) of an important issue of corporate governance during transition: the incentive of dominant shareholders to consume private benefits at the expense of minority shareholders. The authors use Czech data from 1996–2003 to assess whether this rent extraction takes place. Given that they find such rent appropriation, they further estimate whether and to what extent minority shareholders are able to monitor large shareholders to partially mitigate such behavior.

A simple indicator of a possible rent extraction is dividend policy: the higher the dividends a firm pays (holding everything else constant), the more proportionately the fruits of the firm's work are shared across all shareholders, implying that majority owners are less likely to be extracting rents at the expense of other shareholders. Bena and Hanousek find that the dividend policy depends on the concentration and domicile of ownership. In addition, the presence of a significant minority shareholder increases the target dividend payout ratio. Given this, they conclude that a significant minority shareholder can reduce the ability of a majority owner to extract rent. The results are robust to alternative definitions of key ownership variables, alternative ways of measuring the firms' investment opportunities and efficiency, and alternative estimation techniques.

A second frequently examined transition issue involves the labor market. Skills acquired under communism were typically inadequate for the new economy, with a distribution driven by the past non-market valuations and needs of the central planner. In Chapter 5, Münich, Švejnar, and Terrell estimate the returns to various kinds of human capital during both the communist period and the transition to a market system. Not surprisingly, returns to education under communism were dismal – below 3 percent per year of education. The transition brought about a major increase in the returns to education in both the private and state sectors. After the regime change there were, in general, bigger increases in the returns to education than in the returns to experience. Those who obtained vocational high school and university degrees experienced more rapid rates of increase in their returns than individuals with basic education. On the other hand, with respect to experience, men's wage-experience profile was concave in both regimes and did not change from the communist to the transition period. In sum, their results contradict the intuition that education acquired under communism was less appropriate for a market economy than education obtained after the transition began. In addition, one could not reject the hypothesis that experience obtained under communism was rewarded identically to experience obtained during the transition.

It appears from these results that the communist system was somehow able to maintain a relatively effective educational system even though this system was divorced from pecuniary rewards. Also, a large part of unobservable, individual-specific wage effects (e.g., skill premia) carried over from communism to the market economy, suggesting that the same basic skill set was valuable under each system. While the *de novo* firms in the early transition period provided considerably higher wages, state and privatized firms gradually adjusted their wage grids upward so that by 1996 wages were almost equal across sectors.

Jeong, Kejak and Vinogradov (Chapter 6) shift our attention away from education in general and towards the micro-composition of specific types of education. The authors find a serious disparity between the skills taught under communism and those needed by the market economy. Communist planners over-supplied technical specializations and under-allocated resources to training in business and consumer services when compared to the demands of a free market economy. Once the market was liberated, the share of workers in business occupations rose rapidly while those in technical fields dropped in both Poland and the Czech Republic. A similar shift was not observed in Hungary, a fact the authors attribute to that country's pre-transition introduction of market processes. Overall, estimates suggest that the gap between the structure of demand for workers and the composition of existing human capital could be responsible for an output loss of up to 40 percent of 1990 GDP.

Unemployment haunted almost all transition countries in the 1990s. The seventh chapter by Ham, Švejnar, and Terrell looks at a striking difference between the Czech and Slovak Republics. While the Czechs enjoyed a low unemployment rate of about 3–5 percent, the Slovaks faced double digit levels. Looking at labor-flow data leads to the conclusion that this differential was largely due to much higher rates of transitioning from unemployment to employment in the Czech Republic than in Slovakia. In other words, both Czechs and Slovaks were being discharged, but the Czechs were rapidly finding new jobs. The question then becomes: what were the causes of this difference in the exit rates? As the Czech and Slovak Republics shared many institutional and legal features, their situation creates almost ideal conditions for analysis: a natural experiment consisting of similar initial conditions but different treatments. Results suggest that in both republics, the unemployment compensation system has a moderately negative effect on the exit rate from unemployment. This conclusion is based on a decomposition of the determinants of the expected duration of unemployment in the two republics. For those who receive unemployment benefits, almost all of the difference in exit rates arises from differences in the level and structure of labor demand at the district level. Among non-recipients, on the other hand, differences in demographic characteristics play a more important role than differences in demand factors. The authors also argue that the results show the relative inability of the Slovak Republic (and probably also of the other Central and Eastern European countries) to absorb low-skilled, unemployed workers.

Finally, given that the unemployment compensation scheme was identical in the Czech and Slovak Republics, they estimate that this system has moderate effects on the duration of unemployment spells in these countries when compared with the effects found in studies of the United States, Canada, and Europe. This result suggests that policy makers might have been able to improve safety net provisions without endangering efficiency.

While the previous chapter takes advantage of the similarities between two related countries, Chapter 8 by Jurajda and Terrell chooses countries with different approaches to examine differences in job creation and job destruction. In particular, they contrast the more gradualist Czech with the very rapid Estonian approach to the destruction of the communist economy. Such a comparison brings into focus the theoretical predictions of two models of reallocation: gradualist theories motivated by transition from central planning and the creative-destruction-with-frictions theoretical work motivated by the adjustment crises of the developing world.

In the early stages of transition, most reallocation occurs along a single dimension whereby labor moves from existing post-soviet enterprises to small, newly created private firms. While Estonia serves as an example of a country that did not have the resources to support the ailing old sector or provide a safety net for workers, the Czech Republic serves as an example of a country where the government had the capacity to provide safety nets and/or subsidies to both slow down job destruction and support job creation. Using very different early-transition policies, the Czech and Estonian economies ended up with similar levels of sectoral reallocation. The Czechs "paid" for their lower unemployment with greater welfare benefits (hence higher taxes), whereas in Estonia many jobless workers faced unemployment with little welfare support. In sum, gradual job destruction combined with job creation support allow extensive reallocation to concur with low unemployment. Drastic job destruction, on the other hand, need not slow down job creation as long as unemployment benefits are kept very low.

The ninth chapter, by Jurajda, deals with the much-discussed male-female wage differential. A well-established fact is that occupations and industries staffed mainly by female workers pay lower wages to both men and women compared to predominantly "male" occupations and industries. The literature on gender segregation puts forward three main hypotheses for why "female" occupations pay less: (i) discriminating employers may prevent women from working in high-wage occupations; (ii) "female" occupations may offer costly non-wage characteristics preferred by women; and (iii) workers employed in "female" occupations may have lower labor quality. Thus, is the observed persistent concentration of women in low-paid groups of workers an artifact of gender segregation, or is the self-selection of women regarding jobs they desire and/or skills they choose to obtain a key explanation for the existence of the gender wage gap? The advantage of studying the gender pay gap in the transition from central planning to a market economy is that we observe dramatic changes in employment rates, which are, at least in part, exogenously driven by different transition policies. The results presented for the Czech and Slovak Republics suggest that little immediate change occurred in the structure of the wage gap with the introduction of anti-discrimination legislation, with the possible exception of a decrease in the effect of firm-level gender segregation. Yet, despite the new legislation, almost two-thirds of the gender wage gap remains unexplained, and segregation continues to represent a major source of the gap. Since segregation affects gender wage differences primarily within firms, the implementation of the anti-discrimination policies aiming to equalize wages in occupations across firms would have little effect.

One of the key features of the early stage of transition was an enormous fall in economic activity as measured by the aggregate figures. There are numerous explanations and models but I like two of them, both elegant and simple. The one I use myself says that since the real well-being of the people appears to have fallen relatively little compared to the reported 20 to 40 per cent decline in GDP, the fall is actually a measure of the extent of useless communist production that nobody wanted, i.e., a measure of the amount of wasted resources rather than a measure of valuable economic activity that had existed under communism but disappeared with transition.

A second explanation, offered by Filer and Hanousek in the final chapter, highlights a statistical artifact: the mismeasurement of real output and inflation due to inadequate accounting for improvements in the quality of goods and services. Measurement of quality changes has proven to be an especially difficult aspect of calculating unbiased rates of inflation. Their innovative approach to capture quality improvements is based on consumer focus groups. They advocate applying this methodology in an environment where quality changes might be expected to be especially rapid and extensive, like in transition economies, when the traditional methods of quality-improvement bias are bound to fail. Their results indicate a substantial understatement of quality improvements during transition when compared to official methodology and, therefore, a substantial overstatement of inflation. This results in a serious downward bias in growth rate estimates for post-communist economies. Overall, it appears that the Czech Statistical Office has captured only a fraction (at the median, perhaps 15 percent) of the quality change that the actual consumers believe occurred. The move to free markets has, therefore, apparently improved consumers' welfare more by improving *what* they can purchase rather than by increasing *how much* they can purchase. Overall, the mismeasurement of quality changes may have understated Czech growth rates during the first decade after communism by as much as 5 percentage points per year. These two causes seem to eliminate a majority of the supposed economic "decline."

As these examples of a far larger corpus of CERGE-EI research show, the transition was not only an interesting and complex process in and of itself. It also revealed areas that were under-researched in prior economic analysis. It enabled both asking new questions as well as trying new research concepts that utilize the great variation created by the transition process. In this respect, we have had a unique opportunity to study the natural experiment created by a major systemic change. The transition countries were not, on average, obviously undeveloped. They were located somewhere between the middle income and high income countries. This is one reason why the reform processes originally designed for poorer countries were not immediately adopted, no matter how much they might have been appropriate. Lastly, the transition countries have, in a very real way, lost the cold war – the battle of the efficiency of two economic systems, one based on individual choice and freedom with responsibility and the other based on dirigisme and limited personal choices. Freedom proved to be the essential driver of long-term growth and prosperity.

Today, many may claim that transition is over; yet, the legacy persists. The post-transition countries are still different from the Western European countries today. More importantly, however, they are also different from what Western European countries were when they had similar levels of income to today's post-communist states (several decades ago). But in many respects, they are also alike. Within the past 20 years, the European transition countries have established democratic systems and market economies. In addition, they are back in the Atlantic civilization circle, members of NATO, the EU and, at least for some, the EMU. Thus, despite various problems and false starts, at the bottom we find a success story. They have found – and executed – the X^{-1}.

1 | Effects of Privatization and Ownership in Transition Economies

Saul Estrin, Jan Hanousek,
Evžen Kočenda, Jan Švejnar

Originally published in *Journal of Economic Literature 2009, 47, 3: 699–728*

1. Introduction

This paper is motivated by the ongoing debate among economists and policy makers about the efficiency and other economic effects of privatization of state-owned enterprises (SOEs). Our goal is to evaluate what we have learned to date about the effects of privatization from the experiences during the last 15–20 years in the post-communist (transition) economies and, where relevant, China.

The transition economies – economies in Central and Eastern Europe (CEE) and in the Commonwealth of Independent States (CIS) that replaced most of the former Soviet Union – provide a useful laboratory, having experienced major changes in the values of many relevant variables as they changed their economic system. Unlike most other developing countries and until recently also China, the transition economies for instance did not merely privatize a number of key state-owned firms or strive to improve the functioning of their legal and institutional framework. As may be seen from Table 1, they carried out a major transformation that made the share of private sector in GDP increase from extremely low levels to between 60% and 90% (see EBRD, 2007) and they instituted from scratch a market-oriented legal and institutional system. The transition economies therefore share with many other developing countries numerous characteristics associated with "weak" institutions, such as poorly conceived and/or ineffectively enforced property rights and insufficiently developed capital markets (see Daron Acemoglu, Simon Johnson and James Robinson, 2001), but they have carried much larger privatization programs than have been observed in other developing countries and until very recently also in China. One can hence obtain valuable insights about the impact of privatization by focusing on the large literature dealing with the transition. It is appropriate to undertake a study of this type now because it has been nearly twenty years since the start of transition so work has emerged based on datasets of sufficient size, length and quality to allow the use of more sophisticated methods and to address more robustly issues of causality.

There has already been one major attempt to survey this literature, by Simeon Djankov and Peter Murrell (henceforth D-M) in 2002. D-M applied a meta-analysis to the findings from a large number of diverse early studies of the transition economies (but not China), combining – controversially – various indicators of performance into one composite measure of restructuring. The early literature focused on the impact on company performance of different types of mainly domestic owners – insiders, outsiders, investment funds – and was based largely on country-specific survey datasets that were frequently quite small and not necessarily representative. It did not examine in a major way the effects of foreign direct investment (FDI) as this remained relatively low until the mid-1990s in CEE (except for Hungary and the Czech Republic) and until the new millennium in the CIS (see Klaus Meyer, 1998).

Table 1: Private Sector Share of GDP

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Czech Republic	10	15	30	45	65	70	75	75	75	80	80	80	80	80	80	80	80
Hungary	25	30	40	50	55	60	70	75	80	80	80	80	80	80	80	80	80
Poland	30	40	45	50	55	60	60	65	65	65	70	75	75	75	75	75	75
Slovak Republic	10	15	30	45	55	60	70	75	75	75	80	80	80	80	80	80	80
Slovenia	15	20	30	40	45	50	55	60	60	60	65	65	65	65	65	65	65
Estonia	10	10	25	40	55	65	70	70	70	75	75	75	80	80	80	80	80
Latvia	10	10	25	30	40	55	60	60	65	65	65	65	70	70	70	70	70
Lithuania	10	10	20	35	60	65	70	70	70	70	70	70	75	75	75	75	75
Bulgaria	10	20	25	35	40	50	55	60	65	70	70	70	70	75	75	75	75
Romania	15	25	25	35	40	45	55	60	60	60	60	65	65	65	70	70	70
Russia	5	5	25	40	50	55	60	70	70	70	70	70	70	70	70	65	65
Ukraine	10	10	10	15	40	45	50	55	55	55	60	60	65	65	65	65	65

Source: European Bank for Reconstruction and Development (EBRD), Transition Reports

D-M concluded that privatization to outside owners resulted in 50 percent more restructuring than privatization to insiders (current managers or workers). Privatization to workers had no effect in CEE and a negative effect in the CIS. Investment funds, foreign ownership and other block-holders were found to produce more than ten times as much restructuring as diffuse individual ownership. Hardening of budgets constraints (i.e. curtailing firms' access to formal or informal state subsidies) was also found to have a positive effect on restructuring. Among other factors, import competition had a positive effect on performance in CEE, but a negative effect in CIS. Overall, D-M noted that the impact of privatization on company performance was typically positive and statistically significant in CEE, but statistically insignificant in CIS. They suggested that this could be explained by the more widespread occurrence of insider ownership after privatization and a weaker institutional environment leading to less effective governance by outside owners in the CIS countries.[1] Finally, D-M also pointed out that about one-half of the studies they surveyed did not take into account the endogeneity and selection issues associated with changing ownership and firm performance, and they urged future research to tackle this issue.[2]

1 This was also argued in a short survey by Sergei Guriev and William Megginson (2006) which related the mixed results on the impact of privatization in transition economies to the slow progress in microeconomic and legal reform, especially in CIS countries.

2 D-M's arguments were developed in Megginson (2005). He concluded that "mass" privatization often led to disappointing outcomes, perhaps because it was frequently associated with insider ownership. Indeed, despite their massive privatization programs, because of their relatively low levels of development and the widespread use of "voucher privatization", transition economies only generated 5% of the total global privatization proceeds between 1990 and 2000.

The present study highlights several significant shifts of emphasis in the literature in recent years. Firstly as ownership structures have evolved, research interest has shifted from comparing categories of domestic owners (e.g., insider versus outsider) to domestic versus foreign ownership, the performance of privatized versus *de novo* enterprises and with the impact of concentrated versus dispersed ownership. Researchers have also increasingly noted that policies and institutional development have diverged between the CEE and CIS countries, with the former increasingly adopting European Union (EU) rules and joining the EU, and the latter proceeding slower in introducing a market friendly legal and institutional system. China also began from the mid-1990s to privatize large former state owned firms. Moreover, unlike D-M who had to combine all available performance measures together in their meta-analysis, we are able to distinguish separately the impact of privatization on efficiency (total factor productivity – TFP), profitability, revenues, and other indicators. Thirdly, an important aspect of our approach is to distinguish between studies on the basis of their econometric methodology in order to focus attention on more credible results. As might be expected given the changes in emphasis and methodology, and by including a comparison with China, our conclusions are richer and more nuanced, as well as more robust, than those available to D-M.

Commencing with the macro studies, we find that the results suggest that privatization, especially when accompanied by complementary reforms, may have a positive effect on the level of aggregate output or economic growth. However, one of the most widely debated issues of transition (e.g., János Kornai, 2001), namely the effect on aggregate output and growth of rapid privatization (frequently accompanied by dispersed ownership) versus slower privatization (often with more concentrated ownership) remains unresolved.

As to the impact of privatization on the level of TFP, we find that in CEE the overall effect is mostly positive during both the early and later transition periods, but that the effect of privatization to domestic owners is quantitatively much smaller than that to foreign owners, and that it is greater in the later than earlier transition period. In CIS, privatization to foreign owners yields a positive or insignificant effect while privatization to domestic owners generates a negative or insignificant effect. In most instances, the estimated economic effect is smaller in the CIS than CEE. Overall, the TFP effect of privatization to domestic owners is weaker than that to foreign owners, takes longer to take a hold, and in the CIS it has been outright negative or insignificant. There are as yet no TFP studies using data from China which employ robust methodologies and perhaps because of this, the available papers find diverse results, with the effect of non-state ownership being mostly positive but sometimes statistically insignificant and sometimes negative.

Concentration of ownership is important, with majority private ownership having mostly positive effects on the level of TFP. The overall positive effect is again driven primarily by foreign owned firms. The effect of majority domestic private ownership tends to be positive but smaller in magnitude. Studies that distinguish between privatized SOEs and newly created private firms suggest that *de novo* firms are more productive than or at least as productive as SOEs privatized to domestic owners. The effect of employee (insider) ownership on the level of TFP is found to be mostly statistically insignificant or in one case actually positive. Estimates of the effects of privatization on TFP growth suggest that in CEE privatization had a positive effect on the rate of change of TFP in the early transition period and that the effect disappears in the later stage.

The effect of ownership on profitability has been estimated mostly in CEE and shows a small positive or insignificant effect of privatization to domestic or foreign owners on profitability levels in the early as well late transformation periods, together with an insignificant effect of privatization to domestic and foreign owners on the rate of growth of profitability. The effect varies across types of ownership, and concentrated domestic private ownership, managerial ownership, and to a lesser extent foreign ownership tend to have a positive effect on profitability, while state keeping a golden share or concentration of worker ownership appear to be unrelated to profitability. The studies of private ownership on profit of firms in China vary considerably in terms of methodology sample size and findings, with most indicating a positive and usually significant effect.

The effect of privatization on the level of firm revenues, capturing the effect of privatization on the scale of operation of the firm, is mostly strong and positive. In terms of revenue growth, we observe in CEE a high positive effect of privatization to foreign owners in the early period and a small effect in the later period, as well as an insignificant effect of privatization to domestic owners. Overall, the studies of CEE and CIS countries indicate that privatization tends to have a positive effect on the scale of operation, while studies of the effect of private ownership on the rate of change of scale of operations (from CEE, CIS and China) suggest that this effect is not statistically significant except in certain categories of ownership.

Estimates of the effect of privatization on labor productivity (not controlling for the use of others inputs) are similar to the TFP results – the effect of privatization is primarily positive or insignificant. As in the case of TFP, foreign ownership and concentrated ownership are found to have a positive or insignificant effect, while the effects of employee and management ownership are estimated to be mostly statistically insignificant. The corresponding studies of firms in China yield mostly insignificant estimates of the effects of private/non-state ownership on labor productivity.

In terms of the effect of privatization on employment, the estimates indicate that there is a tendency for privatized firms, especially those with foreign owners, to increase or not to reduce employment relative to firms with state ownership. In general, employee ownership and control do not have a significant effect on employment, providing parallel evidence to the TFP studies that this form of ownership does not result in excess employment.

Studies of the effects of ownership on wages find that state ownership is associated with lower wages in some countries, such as Russia and former Czechoslovakia, but not in others, such as Poland. In Russia, where in the 1990s firms tended to owe wages to their workers, SOEs were more likely to exhibit wage arrears than firms with domestic and foreign private ownership, firms with mixed ownership and *de novo* firms.

Studies that have analyzed the effect of privatization on other dependent variables show that (a) privatization results in higher exports and greater efficiency, as measured by the cost of inputs relative to sales, Tobin's Q, and degree of soft budget constraints, and (b) privatization to foreign firms leads to more restructuring and sale of assets, greater likelihood of payment of dividends, and smaller likelihood of default on debt. These results exhibit a pattern that is in line with the above measures of performance.

The structure of the paper is as follows. In Section 2 we discuss the theoretical and institutional issues raised by privatization in transition economies. In section 3 we briefly examine the macroeconomic evidence about the impact of privatization before turning in section 4 to a survey of the enterprise-level economics literature about the impact of privatization on different indicators of company performance. We conclude our study in Section 5 with policy-oriented observations.

2. Theoretical and Institutional Issues

In the early 1990s privatization was widely considered one of the keystones of the entire transition process. The policy arguments were based on successful experience in developed economies (e.g., Matthew Bishop and John Kay, 1988; Aidan Vining and Anthony Boardman, 1992), as well as on evidence from developed and middle-income countries that suggested that privatization improves enterprise efficiency (see Megginson and Jeffrey Netter, 2001 for a survey). The so called Washington Consensus emphasized privatization and belief that private ownership together with market forces would ensure efficient economic performance. Combined with price liberalization, freedom from state control was seen as the way to bring prices into line with opportunity costs and to harden budget constraints (see Kornai, 1990).

However, it was also often recognized that privatization on its own might not be sufficient and that systemic changes and policy reforms were a prerequisite for successful transition (Jan Švejnar, 1989; David Lipton and Jeffrey Sachs, 1990; Olivier Blanchard, Rudiger Dornbusch, Paul Krugman, Richard Layard, and Lawrence Summers, 1991; Philippe Aghion and Blanchard, 1994). We briefly review the accompanying policy reforms and systemic changes as well as the variation in the effectiveness of their implementation in the first sub-section (2.1) below.

The transfer of ownership rights was seen by most academics and policy makers as being crucial for the efficient allocation of resources and economic growth. As a result, much empirical work has been related to efficiency and in the second sub-section (2.2) below we therefore survey the efficiency-related arguments for privatization.[3]

The large scale of privatization spawned considerable variation in privatization methods. It was suggested at the time that "bad privatization methods", for example so-called "mass privatization" in which ownership rights were widely dispersed, may lead to "bad ownership structures" and therefore reduce the potential gains from privatization. We evaluate this argument in the third sub-section (2.3).

In the final sub-section (2.4), we consider factors likely to influence the selection of firms for privatization. The theoretical and empirical evidence indicates that firms were not chosen to participate in the privatization process at random. Hence empirical estimates that fail to take account of this phenomenon will be biased. The prevalence of selection bias leads us to apply stricter criteria than previous surveys with respect to econometric methods when we evaluate the findings from the empirical literature in the final section of the paper.

2.1 Policies in Transition Economies

Privatization in the transition economies occurred in the context of broader systemic change. In almost all these economies, but not China (see Lawrence Lau, Yingyi Qian, Gerard Roland, 2000), governments plunged ahead with what Švejnar (2002) calls *Type I* reforms, namely macro stabilization, price liberalization and dismantling of the institutions of the communist system. Most countries also opened up rapidly to international trade, thus inducing a more efficient allocation of resources based on world market prices, and quickly reduced direct subsidies to SOEs.

Švejnar's *Type II* reforms involved the development and enforcement of laws, regulations and institutions that would ensure a successful functioning of a market-oriented economy. These reforms included privatization and the establishment and enforcement of a market-oriented legal system and accompanying institutions able to create well-defined property rights, permit the enforcement of contracts, and limit corruption.

3 From a political perspective, however, privatization was viewed as being necessary in transition economies, even if there were to be no efficiency improvements – the reason for privatization was to eradicate the command economic system rooted in communist ideology (see Andrei Shleifer and Robert Vishny, 1994).

According to the EBRD's Transition Indicators (EBRD, various years) progress in developing a market-supporting legal system was everywhere slow, although the pace was more rapid in CEE than CIS in limiting corruption and establishing a functioning legal framework and institutions. An important impetus for implementing legal and institutional reforms in most countries in Central Europe, the Balkans and the Baltic, has been the need to develop a system that conforms to that of the EU as a prerequisite for accession (Richard Baldwin, Joseph Francois, and Richard Portes, 1997).

2.2 Privatization and Efficiency

Historically SOEs were established to ensure political control of production, better provision of public goods, more effective ways of dealing with externalities, spearheading of economic development in the absence of "well functioning" markets, and guaranteeing full employment and equitable income distribution. The economic performance of many SOEs proved disappointing, however, and since the early 1980s privatization started to be advocated as a means of establishing clear property rights, providing economic incentives and stimulating superior economic performance of firms and economies at large (see John Vickers and George Yarrow, 1988, Bernardo Bortolloti and Domenico Siniscalio, 2004). One argument for privatization is that firms under central planning are inefficiently large and their divestitures, combined with privatization, constitute a desirable way to improve corporate performance (see Jan Hanousek, Evžen Kočenda and Švejnar, 2009).[4] Another argument for privatization stresses the fact that the objectives imposed by the state as owner in SOEs are not necessarily consistent with profit maximization (see Saul Estrin and Virginie Perotin, 1991). The politicization of enterprise decision-making may also open firms up to lobbying and unproductive rent seeking (see Shleifer and Vishny, 1994, 1997).

Even if the state as owner seeks to maximize the profits of its firms, problems of corporate governance may still lead to inferior performance. Outside owners – whether private or state – do not have full information about corporate performance, so firm-specific rents may be appropriated by the managers. However, private ownership may place more effective constraints on managers' discretionary behavior, via high-powered incentives for managers (Randall Morck, Shleifer and Vishny, 1989) or through the operation of the market for corporate control (Schleifer and Vishny, 1997), though if ownership is dispersed, owners may face a free rider problem in which the individual returns to monitoring by each owner are less than the costs (Shleifer and Vishny, 1997). The weak monitoring of managers by the state and the absence of external constraints often enabled SOE managers to gain discretion and follow their own objectives (Estrin, 2002).

4 Hanousek, Kočenda and Švejnar (2008) find that divestitures increase the firm's profitability but do not alter its scale of operations, while the effect of privatization depends on the resulting ownership structure.

In much of continental Europe, greater emphasis has traditionally been placed on bank debt than equity, with governance exercised via board membership of the controlling owners. This approach has also developed in a number of transition economies. However, in many developing economies as well as in some developed countries, family and business group ownership remains predominant, and though the ownership structures are typically highly concentrated, this ownership form is argued to impair company performance relative to outsider ownership structures (Morck, Daniel Wolfenzon and Bernard Yeung, 2005). This is relevant for transition economies because, privatization, especially in the CIS, has led to the emergence of diversified business groups owned by individuals ("oligarchs"). This might explain differential performance between CEE and CIS, though preliminary evidence suggests that business groups may actually be more efficient than other privatized companies in Russia and Ukraine (see Guriev and Andrei Rachinsky, 2005; Yuriy Gorodnichenko and Yegor Grygorenko, 2008).[5]

Firms in transition economies also suffered the incentive problems caused by the softness of budget constraints (see Kornai, 1990, Mathias Dewatripont, Eric Maskin and Roland, 2000; Kornai, Maskin and Roland, 2003), with poorly performing firms often being granted easier access to external investment funds than the better performing ones (Lubomír Lízal and Švejnar, 2002). This led analysts to stress that hardening of budget constraints should be a priority and could be achieved most effectively by breaking the link between firms and the state through privatization (Alan Bevan, Estrin and Mark Schaffer, 1999). Moreover, Roman Frydman, Cheryl Gray, Marek Hessel and Andrzej Rapaczynski (2000) have argued that the imposition of hard budget constraints on SOEs will not induce strategic restructuring because entrepreneurial incentives associated with outside investor will still be absent. This relates to the incomplete contracts ideas of Oliver Hart and John Moore (1988) that have been used to argue that state managers tend to make routine decisions whereas private owners would engage in non-routine decisions and stimulate entrepreneurship. In the presence of external shocks, privatized firms are hence thought to move more readily into new markets and product lines and hence be less likely to lay off workers than SOEs. This suggests that privatization might only be effective when control shifts to new owners, who are thereby able to change the managers. As we discuss below, delayed privatization can undermine the performance of the SOEs, since in this situation the incentives of managers

5 A number of theoretical papers have addressed the problems raised by the need to induce SOE managers to accept privatization (e.g. Shleifer and Vishny, 1994; Francesco Cornelli and David Li, 1997), although in practice this turned out not to be a problem. The desire to generate widespread political support for privatization in the context of de facto managerial control of enterprises has also been considered. For example Bruno Biais and Enrico Perotti (2002) analyzed politically motivated privatization. They found that when median voters favor redistribution, strategic rationing and under-pricing will be needed to shift problematic preferences. John Bennett and James Maw (2003) and Bennett, Estrin, and Maw (2005) also consider under-pricing, and explain how setting a zero price for privatized firms may be a rational strategy, even for a revenue maximizing government, provided the state also retains some shares in the privatized entity.

become to seize assets or to tunnel them out, rather than to improve performance (see Johnson, Rafael LaPorta, Florencio Lopez-de-Silanes, and Shleifer, 2000).[6]

Perhaps the main caveat to the efficiency arguments in support of private ownership concerns the welfare dilemmas when private firms provide public goods and/or have natural monopoly power (Jean-Jacques Laffont and Jean Tirole, 1993). If firms have monopoly power, privatization can be harmful even if productive efficiency of a firm increases, unless there are adequate regulatory controls or sufficiently rapid entry (see also Edward Glaeser and José Scheinkman, 1996). Monopoly power also creates a dilemma for the state as owner in a privatization process; firms that are privatized with monopoly power can be sold for higher prices than if the company is broken up to create a more competitive market structure. Similarly, if corporate governance provisions for private firms are lax, company assets may be stolen and misallocated. Monopoly power may hence explain a divergence between empirical results concerning profitability and sales on the one hand, and TFP on the other.[7]

2.3 Extent and Methods of Privatization

The fact that the state owned almost every industrial firm in socialist economies raised questions about how much privatization should be undertaken, by what methods and at what rate. In practice, most countries decided to privatize a large number of firms rather quickly (Estrin, 1994) and were therefore forced to innovate in privatization methods in order to address the unprecedented issues of scale and the political urgency for speed. Some authors have suggested that deficiencies in some of these new methods of privatization, notably the widespread use of forms of "mass" privatization, whereby shares are distributed at nominal prices to the population at large, may explain the apparent initial deficiencies in the impact of the policy (e.g. Joseph Stiglitz, 2002).

The arguments for fast privatization were that (a) price liberalization and other reforms would not provide sufficient incentives for SOEs to restructure and become competitive, (b) state would not be able to resist intervening in SOEs (Frydman and Rapaczynski, 1991; Maxim Boycko, Shleifer and Vishny, 1995) and (c) managers (and/or workers) would decapitalize firms in the absence of rapid clarification of property rights (Frydman, Edmund Phelps, Rapaczynski and

6 One can also consider the issue of corporate governance from the perspective of employee participation in management (see Derek Jones, 2004).

7 Privatization also has important for the distribution of income and wealth. Early analysts favored privatization at reduced prices and open to the population as a whole on grounds of equity (Blanchard, *et al.*, 1991) and models were developed to evaluate the political processes balancing distributive and efficiency issues (Biais and Perotti, 2002; Schleifer and Vishny, 1994). In practice, however, ownership structures have evolved to become more concentrated and the emergence of "oligarchic" business groups in the former CIS has probably also exacerbated income inequality. Nancy Birdsall and John Nellis (2003) surveyed the impact of privatization on distribution in developing economies and concluded that privatization programs had worsened the distribution of asset ownership, more so in transitional economies than Latin America.

Shleifer, 1993; Blanchard, Dornbusch, Krugman, Layard, and Summers, 1991). In contrast, Dewatripont and Roland (1992a,b) and Roland (1994) argued that gradual privatization was needed because the political backlash to rapid privatization of all firms would be unacceptable. In particular, Dewatripont and Roland's (1992a,b) argument for gradualism was that it allowed the government to pursue a strategy that necessitated fewer workers/voters being immediately laid off and that it would reduce uncertainty. As we discuss below, however, empirical evidence shows that in most countries privatization did not bring about a reduction in employment.

The use of mass privatization did spearhead a remarkable growth in the private sector (Table 1).[8] However, this achievement should not conceal concerns about quality of privatization that was undertaken.[9] Mass privatization led to ownership structures that were initially highly dispersed because the entire adult population of the country, or all insiders to each firm, were allocated vouchers with which to purchase the shares of the company. Mass privatization was also argued to hinder the establishment of effective corporate governance, especially when long "agency chains" were created by the emergence of financial intermediaries holding privatization vouchers (John Coffee, 1996; Stiglitz, 2002). It probably also hindered the development of secondary capital markets and in many countries it also initially resulted in majority ownership by insiders (Estrin, 2002).

Whether as a consequence of institutional weakness and/or the methods of privatization, the EBRD Transition indicators show that capital markets in transition economies developed less quickly than other market economy structures such as liberalized price setting or openness to trade. Indeed, stock markets in transition economies during the 1990s were often characterized by insufficient regulation, institutional fragility and weak minority shareholder protection (EBRD 1998; John Bonin and Paul Wachtel, 2003).

2.4 Selection of firms to be privatized

Whatever the privatization methods used, it is likely that firms are not assigned for privatization at random. This has important implications for econometric work assessing the impact of privatization on company performance because it implies that studies that treat the allocation of firms for privatization as random or do

8 A hidden outcome of the large-scale property transfers was the creation of lasting state control over assets in many privatized firms. The actual extent of privatization, especially in the early years of transformation, was therefore less than appears from the official statistics. See e.g., Hanousek and Kočenda (2008).

9 For example, though retained state shareholdings were small in some of the leading transition economies in CEE, the state continued to own significant shareholdings in others, especially in the CIS. Thus in a 1999 survey of privatized firms, the EBRD found that in 20 of the 23 countries, the state had retained some shares in around 20% of privatized firms, with more than a 20 percent shareholding in around 12 percent of the firms. The state kept a share of more than 15 percent of privatized firms in eight countries and more than 30 percent in a further four (Bennett, Estrin and Maw, 2005). Retained state ownership has been a factor in recent Chinese privatizations (Lihui Tian and Estrin, 2008). Governments have also issued golden shares to retain influence over some of the privatized SOEs.

not adequately control for the non-random selection may potentially overstate the positive effect of privatization on performance. D-M for instance indicate that 47 percent of pre-2003 studies that they survey do not control for this non-random selection.

Realizing this shortcoming, Nandini Gupta, John Ham and Švejnar (2008) analyze the problem that arises in the studies that ignore the fact that better or worse firms may be privatized first. They note that there may be several reasons why a government may choose to sequence the privatization of SOEs. First, the government may incur excessively high transaction and congestion costs if it tries to privatize all firms simultaneously. Second, by sequencing it may reveal information about the firms to investors (later buyers may observe the quality of the firms sold earlier) if there is uncertainty about the quality of the firms being privatized, or avoid political opposition to reforms (Dewatripont and Roland, 1995). Finally it may want to sequence privatization so as to avoid unemployment (Aghion and Blanchard, 1994; and Barbara Katz and Joel Owen, 1993).

Gupta, Ham and Švejnar (2008) consider five competing government objectives for privatization: i) maximizing Pareto efficiency through resource allocation; ii) maximizing public goodwill from the free transfers of shares to the public; iii) minimizing political costs stemming from unemployment;[10] iv) maximizing efficiency through information gains and v) maximizing privatization revenues. They use firm-level data from the Czech Republic to test the competing theoretical predictions about the sequencing of privatization and find strong evidence that the firms the government privatized first were more profitable, were firms in downstream industries, and in industries subject to greater demand uncertainty. Privatizing more profitable firms first is hence inconsistent with maximizing Pareto efficiency but it is consistent with the model of maximizing privatization revenues, maximizing public goodwill and minimizing the political cost of unemployment. However, the implication of the political cost model that employment growth in the firm's industry should affect sequencing is not supported by the results. Gupta, Ham and Švejnar's (2008) finding that firms in downstream industries and in industries with greater demand uncertainty were more likely to be privatized early suggests that the government placed emphasis on efficiency in the Glaeser and Scheinkman (1996) sense, namely by privatizing first firms that required flexible management.[11]

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10 Political configurations can influence the pace and timing of privatization, as was found by Bortolotti and Paolo Pinotti (2003) in their study of 21 OECD countries over the period 1977-2002. In particular, the authors found that political fragmentation gave several groups the opportunity to veto or otherwise block large-scale privatization, and hence delay or even halt the process.

11 Glaeser and Scheinkman (1996) examine sequencing strategies that would increase efficiency via informational gains. In their model private firms respond to demand and cost shocks, but this information is ignored by public firms. The Glaeser-Scheinkman model predicts that privatization should begin where demand or cost volatility is the greatest and where it maximizes the flow of information. Thus when demand uncertainty is greater than cost uncertainty, the authors argue that downstream firms should be privatized

3. Privatization and Growth

A number of theoretical models provided competing predictions about the effects of privatization on macro-economic performance and growth. In Thorvaldur Gylfason (1998), privatization is shown to increase national economic output in a two-sector full-employment general-equilibrium model by enhancing efficiency as if a relative price distortion were being removed through price reform, trade liberalization, or stabilization. Nico Hansen (1997) uses a general equilibrium imperfect competition model to show that a broad distribution of ownership rights can have favorable influence on micro-economic efficiency.

Several studies use aggregate data to assess the effect of privatization on economic performance. Using data from thirty five developing market economies Patrick Plane (1997) finds that privatization (through divestiture) has a significant positive effect on economic growth and that the effect is stronger when privatization takes place in industry or infrastructure rather than in other sectors. Daniel Berkowitz and David De Jong (2001) find that regions with more large-scale privatization exhibit greater formation of new (legally registered) enterprises, which in turn exhibits a strong positive correspondence with growth. Steven Barnett (2000) uses macroeconomic and privatization data from 18 countries to find that privatization proceeds transferred to the budget tend to be saved and used to reduce domestic financing. His other main finding is that total privatization, as opposed to just the proceeds being transferred to the budget, is correlated with an improvement in macroeconomic performance as manifested by higher real GDP growth and lower unemployment. In a cross-country aggregate study, Clifford Zinnes, Yair Eilat, and Sachs (2001) use a panel data set from 25 transition countries to find that privatization does not by itself increase GDP growth, but they suggest that a positive effect is present when privatization is accompanied by hard budget constraints and in-depth institutional reforms. Bennett, Estrin and Giovanni Urga (2007) use a panel data model and GMM estimation methods for almost all the transition economies (26 countries), controlling for country or time specific factors with fixed effects. They do not identify a significant relationship between private sector share and growth; hence their results do not indicate a direct relationship between privatization and growth. However, they do have results concerning methods of privatization in that they find countries which used mass privatization enjoyed significantly higher growth post-privatization relative to pre-privatization, compared with countries that used other privatization methods. Their study suggests that, the advantage of speed in privatization brought about by mass privatization may have yielded long-term benefits in terms of economic growth.[12] Using similar data, Fabian Gouret (2007) provides complementary evidence about the impact of privatization

before upstream firms because downstream firms are better positioned to transmit information between the retail and upstream sectors.

12 They argue that their result is due to an increase in ownership concentration following mass privatization that had strengthened control over firms.

methods on growth. He also finds a positive effect from mass privatization but it is smaller than from the more gradual methods of privatization. The difference in the results of the two studies stems from differences in specification, not completely overlapping data sets and the use of different estimation methods.

The macro studies hence suggest that privatization, especially when accompanied by complementary reforms, may have a positive effect on the level of aggregate output or economic growth, but the effect of speed, and the accompanying dispersed versus more concentrated ownership, on aggregate output and growth is unclear.

4. The Effects of Privatization on the Performance of Firms

Earlier surveys of firm-level studies examining the effects of privatization on firm performance range from ones that find a large variation of outcomes but no systematically significant effect of privatization on performance (Bevan, Estrin and Schaffer, 1999) to those cautiously concluding that privatization improves firm performance (Megginson and Netter, 2001), to ones that are fairly confident that privatization tends to improve performance (Mary Shirley and Patrick Walsh, 2001; and Djankov and Murrell, 2002).

This variation in the interpretation of results is brought about in part by the fact that the early studies had access to different and often somewhat limited data on firm performance and ownership. For these reasons, many studies treat ownership as a relatively simple categorical concept and some are often unable to distinguish the exact extent of ownership by individual owners or even relatively homogeneous groups of owners. Equally important, the diversity of interpretations and findings is generated by three types of interrelated analytical problems that may be expected in early studies in the context of the rapidly changing transition economies. First, the early studies rely on short time periods with observations concentrated immediately before and after privatization. Second, the early studies (a) use small and often unrepresentative samples of firms, (b) are frequently unable to identify accurately ownership because privatization is still ongoing or because the frequent post-privatization changes of ownership are hard to detect, and (c) often combine panel data from different accounting systems. Third, as we have discussed above, many of the early studies have not been able to control adequately for the selection/endogeneity problem of ownership and their estimates of the effects of privatization may hence be biased.

Since the studies are heterogeneous with respect to their methodologies, we classify all studies into those that (a) employ fixed effects or instrumental variables (IVs) to handle the selection/endogeneity problem inherent in privatization and (b) do not tackle this problem and use OLS. Our classification has an important reason behind it. First, one can make the assumption that unobservable ownership effects, including those stemming from selection of firms for privatization or acquisition of firms by foreign owners, are typically correlated with the explanatory variables and error term in the model and do not change over time. In this case the bias arising from unobserved heterogeneity can be removed by estimating the fixed effects model. The fixed effects model contains an individual specific constant that captures all time-invariant (observed as well as unobserved) characteristics. The second assumption concerns the situation in which unobservable ownership effects vary over time. In this case it is necessary to employ estimation using instrumental variables to account for the selection/endogeneity problem inherent in privatization.[13] The success of the IV estimation depends heavily on finding adequate instrumental variables that satisfy the exogeneity condition. As suitable instrumental variables are often difficult to obtain, the fixed effects estimation has been frequently used, especially in earlier studies.

In our evaluation, we use only estimates from the set of studies that employ fixed effects or IVs because they are less likely to suffer from selection bias. In the case of privatization, private (especially foreign) owners are naturally interested in acquiring firms that have (at least potentially) superior performance. Hence, studies that do not account for selection may erroneously attribute potentially superior performance of privatized firms to the new owners rather than to the inherently superior performance of firms selected for privatization.

In view of these issues, we consider 14 privatization studies covered by D-M that handle the selection/endogeneity problem and we add 20 studies that have been published or circulated as working papers by December 2007. In Table 2 we list these 34 studies, together with information on their region and performance indicator.

In assessing the effects of privatization, we focus on total factor productivity (TFP) and TFP growth (Figure 1a and 1b, respectively), profitability and growth in profitability (Figure 2a and 2b, respectively), and revenue level and growth in revenue (Figure 3a and 3b, respectively). We also discuss the main findings of studies dealing with labor productivity, employment, wages, and other indicators of performance (not reported in figures or tables). In the figures, we report separately results from studies dealing with Central-East Europe (CEE), including the Baltics and Balkans, and studies dealing with the Commonwealth of Independent States (CIS), which started the transition later and placed less emphasis on the development of a strong, market-oriented legal framework and institutions.[14]

13 Alternatively, other suitable techniques such as difference in difference estimator and matching-type estimator can be employed, provided that adequate data are available.

14 For a more detailed discussion of the results of these studies, see Estrin, Hanousek, Kočenda and Švejnar (2007), which contains detailed tables listing region, time period, performance measure, types of ownership, and resulting effects separately for each available study from the CEE, CIS and China.

Table 2: List of Surveyed Studies: Territorial Coverage and Performance Indicators

Author(s)	TFP	Profitability	Sales and Revenues	D-M
Andreyeva (2003)	2		2	
Angelucci, Estrin, Konings, Zolkiewski (2002)	1		1	
Brown and Earle (2001a)	2			YES
Brown and Earle (2001b)	2			YES
Brown, Earle and Telegdy (2006)	3			
Carlin, Fries, Schaffer, Seabright (2001)			3	YES
Claessens and Djankov (1998)	1			
Claessens and Djankov (1999)		1		YES
Claessens and Djankov (2002)			1	
Claessens, Djankov and Pohl (1997)		1		YES
Commander and Švejnar (2007)	3			
Djankov and Hoekman (2000)			1	
Frydman, Gray, Hessel, and Rapaczynski (1999)			1	YES
Frydman, Hessel, and Rapaczynski (2000)			1	YES
Grigorian (2000)			1	YES
Grosfeld and Tressel (2002)	1			
Hanousek, Kočenda, and Švejnar (2007)		1	1	
Hanousek and Kočenda (2003)		1		
Jones and Mygind (2002)			1	YES
Jones, Klinedinst and Rock (1998)	1			YES
Maurel (2001)			1	
Miller (2006)		1		
Orazem and Vodopivec (2004)	1			
Perevalov, Gimadii, and Dobrodey (2000)		2	2	YES
Pivovarsky (2001)			2	
Pivovarsky (2003)	2			
Sabirianova, Švejnar, and Terrell (2005)	3			
Salis (2006)	1		1	
Simoneti, Damijan, Rojec, and Majcen (2005)	1			
Smith, Cin, and Vodopivec (1997)	1			YES
Simoneti and Gregoric (2004)	1	1		
Weiss and Nikitin (2002)	1	1		YES
Warzynski (2003)		2		YES
Zalduendo (2003)		1		

Note: 1 denotes coverage of the CEE countries; 2 denotes coverage of the Russia and CIS region; 3 denotes combination of the coverage for CEE, Russia and CIS. Yes in the D-M column indicates the study is covered by Djankov and Murell (2002).

Figure 1: Total Factor Productivity Level

		CEE			Russia & CIS		
		Private domestic	**Any private**	**Private foreign**	**Private domestic**	**Any private**	**Private foreign**
Positive effect	Large effect (>15%)	●●		○◑◑◑ ●●●		◑	◑◑
	Medium effect (5–15%)	◑◑◑				◑	
	Small effect (<5%)					●	
	Insignificant	●		◑●	◑	○	◑
Negative effect	Small effect (<5%)				◑		
	Medium effect (5–15%)				◑		
	Large effect (>15%)		○				

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

As could be expected, even within each category of performance (e.g., TFP), the various studies employ a variety of measures (e.g., revenues, sales, or value added). Since there are very few studies that use a homogenous measure of performance, we have decided not to perform a meta-analysis – combining coefficients and associated standard errors from various studies to obtain a single efficient estimate of the effect of privatization on a given measure of performance. We have opted instead for a graphical presentation to synthesize results obtained from varying measures within a given category of performance. The graphical presentation in Figures 1–3 therefore serves as a proxy for a meta-analysis. As stated earlier, in Table 2 we list all the studies employed in the graphical analysis and indicate what performance measures they use. In the table we also denote whether a study deals with data from the CEE, CIS or both.

In constructing Figures 1–3, we depart from earlier surveys by distinguishing between effects on the level of performance (capturing a one-shot permanent impact) and effects on growth (capturing effects on the rate of change in performance over time). In Figures 1–3 we depict results for levels in panels A and results for growth in panels B. When summarizing the results, we divide the studies estimating the effect on level of performance into those that report relatively large effects (defined as more than 15%), medium effects (5–15%), small effects (less than 5%), and results that are statistically insignificant at the 10% test level. In terms of rate of growth, we divide the studies into those that report relatively large effects (more than 5 %), medium effects (1–5 %), small effects (less than 1 %), and effects that are statistically insignificant at the 10% test level.

We present the results graphically in the form of white, black and half-white/half-black circles. White circles denote effects of studies that cover the early-to-mid 1990's when privatization was not yet completed (the exact timeframe varies across countries). Black circles indicate that the data come from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies that cover both the early and late transition period. As a general rule one circle represents result for one country. For this reason the number of circles exceeds the number of studies. The difference is due to the fact that some studies report results for more than one country or group or time period. Several results from one study are translated into several circles. There are also four studies that report the average effect across more than one country. These studies are not included in the figures but their effects are captured in the text.[15]

Since the effects of foreign and domestic private ownership are in important respects different, we present in separate columns estimated effects of privatization to foreign owners, domestic private owners, and private owners as whole (studies that do not separate private owners' domestic v. foreign status).

4.1 Total Factor Productivity (TFP)

Productive efficiency, or total factor productivity, is of major interest since the communist economies collapsed in large part because they were increasingly unable to sustain innovation and technical progress. In particular, central planners were relatively capable of mobilizing labor and capital resources through compulsory full employment and high rates of investment, but they had hard time increasing the amount of output that SOEs generated from any given inputs. As a result, a major expectation during the transition has been that firms would increase their TFP.

We have identified 17 studies that control for selection/endogeneity and analyze the impact of ownership on TFP or rate of change of TFP, using value added, total product or sales revenues as the dependent variable and either dummy variables or percent share ownership as measures of different types of ownership.[16]

As may be seen in Figure 1, in CEE the overall effect of private relative to state ownership on the level of TFP is mostly positive during both periods. Moreover, studies that break private ownership into categories show that the overall private v. state ownership dichotomy subsumes different private ownership effects. The studies almost uniformly suggest that privatization to foreign owners greatly increases efficiency. This effect of foreign ownership is strong and robust across regions. The

15 This is case of Stijn Claessens and Djankov (1998, 2002), Wendy Carlin, Steven Fries, Shaffer and Paul Seabright (2001), and Simon Commander and Švejnar (2007).

16 There are also five studies that estimate the TFP effect by OLS.

effect of domestic private ownership is by and large also found positive in the CEE region, but it is quantitatively much smaller than that of foreign ownership (the quantitative effects are not fully discernible in the figure). Moreover, this effect is greater in the later than earlier transition period. In CIS, privatization to foreign owners yields a positive or insignificant effect while privatization to domestic owners generates a negative or insignificant effect. Studies that do not distinguish the national origin of the private owner produce a positive effect on TFP levels. In most instances, the estimated economic effect is smaller in the CIS than CEE. Overall, the TFP effect of privatization to domestic owners is weaker than that to foreign owners, takes longer to take a hold, and in the CIS it has been outright negative or insignificant.

For comparative purposes, we have also surveyed the ownership-related studies that have been carried out on data from China. Probably because large scale privatization is a relatively recent phenomenon in China, there have not yet been any studies of great econometric sophistication and this may explain the patchy results. A number of studies, including Jefferson and Rawski (1996), address TFP issues with firm level data but do not examine differences in TFP related to privatization or ownership. Studies that address these issues (e.g. Yifan Hu, Frank Song, and Junxi Zhang, 2004; Shahid Yusuf, Kaoru Nabeshima, and Dwight Perkins, 2006)) find diverse results, with the effect of non-state ownership being mostly positive and often statistically significant.[17]

Compared to the D-M survey that found the effect of private ownership to be positive in CEE but insignificant in CIS, we hence find a strong positive effect of foreign ownership in both the CEE and CIS regions, and a quantitatively smaller positive effect of domestic private ownership in CEE and in Ukraine (together with a negative effect in Russia and the rest of CIS). The reason for finding a stronger positive effect than D-M is in part because we are focusing on studies that take into account the problem of selection/endogeneity of ownership, whereas the earlier surveys did not place as much emphasis on this issue. Indeed, the unreported OLS studies, including those in China, generate much more diverse effects in terms of the estimated OLS coefficients. Another reason for our stronger and more uniform findings of positive effects of private ownership may be that more of our studies cover recent years and privatization may take several years to have an effect as strong owners take control and markets start to function. Finally, institutional development is a slow process and more recent data may pertain to a more developed legal and institutional setting in most of the transition economies. The variety of findings about the effects of non-state ownership in China may also be related to the fact that privatization on a relatively large scale is a more recent phenomenon in China.

17 For a more detailed discussion of the results of these studies, see Estrin, Hanousek, Kočenda and Švejnar (2007).

Figure 2: Total Factor Productivity Growth

		CEE			Russia & CIS		
		Private domestic	Any private	Private foreign	Private domestic	Any private	Private foreign
Positive effect	Large effect (>5%)	○	○				
	Medium effect (1–5%)						
	Small effect (<1%)		○ ◑				
	Insignificant	◑		○ ◑			
Negative effect	Small effect (<1%)						
	Medium effect (1–5%)						
	Large effect (>5%)						

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

Several studies examine concentration of ownership and find that it plays an important part, with majority private ownership having mostly positive effects on TFP. The overall positive effect is again driven primarily by foreign owned firms. The effect of majority domestic private ownership tends to be positive as well, but it tends to be smaller in magnitude. As before, the effect is found to be positive in Ukraine but negative in Russia. Overall, we hence find qualified support for the hypothesis that concentrated private ownership tends to increase efficiency more than dispersed ownership.

The existing privatization studies also provide information about the effect of employee (insider) ownership on efficiency. There has been a major debate about whether employee ownership and control are associated with lower or higher efficiency and excessive use of labor (labor hoarding).[18] We have found seven studies that examine the effect of employee ownership on TFP. Six estimates from both CEE and CIS countries are statistically insignificant and one (Estonia) shows a positive effect of employee ownership on TFP. These results are different from those of D-M who find the overall effect of employee ownership on performance to be insignificant in CEE and negative in CIS. One reason for this discrepancy may be the aforementioned limited overlap between our and D-M studies in this area. Moreover, D-M report that "the results for managers and workers show

18 In addition to our discussion above, see Manuel Hinds (1990), John Earle and Estrin (1996), and Josef Brada (1996).

a considerable degree of sensitivity to how selection bias is handled", while we focus on studies that handle the issue of selection. Finally, D-M recalculate some estimates (e.g., in their Table 1) for the sake of comparability across studies, while we present the effects as reported in the original studies.

Two studies distinguish between privatized SOEs and newly created private firms. Klara Sabirianova, Švejnar, and Katherine Terrell (2005) use 1992–2000 firm-level data for almost all industrial firms in the Czech Republic and Russia and find that foreign start-ups are less efficient than existing foreign owned firms, but more efficient than domestic start-ups, which are in turn more efficient than existing domestic firms. This study hence suggests that new firms tend to be more efficient than firms privatized to domestic owners. Using 2002 and 2005 firm-level data from 26 transition economies, Commander and Švejnar (2007) find that domestic start up firms are less efficient than foreign owned firms but not significantly different from domestic privatized or state-owned firms. The two studies hence suggest that *de novo* firms are more productive than or at least as productive as SOEs privatized to domestic owners.

As may be seen from Figure 2, effects of privatization on TFP growth have been estimated by country only in the CEE region. The results suggest that in CEE privatization had a positive effect on the rate of change of TFP in the early transition period and that the effect disappears in the later stage. The studies do not distinguish between domestic and foreign categories of private ownership. Commander and Švejnar (2007) have estimated the effect of privatization to domestic and foreign owners on TFP growth on a sample of 27 transition economies, thus combining CEE and CIS countries. Using data from 2002–2005, they find the two effects to be both statistically insignificant. It is hence possible that foreign owners brought about a sizable increase in efficiency in the period immediately after acquiring the local firms in the 1990s, but that later on the rate of change in efficiency has been on average similar in all the principal types of ownership of firms.

4.2 Profitability

Profitability is an important indicator of company performance, although in the transition economies, as in many other developing countries, profits may be underreported by firms to evade taxes, and may reflect market power as well as technical efficiency.

In Figure 2 we summarize the effects of ownership on profitability from 10 studies. Most studies pertain to CEE and show a small positive or insignificant effect of privatization to domestic or foreign owners on profitability levels in the early as well late transformation periods (Figure 2A). This is accompanied by insignificant effects of privatization to domestic and foreign owners on the rate of growth of profitability (Figure 2B).

Figure 3: Profitability Level

		CEE			Russia & CIS		
		Private domestic	Any private	Private foreign	Private domestic	Any private	Private foreign
Positive effect	Large effect (>15%)						
	Medium effect (5–15%)		◑				
	Small effect (<5%)	○◑		◑●			
	Insignificant	●	○◑	○		○	
Negative effect	Small effect (<5%)						
	Medium effect (5–15%)						
	Large effect (>15%)						

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

A further analysis of this overall pattern indicates that the effect varies across types of ownership (bank, investment fund, individual, etc.), with the positive effects in the case of foreign owners being brought about by industrial (non-financial) companies as owners, while in the case of domestic owners it is usually some form of financial ownership that generates positive effects on profit. In this finer categorization, however, the effects vary across studies. Interestingly, using data from the Czech Republic, Andrew Weiss and Georgiy Nikitin (2002) find a positive effect of national (state) ownership on the rate of change of both operating profit per worker and operating profit per unit of capital, as well as a positive effect of municipal ownership on the rate of change of operating profit per worker. Using data of the publicly traded firms in the Czech Republic during 1993–1995, Hanousek and Kočenda (2003) in turn find a positive effect of foreign majority ownership on the rate of change in returns on assets. Finally, Hanousek, Kočenda, and Švejnar (2007) find positive effect of the subsequent ownership by banks on change in ROA but this effect is offset by negative effect of change in ownership. Foreign industrial owners exhibit positive effect of initial ownership on profit over sales, while effect of subsequent ownership by others foreign owners is negative. Overall, profitability is not significantly affected by the state keeping a golden share.

Three studies that control for endogeneity/selection examine the effect of ownership concentration. In the Czech Republic, Hanousek, Kočenda, and Švejnar (2007) find no effect of concentration that results from the initial large scale privatization, but

Figure 4: Profitability Growth

		CEE			Russia & CIS		
		Private domestic	Any private	Private foreign	Private domestic	Any private	Private foreign
Positive effect	Large effect (>5%)						
	Medium effect (1–5%)					◑	
	Small effect (<1%)		○				
	Insignificant	○●		○●			
Negative effect	Small effect (<1%)						
	Medium effect (1–15%)						
	Large effect (>5%)						

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

they find a positive effect of majority ownership by domestic private owners as a result of ownership changes that took place after privatization. In terms of foreign ownership, the authors do not find any effect of high (majority) concentration among foreign owners, but do find that strong (blocking) minority (33–49%) foreign ownership has a positive effect on return on assets. Jeffrey Miller (2006) finds the effect of concentrated ownership on return on assets to be positive in Bulgaria, while Marko Simoneti and Alexandra Gregoric (2004) find concentrated management (but not employees) ownership to have a positive effect on profit/sales in Slovenia. Hence, concentrated domestic private ownership, managerial ownership, and to a lesser extent foreign ownership tend to have a positive effect on profitability, while state keeping a golden share or concentration of worker ownership appear to be unrelated to profitability.

Studies of the effects of ownership on profit of firms in China vary considerably in terms of their methodology, sample size and findings, and as yet only one uses sophisticated econometric methods. Thus Gary Jefferson and Jian Su (2006) estimate the effect of private ownership on profit/sales to be positive but significant only at the 10% test level. Other studies include Xiao-Yuan Dong, Louis Putterman, and Bulent Unel (2006) who find the effect of state urban and private rural ownership to be positive, while that of state rural and private urban ownership to be negative. Several studies of China examine ownership concentration, with Ligang Song and Yang Yao (2004) finding with that state and private majority ownership has a

Figure 5: Revenue Level

		CEE			Russia & CIS		
		Private domestic	Any private	Private foreign	Private domestic	Any private	Private foreign
Positive effect	Large effect (>15%)	◑		◑●●		○	
	Medium effect (5–15%)	◑					
	Small effect (<5%)	○		○		●	
	Insignificant						
Negative effect	Small effect (<5%)					●	
	Medium effect (5–15%)						
	Large effect (>15%)						

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

positive effect relative to non-majority state and private ownership, with the latter not being significantly different from one another. Tian and Estrin (2008) in turn find that state having small shareholding has the largest positive value on corporate value, followed by high state shareholding, while intermediate state shareholding has the lowest effect. Finally, Qian Sun and Wilson Tong (2003) find that majority state or foreign ownership does not have a significant effect on the operating income/sales ratio.

In CEE, CIS and China, the effect of private foreign and domestic ownership on profitability is hence found to be positive or statistically insignificant, with the significance depending on the particular type of ownership. Concentrated domestic private ownership, managerial ownership, and to a lesser extent foreign ownership generally tend to have a positive effect on profitability, while evidence from CEE also suggests that profitability is unaffected by whether or not the state keeps a golden share or workers wield a more concentrated ownership.

4.3 Revenues

In Figure 3 we report the privatization effects on revenues from 14 studies. Since these studies do not control for input use, they effectively measure the effect of privatization on the scale of operation of the firm. In most studies carried out in CEE there is a strong and positive effect of private ownership on the level of

Figure 6: Revenue Growth

		CEE			Russia & CIS		
		Private domestic	Any private	Private foreign	Private domestic	Any private	Private foreign
Positive effect	Large effect (>5%)			○			
	Medium effect (1–5%)						
	Small effect (<1%)			● ◑			
	Insignificant	○ ●				○	
Negative effect	Small effect (<1%)						
	Medium effect (1–5%)						
	Large effect (>5%)						

White circles denote effects of studies that cover the early-to-mid 1990's period. Black circles denote those from the mid-to-late 1990's onwards. Half-white/half-black circles denote effects of studies covering both periods. One circle represents result for one country.

revenues (Figure 3A). The effect is detected in studies that cover either the more recent period or both the earlier and more recent periods. Studies that derive their estimates only from the early period generate small (less than 5%). The positive effect is found with respect to both domestic and foreign private ownership, with foreign ownership appearing to have greater positive effects. A similarly strong positive effect is found in a study covering privatization in the early period in CIS. However, two studies that cover the later transition period in the CIS find small positive and negative effects, respectively. The CIS studies do not distinguish between domestic and foreign ownership.

In terms of revenue growth, we see in CEE a high positive effect of privatization to foreign owners in the early period and a small effect in the later period, and an insignificant effect of privatizing to domestic owners. The one study that covers CIS does not distinguish between domestic and foreign private ownership and suggests that the effect of privatization is statistically insignificant. The somewhat positive findings for foreign-owned firms may be brought about by their better access to foreign markets and possibly support from foreign headquarters.

With respect to China, Jin Jia, Sun, and Tong, (2005) find the effect of ownership on the rate of change of real sales to be insignificant, while Sun and Tong (2003) estimate this effect to be negative for state majority ownership, insignificant for foreign majority ownership and positive for companies that are listed on the stock exchange.

Overall, the studies of CEE and CIS countries indicate that privatization tends to have a positive effect on the scale of operation, while studies of the effect of private ownership on the rate of change of scale of operations (from CEE, CIS and China) suggest that this effect is not statistically significant except in some well defined categories of ownership.

4.4 Labor Productivity

Estimates of the effect of ownership on labor productivity (not controlling for the use of others inputs) are based on twenty four studies. The results of these studies have a less clear-cut interpretation since differences across types of firms could be due to different efficiency or simply to different non-labor (especially capital) factor intensity. For this reason we do not present these results graphically. Nevertheless, it is reassuring that the findings of these studies are similar to the TFP results – they suggest that the effect of private ownership is primarily positive or insignificant. Similarly, as in the case of TFP, foreign ownership and concentrated ownership are found to have a positive or insignificant effect, while the effects of employee and management ownership are estimated to be mostly statistically insignificant. Finally, newly established firms are found to have lower labor productivity than others in some studies but not in others, but this may be brought about by a scale effect. Government retention of a golden share (veto power over certain key decisions) appears to have an insignificant effect.

The corresponding studies of firms in China yield mostly insignificant estimates of the effects of private/non-state ownership on labor productivity, with only one estimate being positive. Overall, the effects of all types of private ownership on labor productivity (not controlling for non-labor inputs) are hence found to be positive or insignificant in CEE and CIS, and mostly insignificant in China.

4.5 Employment

The effect of privatization on employment, like on revenues, is an indicator of the extent of restructuring brought about through privatization. As such, it provides an important empirical link to the theoretical models of transition.

Seventeen studies have examined the effect of ownership on employment or rate of change of employment, with thirteen of them tackling the issue of endogeneity/selection. The estimates indicate that there is a tendency for privatized firms, especially those with foreign owners, to increase or not to reduce employment relative to firms with state ownership, *ceteris paribus*, where the control variables usually but not always include output (sales) and/or output and input prices. This positive or insignificant employment effect is very different from the negative employment effect found in the Mexican privatized firms by LaPorta and Lopez-de-Silanes (1999).

In general, employee ownership and control do not have a significant effect on employment, providing parallel evidence to the TFP studies that this form of ownership does not result in excess employment.

Using a large 1980–90 sample of firms in China, Julia Lane, Harry Broadman, and Inderjit Singh (1998) find a negative effect of the state and collective ownership on both job creation and job destruction.

The studies of employment hence find that privatization in the post-communist economies and China is not associated with a reduction in employment, a phenomenon that is assumed in many theoretical models and which was documented in some developing countries (e.g., Mexico). On the contrary, private owners tend to keep employment at higher levels than SOEs, *ceteris paribus*.

4.6 Wages

Five studies of the effects of ownership on wages find that state ownership is associated with lower wages in some countries, such as Russia and former Czechoslovakia, but not in others, such as Poland. Daniel Münich, Švejnar and Terrell's (2005) study of the Czech Republic suggests that there is no significant difference in the rate of return on an additional year of education between state-owned, privatized and newly established private firms, but that private firms reward university education more than SOEs.

In Russia, where in the 1990s firms tended to owe wages to their workers, SOEs were more likely to exhibit wage arrears than firms with domestic and foreign private ownership, firms with mixed ownership and *de novo* firms (Earle and Sabirianova, 2002; Hartmut Lehmann, Jonathan Wadsworth, and Alessandro Acquisti, 1999). Hence, during this period private ownership was associated with a greater adherence to labor contracts than state ownership.

4.7 Other Indicators of Performance

At least 35 studies have analyzed the effect of ownership on other dependent variables. The following patterns of private ownership effects seem to be broadly supported by the data: (a) private ownership tends to result in higher exports and greater efficiency, as measured by the cost of inputs relative to sales, Tobin's Q, and soft budget constraints, (b) foreign firms tend to restructure and sell assets more than others (Djankov, 1999), are more likely to pay dividends (Jan Bena and Hanousek, 2008), and are less likely to default on debt (Frydman, Hessel, and Rapaczynski, 2000). Despite the fact that the broad range of indicators used in the studies precludes a unified summary, the results exhibit a pattern that is in line shown by other indicators.

5. Concluding Observations

The transformation of the former communist countries from almost completely state-owned to mostly privately-owned economies is one of the fundamental events in recent economic history. Given the relatively poor performance of the centrally planned economies before the transition, most academics and policy makers expected privatization to result in greatly improved economic performance. As it turned out, the post-communist countries went through a deep recession in the first three to eight years of the transition, a period that usually coincided with the launch of privatization. Yet, they have been among the fastest growing economies since then – in the last ten to fifteen years. In contrast, China did not lead its transition with large scale privatization and it avoided the transition recession observed in Central and East Europe (CEE) and the Commonwealth of Independent States (CIS). However, it is relatively soon to draw strong conclusions from the Chinese experience with privatization, and there is a paucity of econometrically convincing studies at this stage. The evidence assembled in this study suggests that privatization and performance are related but that the relationship is more complicated than has been assumed.

First, privatization to foreign owners is found to result in considerably improved performance of firms virtually everywhere in the transition economies – an effect that is best characterized as a fairly rapid shift in performance rather than a gradual improvement over an extended period of time. Second, the performance effect of privatization to domestic owners has on average been less impressive and it has varied across regions. The effect has been smaller, often delayed, but positive in CEE; it has been nil or even negative in Russia and the rest of the CIS. This divergence of findings between the CEE and CIS coincides with differences in policies and institutional development in the two regions, with the former increasingly adopting European Union (EU) rules and joining the EU, and the latter proceeding slower in introducing a market friendly legal and institutional system. Third, in China the results to date are less clear cut and relatively more estimates suggest that privatization to domestic owners improves the level of performance, perhaps because of the benefits of the gradual reform process.

In-depth firm-level studies further suggest that concentrated (especially foreign) private ownership has a stronger positive effect on performance than dispersed ownership in CEE and CIS, but foreign joint ventures rather than wholly owned foreign firms have a positive effect on the level of total factor productivity in China. Worker ownership in CEE and CIS (collective ownership in China) does not seem to have a negative effect. Data from CEE and CIS suggest that new firms are equally or more efficient than firms privatized to domestic owners, and foreign start-ups appear to be more efficient than domestic ones. Interestingly, contrary to assumptions of many theoretical models, as well as evidence from some developing countries (e.g., Mexico), privatization in the post-communist economies is not associated with a reduction in employment. On the contrary, private owners tend to keep employment at higher levels than state-owned firms, *ceteris paribus*. Finally, macro studies are consistent with micro analyses in that they suggest that privatization, especially when accompanied by complementary reforms, may have a positive effect on the level of aggregate output or economic growth. An important issue that remains unresolved is whether speed of privatization, and the accompanying dispersed versus more concentrated ownership, has a positive or negative effect on aggregate output and growth.

In view of the above results, the question naturally arises as to why the effect of privatization in CEE and CIS has been smaller in the case of domestic than foreign private owners. Discussions with managers, policy makers and analysts suggest three leading explanations. The finding may reflect in part the limited skills and access to world markets on the part of the local managers. Domestically owned privatized firms are also the ones where performance-reducing activities such as looting, tunneling and defrauding of minority shareholders have been most frequent. Finally, in a number of countries the nature of the privatization process initially prevented large domestic private owners from obtaining 100% ownership stakes and insiders or the state often owned sizeable holdings (see Kočenda and Hanousek, 2008). It frequently took these large shareholders several years to squeeze out minority shareholders and in the process the large shareholders sometimes artificially decreased the performance of their newly acquired firms in order to squeeze out the minority shareholders at low share prices.

The results highlight the importance of good management and corporate governance, access to world markets, and the presence of a functioning legal and institutional framework. For the former state-owned firms, restructuring is most easily and effectively achieved by foreign ownership. Foreign firms routinely bring in capable expatriate managers and invest heavily in training local managers. They sell products through their global distributional networks, introduce a relatively advanced system of corporate governance and stress the importance of business ethics. Corporate governance of foreign firms hence compensates to a considerable extent for the underdeveloped legal and institutional system in many transition economies. While some domestic firms have also developed good corporate governance, the underdeveloped legal system has allowed local managers (or block shareholders) in many privatized firms to maximize their own benefits at the expense of corporate performance and hence welfare of (other) shareholders as well as stakeholders such as workers and government treasury. This is likely to account for the limited positive performance effects of privatization to domestic private owners as compared to the performance of firms privatized to foreign investors. Interestingly, in China the constraints imposed by the government on foreign firms, together with a relatively functioning legal system, have diminished the difference between the performance of private domestic and foreign firms and made domestic-foreign joint ventures the most productive form of corporate ownership.

The most important policy implication of our survey is that privatization per se does not guarantee improved performance, at least not in the short- to medium-run. Type of private ownership, corporate governance, access to know-how and markets, and the legal and institutional system matter for firm restructuring and performance. Foreign ownership tends to have a positive effect on performance. The positive effect of privatization to domestic owners, to the extent that it exists, takes a number of years to materialize.

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2 | Enterprise Break-ups and Performance During the Transition from Plan to Market

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1. Introduction

As the Central and East European (CEE) countries embarked on the transition from a planned to a market economy in the early 1990s, the restructuring of state owned enterprises (SOEs) became a major policy issue. From the standpoint of (a) altering the size and number of firms and (b) bringing in new management, one of the most important forms of restructuring observed during the CEE transition was the massive breakup of SOEs in Czechoslovakia and to a lesser extent in Hungary in the early 1990s. In Czechoslovakia, many divisions (subsidiaries) of SOEs applied to their supervisory ministries for permission to break away from their "master enterprise" in the 1990–91 period. The ensuing process of negotiations among government officials, top managers of the SOEs and divisional managers resulted in a phenomenal wave of spin-offs, giving rise to a large number of new firms led by new top management. In particular, while Czechoslovakia started in 1990 with about 700 industrial enterprises employing more than 25 workers, by mid 1992 the number of industrial firms in this category had virtually tripled to about 2000.[1] This restructuring preceded other major reforms, as prices were still under state control in 1990, and even in 1991, when prices were by and large free, the state still owned the firms.[2]

The important question that arises is whether the break-ups had systematic economic effects by improving or worsening the performance of the spun off subsidiaries and/or the remaining master enterprises. We address this issue by analyzing 1990–92 enterprise-level data that relate to the breakups of Czechoslovak SOEs during the 1990–1991 period.[3] Since the Czech and Slovak republics are among the leading transition economies whose policies have been followed by other countries (World Bank, 1996), and since the two republics have displayed major problems with management's appropriation of profit in the presence of weak ownership and legal frameworks (Lízal et al., 1995; Ellerman, 1998; Weiss and Nikitin, 1998; Stiglitz, 1999), our findings are of general interest in the transition context.

1 The latter number includes newly created firms. However, since only firms with more than 25 employees are included, most of the growth in the number of firms has been brought about by the breakups of SOEs. It should also be noted that the breaking up of firms in the transition economies has other aspects than those that we study in this paper. The process for instance includes the unbundling of social service activities (e.g., clinics and kindergartens) and service activities for the workforce (e.g., food and beverage manufacture and holiday homes). These spin-offs generate small firms (often with fewer than 25 workers) that operate in other industries than the core activity of the firm. While important, they are not the subject of our analysis.

2 Yet, as discussed by Kotrba (1995) and Zemplinerova and Stibal (1995), the outcome of the process of enterprise breakups had important implications for the structure of industry and the subsequent program of privatization.

3 We build on previous work (Lízal et al., 1995) by using a better data set and superior analytical techniques to address the issue.

2. A Conceptual Framework for Spin-offs and Breakups

The literature on the desirability of takeovers, mergers, and break-ups of firms in market economies focuses on the tradeoff between transaction costs via markets and the internal inefficiencies within organizations.[4] In the context of the transition, the conceptually more relevant studies focus on the bargaining between the key decisionmakers who, depending on the context, are managers, government officials (politicians), workers, and new private owners.[5]

In the case of Czechoslovakia, the principal factors leading to the 1990-91 break-ups of SOEs appear to have been the goals of and opportunities open to the top management of the SOEs and the management of the divisions of these SOEs. In particular, managers of many divisions of SOEs applied to the supervisory ministries for permission to spin off from their master enterprises. The government displayed a relatively passive posture toward the restructuring and breakups of SOEs since the ministries were charged with screening rather than initiating the spin-offs. Moreover, since the majority of applications for spin-offs were submitted and processed in the last quarter of 1990 and the first quarter of 1991, the ministries worked under time constraints and had little time to encourage applications.[6] The institutional information hence suggests that breakups and spin-offs were initiated by the management of either the master enterprise or the subsidiary.

In conceptualizing the process, note that the compensation of the top management of the firm before the break-up is an increasing function of performance of the entire firm, while after the split it is a positive function of the performance of the remaining master enterprise only. Analogously, the compensation of the management of a subsidiary before the break-up is an increasing function of performance of the entire firm, adjusted for the relative importance of the subsidiary, but it becomes a positive function of the performance of the subsidiary after the split. Rational behavior of managers in this setting yields two competing hypotheses:

1. Break-ups occur because the top managers of the SOEs discard poorly performing divisions in order to improve the performance of the (remaining) master enterprises, or

2. Break-ups are observed because managers of the divisions (subsidiaries) of SOEs spin more efficient units away from the master enterprises.

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4 See e.g., Coase (1937), Alchian and Demsetz (1972), Williamson (1975, 1985), Chandler (1990), Klein et al. (1978), Grossman and Hart (1986), Lichtenberg and Siegel (1987), Ravenscraft and Scherer (1987), Hart and Moore (1990), Kaplan and Weisbach (1992), and Radner and van Zandt (1992).

5 See e.g., Aghion et al. (1994), Shleifer and Vishny (1994), Prasnikar et al. (1994), and Lízal et al. (1995).

6 During this time period the ministry employees were themselves being screened as to whether they had belonged to the communist "nomenclatura" or had worked for the former security police. They were hence under extreme pressure not to transgress their narrowly defined duties.

Since firms created under communism tended to be artificially large, we also examine the hypothesis that the SOEs suffered from inefficiencies such as diseconomies of scale and that the performance of the constituent units could be improved by unbundling:

3. Break-ups occur because the large SOEs suffer from inefficiencies such as diseconomies of scale and break-ups result in a superior performance of both the spun off units and the remaining master enterprises.

Finally, we allow for the hypothesis that as government supervision of management waned and control over management remained weak in the absence of a solid legal framework, appropriation of profit and asset stripping by managers ("tunneling") has become a serious problem:

4. Break-ups occur because managers of subsidiaries benefit from being the top management of a firm even if their unit and the master enterprise perform worse as a result of the break-up.

In this fourth scenario the utility of managers of divisions does not depend on the performance of their firms and the pursuit of managerial goals worsens enterprise performance.

The four hypotheses hence provide a rationale for observing the following four outcomes: (i) the effect of a break-up on performance is positive for the master enterprise and negative for the subsidiary (Hypothesis 1), (ii) the effect is positive for the subsidiary and negative for the master firm (Hypothesis 2), (iii) the effect is positive for both the master enterprise and the subsidiary (Hypothesis 3), and (iv) the effect is negative for both units (Hypothesis 4).

The magnitude of the effects implied by hypotheses 1–4 will of course depend on the overall economic environment. An important countervailing effect is brought about by increased competition, stemming from the break-ups of large firms with monopolistic power and from the opening up of the formerly planned economies to world trade. In particular, increased competition exerts downward pressure on output prices and thus reduces nominal value added and profits. Moreover, the Czechoslovak authorities eliminated quantitative import restrictions as early as 1990, and the average level of trade weighted tariffs became as low as 5% (Drabek and Smith, 1995). However, in 1990–91 the firms in Czechoslovakia were temporarily protected by a uniform 20% import surcharge tax (Dyba and Švejnar, 1995). Since trade with Western economies experienced a phenomenal boom and by mid-1990 exceeded the value of trade with the former Soviet bloc countries (Dyba and Švejnar, 1995), one may expect that the combined effect of the break-ups of monopoly firms and the 1992 elimination of the 20% import surcharge would reduce any positive impact of break-ups on value added and profits in 1992 as compared to the immediate effect observed in 1991. We take these effects into account as we interpret our econometric estimates.

3. The Empirical Analysis

3.1 The Data and Identification of Break-ups

Our empirical analysis is based on quarterly and annual data reported by firms to Czechoslovakia's Federal Statistical Office and Ministry of Finance during the 1990–92 period. The data cover all industrial enterprises employing more than 25 employees.

Although carefully assembled, the data set contains no explicit indicator of the break-ups, since no unplanned changes of industrial structure were expected under central planning.In order to identify the break-ups, we exploited a special feature of statistical reporting. The system required enterprises to report the preceding year's values of variables together with the current values. Moreover, enterprises experiencing spin-offs were required to report preceding year values corresponding to the remaining (post-break-up) part of the enterprise. If a break-up occurred, the remaining master enterprise therefore reported both the current and preceding year's data corresponding to its new (smaller) size. Using quarter by quarter comparisons, we identified the break-ups and the quarter of their occurrence.[7]

Using the quarterly and monthly data, we are able to identify 476 enterprises that were present in the data set from the first quarter of 1990 to the fourth quarter of 1992. We had to drop about 80 of these 476 firms because they provided inadequate information and some observations were also lost as we collected data for the same set of firms for 1992. Overall, in most regressions we are able to use data for 373 firms for 1991 and 262 firms for 1992.

Using the above mentioned procedure for identifying spin-offs, eliminating firms that did not adequately fill out questionnaires and ignoring potential spin-offs involving less than 5% of the labor force or fewer than 5 employees, we were able to identify 152 firms that experienced spin-offs. Most (78) of these spin-offs occurred in the first quarter of 1991, 57 occurred in the last quarter of 1990, and few occurred in the second quarter of 1990 and in the remaining quarters of 1991. We use data from firms that experienced spin-offs in the first quarter of 1991. By doing so we resolve the problem of endogeneity of regressors since we use 1990 values as exogenous variables for the 1991 and 1992 regressions. Of the 78 spin-offs that occurred in the first quarter of 1991, 66 yielded data that could be used in our analysis in 1991 and at least 50 generated data that could be used for 1992.

While the above data exercise allows us to compare the performance of master enterprises that experienced spin-offs to the performance of those that did not, it does not permit us to link the spun off units to their former master enterprises and estimate the effect on the spun off units. In order to be able to do so, we carried out puzzle-like comparisons of the values of variables such as number of employees in

7 An example showing the identification of break-ups may be found in Lízal et al. (1997).

the newly established companies with the decrease in the value of these variables in the master enterprises that were identified as experiencing spin-offs. In order to generate a meaningful number of observations, we were also forced to impose the assumption that the spun off units operate in the same or similar industry as their master enterprises. This enabled us to identify 28 pairs of masters and spun off subsidiaries, 27 of which were usable in our work.[8]

3.2 The Econometric Models

Since the comparisons of means indicate that in 1990 there were no significant differences in performance between firms that later experienced spin-offs and those that did not,[9] our empirical strategy is to estimate the performance effect of a spin-off by comparing the performance of enterprises that were present throughout the 1990–92 period, but did not experience any spin-offs, to the performance of (a) the master enterprises that did experience spin-offs and (b) the newly spun off subsidiaries. The method amounts to comparing the performance of a treatment group (enterprises involved in a break-up) to a control group (enterprises not undergoing a break-up). It goes beyond a simple comparison of means by controlling for the relevant pre-spin-off conditions in these firms.

Enterprise performance $\boldsymbol{\pi}$ may be measured in a number of ways. To provide a relatively broad set of tests, we have used three performance indicators:

1) Value Added/Labor,[10]
2) Profit/Labor,
3) Turnover/Total Cost,

where turnover/total cost = (revenue + cost)/cost = 1 + (profit + cost)/cost = 2 + profit/cost constitutes an alternative measure of the profitability of the firm.

Profitability is the traditional and most widely used measure of performance. We use two alternative measures (one direct, scaled by labor, and one indirect, scaled by total cost) to check how sensitive the findings are to these different measures of performance. There are at least two reasons for using also value added per worker as a performance variable. First, value added per worker is a measure of productive efficiency of the firm when we analyze the impact of break-ups on value

8 See Lízal et al. (1997) for details. Note also that data problems related to the 1993 dissolution of Czechoslovakia and the completion of the first wave of privatization have prevented us from extending our panel beyond 1992.

9 Lichtenberg and Siegel (1987) have found that poorly performing firms are more likely to change ownership. However, as was pointed out by Stiglitz (1987, p. 682) and Jorgenson (1987, p. 675), Lichtenberg and Siegel (1987) have a biased sample since the results are conditioned on the fact that the firm has survived in the sample, i.e., it was not closed down because of inferior performance. Our sample does not suffer from this flaw since there were no shutdowns in Czechoslovakia in the period under study.

10 Since the data sets did not contain ready measures of value added, we have constructed a proxy for it by adding profit and labor costs.

added per worker, while controlling for variables that approximate an arbitrary production function. In this sense our analysis may be seen as testing the impact of break-ups on productive efficiency. Second, value added per worker is traditionally assumed to be one of the likely objective functions of labor-managed firms (see e.g., Ward, 1958; Vanek, 1970; and Prasnikar et al., 1994). Since worker-insiders are widely believed to have gained influence in enterprises during the transition (e.g., Blanchard, 1997; and Burda, 1993) and micro-evidence indicates that they tend to appropriate a significant portion of value added (Prasnikar and Švejnar, 1998), an analysis of the impact of break-ups on value added per worker is useful as it measures the impact on what is arguably an important objective of the firm.

The performance variables are based on 1991 and 1992 annual data and the effect of the split can be captured by allowing the expected future performance to be a function of two sets of arguments:

$$\mathrm{E}\,(\boldsymbol{\pi}_{\text{after split}}) = \boldsymbol{\pi}\ \textbf{(spin-off characteristics | pre-spin-off characteristics),}$$

where the spin-off characteristics capture the effect of the split, while the pre-spin-off characteristics are 1990 firm-specific indicators that represent the available information from which the expectations of a future performance of the enterprise might be inferred.

Since the effect on performance may vary with the size of the spin-off, we estimate the spin-off effect as a linear function of the size of the spin-off. In particular, using data on the spun off subsidiaries and master enterprises that experienced break-ups as well as those that did not, we estimate coefficients $\boldsymbol{\alpha_0}$, $\boldsymbol{\alpha_1}$ and vector $\boldsymbol{\beta}$ in the following model:

$$\pi_i = \beta' X_i + \alpha_0 d_i + \alpha_1 df_i + e_i \quad , \tag{1}$$

where index $\boldsymbol{i}$ denotes firms, $\boldsymbol{\pi_i}$ is a measure of enterprise performance, $\boldsymbol{X_i}$ are variables controlling for pre-spin-off conditions, $\boldsymbol{d_i}$ is a dummy variable coded **1** if the enterprise is a spun off subsidiary or a master firm that experienced a spin-off and zero otherwise, and $\boldsymbol{df_i}$ is the share that the labor force of the spun off subsidiary represents in the total labor force of the master enterprise before the break-up. The values of $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$ are zero for firms that did not experience spin-offs. The average, minimum and maximum values of $\boldsymbol{df_i}$ are reported in Table 1.

If the unobserved random characteristics of an enterprise did not influence the occurrence of a spin-off and the value of $\boldsymbol{df_i}$, ordinary least squares (OLS) would generate consistent estimates of the $\boldsymbol{\alpha}$'s and vector $\boldsymbol{\beta}$. However, the process of determination of $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$ is most likely correlated with unobserved characteristics of the enterprise, such as the ability of management and know-how. As a result, it is likely that

$$E(e_i | d_i) \neq 0, E(e_i | df_i) \neq 0 \quad . \tag{2}$$

Table 1: An Example of the Identification of a Spin-off

Year of Report	Reported Variable	Quarters			
		I.	II.	III.	IV.
1990 by both Types of Firm	Current (1990) Labor	700	700	700	700
1991 by a Master Enterprise that Spun off a Subsidiary	Lagged (1990) Labor	700	300	300	300
1991 by a Firm with Layoffs		700	700	700	700
1991 by both Types of Firm	Current (1991) Labor	700	300	300	300

Note: A comparison of a firm that spun off a unit with 400 employees in the second quarter of 1991 to a firm that laid off 400 employees in the same period.

The error term in equation (1) is hence likely to be correlated with $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$, and OLS estimates are likely to be inconsistent. The solutions for this problem are well known (see e.g., Madalla, 1983; or Heckman and Singer, 1985), with the simplest and most robust one being the use of instrumental variables (IVs), where the instruments for $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$ are variables that are correlated with $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$ but not with $\boldsymbol{e_i}$. In theory, maximum likelihood estimation (MLE) is more efficient, but in the presence of the dummy and share variables MLE requires numerical integration and is sensitive to misspecification. Moreover, since the relative advantage of the MLE method is based on large sample properties and we have 400 or fewer observations, we use the more robust IV approach.

Our vector of control variables $\boldsymbol{X_i}$ consists of the following variables: labor (number of employees), labor squared, net capital, net capital squared, net capital per labor, net capital per labor squared, and industry dummy variables for seven industry groups (heavy industry; machinery; production of building materials; production of pulp, wood processing and paper; glass and ceramics; food and beverages; and textile and leather). We thus use a simple but flexible additive form that represents a second-order approximation to any production function. Since we are using 1990 $\boldsymbol{X_i}$s, we do not encounter the problem of endogeneity that would arise if we used current period (1991 and 1992) values of $\boldsymbol{X_i}$s. In fact, in 1990 the values of $\boldsymbol{X_i}$s were still determined by the central plan. Both the spun off subsidiaries and all the master enterprises were thus assigned as exogenous control variables the 1990 values of $\boldsymbol{X_i}$s that correspond to the enterprise from which they evolved.

In instrumenting $\boldsymbol{d_i}$ and $\boldsymbol{df_i}$, the crucial source of identification is a set of six dummy variables for the individual supervisory ministries that made the final decisions about the proposed spin-offs (Federal Ministry of the Economy, Czech Ministries of Industry, Machinery, and Construction, and the Slovak Ministries of Economy and Industry). The six ministries were independent of one another and their decisions were fairly idiosyncratic. Moreover, by 1991 the ministries were relaxing their supervisory functions and had only limited information about the current and future performance of the firms. Yet, since the ministries decided whether the split was to be approved or not and how exactly it was going to be carried out, the ministry dummy variables are correlated with (and hence are good predictors of) the variables measuring the occurrence and share of the spin-off.[11] Since the ministries were separate for the Czech and Slovak Republics, the ministry dummy variables also serve as dummy variables for the two republics.

3.3 Empirical Results

3.3.1 The Effects of Break-ups on Master Enterprises

In this section we present coefficient estimates of equation (1) based on data from master enterprises that experienced spin-offs and those that did not. The results are based on samples with 373 firm-level observations in 1991 and approximately 260 observations in 1992. About 20% of these firms experienced a spin-off.

In Table 2 we present the estimated IV coefficients $\boldsymbol{\alpha_0}$ and $\boldsymbol{\alpha_1}$, with the upper half of the table containing the estimates for 1991 and the bottom half for 1992. As may be seen from Table 2, all three estimates of $\boldsymbol{\alpha_0}$ and $\boldsymbol{\alpha_1}$ for 1991 are statistically significant. The performance effect declines with the size of the spin-off, being positive for small, medium-sized and slightly above average sized spin-offs, but becoming negative for those that are significantly above average in size. As we show in Column **c** of Table 2, the size of spin-off at which the effect turns from positive to negative (38% for value added per worker, 52% for profit per worker and 50% for turnover/cost) exceeds the average spin-off size of 30% reported in Table 1.[12] The results thus suggest that in the short run master enterprises that experienced small to slightly above average spin-offs gained in terms of both efficiency and profitability – a finding that is consistent with Hypotheses 1 and 3 of Section 2. In contrast, firms that lost more than 38% of their labor force through a spin-off suffered in terms of value added per worker. Those that lost more than 50% of their labor in the spin-off also experienced a negative effect in terms of profit/labor and turnover/cost. Since we are measuring the effect immediately after the break-up, a possible explanation of the negative impact of large spin-offs ($\boldsymbol{\alpha_1}$<0) is that they necessitate more fundamental restructuring than small spin-offs, with performance suffering in the short term during the adjustment process.[13]

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11 The correlations between industry dummies used in the Xi vector of control variables and the ministry dummies identifying the effect of the spin-off variables are fortunately quite low. In the case of one industry, the correlation coefficient reaches 0.78, but all other correlation coefficients are below 0.4.

12 The size at which the effect changes from positive to negative may be referred to as the "critical size" of the spin-off. In our case, it is measured in terms of the labor share of the master enterprise that experienced a spin-off. As may be seen from the calculated values in Tables 2–4, the 1991 estimates of the critical size of the spin-off range from 38% to 52% for master firms, 31% to 34% for spun off subsidiaries and 34% to 45% for the joint estimates. The effect of the spin-off is hence estimated to be positive within a sizable range of spin-off values, including the average spin-off size of about 30% (Table 1).

13 We are indebted to an anonymous referee for pointing out this explanation to us. A competing explanation would be that sizable break-ups created strongly competing firms that drove down product prices, nominal

Table 2: Number of Spin-offs in 8 Consecutive Quarters of 1990–1991

Quarter	I.–II.	II.–III.	III.–IV.	IV.–V.	V.–VI.	VI.–VII.	VII.–VIII.
Number of Spin-offs	8	0	57	78	2	6	1

The estimates reported in the bottom panel of Table 2 refer to 1992 and for value added and profit per worker they are based on a smaller sample than those for 1991 since about 30 percent of firms did not report data on labor in 1992. As is evident from Table 2, while in the case of value added and profit per worker the estimated 1992 coefficients have the same signs as those for 1991, the estimated standard errors are relatively large and the estimated effects are statistically insignificant. The decline in statistical significance of the negative effect of large spin-offs ($\boldsymbol{\alpha}_1$<0) between 1991 and 1992 is consistent with the aforementioned explanation that large spin-offs necessitated more fundamental and hence costly restructuring in 1991 and that this negative effect on performance might have tapered off by 1992. The question that remains, however, is why the effect becomes statistically insignificant between 1991 and 1992 for spin-offs of all sizes. We have pursued this issue by checking if the decrease in statistical significance of the estimates of $\boldsymbol{\alpha}_0$ and $\boldsymbol{\alpha}_1$ between 1991 and 1992 is caused by a decrease in the sample size or by other phenomena. To do so, we have re-estimated the 1991 value added/labor and profit/labor regressions using only data from firms that constitute the 1992 sample. The resulting estimates have the same signs as those in Table 2, with three of the four estimates being statistically insignificant. These findings hence indicate that the decrease in the sample size could be the cause of decline in statistical significance observed in Table 2 between 1991 and 1992.

In contrast, the 1992 estimates for turnover/cost, reported in the bottom panel of Table 2, are based on a very similar number of observations as the 1991 estimates reported in the upper panel of the table. For this indicator the issue of a reduced sample size does not arise and the insignificance of the 1992 estimates of the effect of the breakups is attributable to other phenomena, such as increased competition and dissipation of profits by management (Hypothesis 4).

3.3.2 Effects of a Spin-off on the Subsidiary

In this section we focus on the difference between the performance of spun off subsidiaries and enterprises that did not experience spin-offs. The total sample size is about the same as before (334 observations for all three indicators in 1991 and 224 observations for value added and profit per worker in 1992), but there are only

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value added and profits. However, as we show presently, this latter explanation is not supported by the weakening of the effect in 1992.

Table 3: The Average Size of a Spin-off and the Typical Sample Size

	Average Spin-off	Standard Deviation	Number of Spin-offs of Master Enterprises / Total Available Sample (Typical)	Minimum Spin-off	Maximum Spin-off
Entire Sample 1990	31.1%	17.0%	118/432	5.3%	70.8%
Analyzed in 1991	28.3%	15.6%	66/373	5.3%	68.2%
Analyzed in 1992	29.5%	16.7%	50/260	5.3%	68.2%

Note: The size of a spin-off is measured as a percentage of the labor force of the master enterprise. The number of enterprises in the 1992 regressions varies because of the unavailability of data for some variables.

27 observations on the spun off subsidiaries in 1991 and, in the case of value added and profit per worker, only 12 in 1992.

In the upper half of Table 3 we present the estimated effects for 1991. As was the case for master enterprises that experienced spin-offs, we find that the estimated effects of a spin-off on the newly independent subsidiary's value added per worker, profit per worker and the ratio of turnover to cost are statistically significant, with $\boldsymbol{\alpha_0} > 0$ and $\boldsymbol{\alpha_1} < 0$. The 1991 estimates hence again yield the performance effect as a negative function of the relative size of the spin-off, with the effect being positive for small to average-sized spin-offs (consistent with Hypotheses 2 and 3) and negative for above average-sized spin-offs (consistent with the explanation based on sizable adjustment costs).

The estimates for 1992, reported in the bottom half of Table 3, show the effect to be negatively related to the size of the spin-off ($\boldsymbol{\alpha_0} > 0$ and $\boldsymbol{\alpha_1} < 0$) for profit/labor and insignificant ($\boldsymbol{\alpha_0} = \boldsymbol{\alpha_1} = 0$) for value added/labor and turnover/cost. There is hence again evidence of a weakening effect of spin-offs over time, but the weakening is less uniform than in the case of the master enterprises. Taken together, the 1991 and 1992 results in Table 3 are consistent with the explanation that more sizable break-ups cause more substantial short-term adjustment costs and hence have a negative effect on performance in the short run. In the case of profit/labor, this negative effect seems to prevail through 1992. As before, we have re-estimated the 1991 value added/labor and profit/labor regressions using only data from firms that are present in the 1992 sample. Unlike the mixed results that we found for master enterprises that experienced break-ups, the present re-estimation generates statistically significant coefficients that have the same signs and similar values as those in the upper part of Table 3. In the case of the spun off subsidiaries, the weakening of statistical significance over time hence appears to be brought about by phenomena such as increased competition and the dissipation of profits by management (Hypothesis 4) rather than by reduced sample size.

Table 4: The Average Size of a Spun off Subsidiary

	Average Spin-off	Standard Deviation	Number of Spun off Enterprises in the Sample	Minimum Spin-off	Maximum Spin-off
Subsidiary	28.7%	15.0%	27	8.1%	70.8%

Note: The size of a spun off subsidiary is measured as a percentage of the labor force of the former master enterprise.

3.3.3 Joint Estimates

In view of the similar estimates obtained for the master firms that experienced spin-offs and the spun off units, we have also carried out joint estimation and tested the hypothesis that spin-offs have equal effects on these two sets of firms. As may be seen from Table 4, the joint estimates are similar to thos e found in the separate regressions for master firms that experienced spin-offs and for spun off subsidiaries. Moreover, as the p-values in the last columns of the tables indicate, on the basis of $X^2_{(2)}$ tests one cannot reject the hypothesis that for each performance indicator the effect of the break-up is identical for the spun off subsidiaries and the remaining master firms. The separate as well as joint 1991 estimates for small, medium-sized and slightly above average spin-offs hence provide support for Hypothesis 3 (SOEs suffer from inefficiencies such as diseconomies of scale and break-ups result in a superior performance of both the spun off units and the remaining master enterprises) as opposed to Hypotheses 1 and 2 (break-ups occur because either master enterprises or subsidiaries are more efficient).

We have also generated joint 1991 estimates for value added/labor and profit/labor using only data from firms that are present in the 1992 sample. These new estimates and the estimates for turnover/cost in Tables 4 show that five of the six relevant coefficients are statistically significant. These results hence indicate that the decline in the statistical significance of the joint estimates between 1991 and 1992 is brought about primarily by phenomena such as increased competition and possible dissipation of profits by managers (Hypothesis 4).[14]

4. Concluding Observations

In terms of altering the number and size of firms, as well as bringing in new top management, one of the most important forms of enterprise restructuring observed in a number of transition economies was the break-up of the large state owned enterprises (SOEs). Our econometric estimates suggest that the major wave of

14 Finally, we have used the 1991 and 1992 data to carry out estimation on first differences. The estimated coefficients in this fixed effects specification are by and large statistically insignificant. While we hoped to generate information from changes of performance over time, our finding of a lack of statistical significance is not altogether surprising, given that we found the 1992 level estimates to have relatively large standard errors and to be themselves statistically insignificant at conventional statistical test levels.

Table 5: Estimated Effects of a Break-up on Master Firms

$$\pi_i = \beta' X_i + \alpha_0 d_i + \alpha_1 df_i + e_i \ ,$$

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	R^2	N
1991					
Value Added / Labor	206.04** (97.59)	-542.10** (251.19)	38.0*** (8.1)	0.40	373
Profit / Labor	375.27** (175.91)	-722.90* (382.10)	51.9*** (12.4)	0.22	373
Turnover / Cost	0.74** (0.32)	-1.49* (0.78)	49.5*** (11.5)	0.08	373
1992					
Value Added / Labor	167.07 (265.79)	-499.67 (545.20)	33.4 (27.2)	0.21	259
Profit / Labor	165.84 (263.58)	-492.39 (540.65)	33.7 (27.3)	0.20	262
Turnover / Cost	-0.37 (0.47)	-0.68 (0.96)	-54.9 (141.3)	0.13	367

Note:

Values in parentheses are standard errors;

c = critical size of the spin-off, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spin-off on performance is zero, i.e., $c = -(\alpha_0/\alpha_1) \cdot 100\%$;

N = number of observations;

* = significantly different from zero at a 10% level of significance;

** = significantly different from zero at a 5% level of significance;

*** = significantly different from zero at a 1% level of significance;

The sample contains 66 master enterprises that experienced a break-up in the 1991 regressions.

There are 66 master enterprises that experienced a break-up in the samples with 367 observations and 50 in the remaining 1992 regression samples.

break-ups of SOEs that took place in Czechoslovakia in the early 1990s had a significant immediate effect on the efficiency and profitability of industrial firms. The effect was positive for small, medium-sized and slightly above average-sized spin-offs, and negative for the very large ones. We also cannot reject the hypothesis that the estimated effect of spin-offs on performance was identical for the spun off subsidiaries and the master enterprises that experienced the spin-offs. Taken together, the positive short-term effects on performance of both the master firms and the spun off units are consistent with our Hypothesis 3, namely that the large SOEs suffered from inefficiencies that were rapidly alleviated by the break-ups into smaller units. The finding that the short-term performance effect was negative for very large spin-offs is in turn consistent with the explanation that sizable break-

Table 6: Estimated Effects of a Break-up on the Subsidiaries

$$\pi_i = \beta' X_i + \alpha_0 d_i + \alpha_1 df_i + e_i ,$$

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	R^2	N
1991					
Value Added / Labor	225.57* (123.44)	-732.54* (385.70)	30.8*** (6.2)	0.18	334
Profit / Labor	434.72** (210.50)	-1375.61** (588.16)	31.6*** (5.9)	0.09	334
Turnover / Cost	1.31** (0.53)	-3.81*** (1.48)	34.3*** (4.5)	0.00	334
1992					
Value Added / Labor	201.17 (468.67)	-713.58 (1399.9)	28.2 (19.4)	0.15	224
Profit / Labor	1230.90* (646.24)	-3717.06** (1894.59)	33.1*** (4.7)	0.02	224
Turnover / Cost	0.64 (0.77)	-3.33 (2.09)	19.3 (12.3)	0.00	324

Note:

Values in parentheses are standard errors;

c = critical size of the spin-off, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spin-off on performance is zero, i.e., $c = -(\alpha_0/\alpha_1) \cdot 100\%$;

N = number of observations;

* = significantly different from zero at a 10% level of significance;

** = significantly different from zero at a 5% level of significance;

*** = significantly different from zero at a 1% level of significance;

There are 27 subsidiaries in the sample for the 1991 regressions.

There are 22 subsidiaries in the sample with 324 observations and 12 subsidiaries in the sample with 224 observations for the 1992 regressions.

ups caused large adjustment costs and thus had a negative short-term effect on performance.

We also find that most 1992 estimates are similar to those for 1991 but that many yield statistically insignificant effects, including the negative one for the sizable break-ups. In order to explain this finding we first control for the fact that for two of the three performance indicators (value added/labor and profit/labor) we have significantly fewer observations for 1992 than 1991. By reproducing 1991 estimates with data from firms that are present only in the 1992 sample, we are able to control for the reduction in sample size and establish that the weakening of the statistical significance is in most cases not attributable to the decrease in the sample size. We conclude that the insignificance is likely generated by (a) the increased competition

Table 7: Joint Estimates of the Effects of a Break-up

$$\pi_i = \beta' X_i + \alpha_0 d_i + \alpha_1 df_i + e_i \ ,$$

Dependent Variable	IV Coefficients and Statistics					
	α_0	α_1	c [%]	R^2	N	p-value
1991						
Value Added / Labor	126.05* (65.63)	-375.67** (181.58)	33.6*** (7.8)	0.46	400	0.43
Profit / Labor	242.83** (112.32)	-503.78** (240.84)	42.8*** (11.8)	0.32	400	0.27
Turnover / Cost	0.53** (0.21)	-1.18** (0.53)	44.7*** (9.1)	0.14	400	0.23
1992						
Value Added / Labor	-7.55 (163.67)	-373.25 (423.35)	-2.0 (45.9)	0.22	274	0.91
Profit / Labor	237.40 (210.81)	-696.37 (479.04)	34.1*** (15.0)	0.17	274	0.22
Turnover / Cost	-0.12 (0.28)	-0.83 (0.68)	-14.5 (45.1)	0.13	389	0.55

Note:

Values in parentheses are standard errors;

c = critical size of the spin-off, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spin-off on performance is zero, i.e., $c = -(\alpha_0/\alpha_1) \cdot 100\%$;

N = number of observations;

p-value = p-value of the $X^2_{(2)}$ test of the equality of the effects of a spin-off on the subsidiaries and master firms;

* = significantly different from zero at a 10% level of significance;

** = significantly different from zero at a 5% level of significance;

*** = significantly different from zero at a 1% level of significance;

The sample contains 27 subsidiaries and 66 master enterprises that experienced a break-up in the 1991 regressions.

There are 22 subsidiaries and 66 master enterprises that experienced a break-up in the sample with 389 observations, and 12 subsidiaries and 50 master enterprises experiencing a break-up in the other samples for the 1992 regressions.

brought about by the break-ups of the large firms into competing units and the 1992 elimination of the 20% import surcharge (the main trade protection measure), and (b) the growing phenomenon of profit dissipation by management as central controls were gradually eroded. The latter interpretation reflects Hypothesis 4 and is consistent with recent reports of siphoning off of profits and asset stripping ("tunneling") by managers in the Czech Republic, Slovakia, Russia and other transition economies with weak ownership structures.

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3 | Corporate Ownership, Control and Performance after Mass Privatization

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1. Introduction

One of the fundamental and most controversial economic questions is whether private firms perform better than state-owned enterprises (SOEs) and whether privatization improves corporate performance. There is now a large literature on this subject, and the issue has gained currency as large-scale privatizations have taken place in many of the former command economies and developing countries. The issue is also of interest because the most populous and rapidly growing countries, China and India, are in the process of privatizing and others, such as Vietnam, are getting ready to privatize their SOEs.

Interestingly, while the premise and conclusions of initial studies with respect to privatization is that it improves firm performance and helps countries grow, the effect has not been clearly established. At the macro level, one observes that some of the fastest large-scale privatizers (e.g., Russia, Ukraine and the Czech Republic) experienced a decline or slow growth after privatization in the 1990s, while some of the fastest growing transition economies in the 1990s (e.g., China, Poland and Slovenia) were among the slowest to privatize. In a cross-country aggregate study, Sachs, Zinnes and Eilat (2000) find that privatization does not by itself increase GDP growth, but they suggest that a positive effect is present when privatization is accompanied by in-depth institutional reforms. Careful micro-econometric studies date back to Caves and Christensen's (1980) classic study that found private and state-owned Canadian railways performing equally efficiently in a head-on competition. Recent surveys of privatization studies based on micro data come up with assessments that range from finding a large variation of outcomes but no systematically significant effect of privatization on performance (Bevan, Estrin and Schaffer, 1999), to cautiously concluding that privatization around the world improves firm performance (Megginson and Netter, 2001), to being fairly confident that privatization tends to improve performance (Shirley and Walsh, 2000, and Djankov and Murrell, 2002).[1]

Apart from being somewhat diverse, the estimated performance effects found in much of the literature are not firmly established. The credibility issue arises from three types of interrelated analytical problems that may be expected to be present in early studies, especially those in the context of the rapidly changing transition economies. First, the early studies rely on short time periods with observations concentrated immediately before and after privatization. They may hence at best capture the short–term effects of privatization rather than the medium and long-term effects of a switch from state to private or mixed ownership. Second, the early studies (a) use small and often unrepresentative samples of firms, (b) are frequently unable to identify accurately ownership because privatization is still ongoing or because the frequent post-privatization changes of ownership are hard to detect, and

1 See Roland for a theoretical analysis and overview of privatization in transition.

(c) often combine panel data from different accounting systems.[2] Third, many of the early studies are not been able to control adequately for endogeneity of ownership (firms not being selected for privatization at random), and their estimates of the effects of privatization may hence be biased (Gupta, Ham and Švejnar, 2000).[3]

Moreover, many of the early studies had access to limited data on firm ownership.[4] As a result, they often treat ownership as a relatively simple categorical concept (e.g., private v. state or state v. foreign, domestic private outsider v. domestic private insider), and they are often unable to distinguish the exact extent of ownership by individual owners or even relatively homogeneous groups of owners. As we discuss below, this also prevents many studies from providing evidence for a lively debate about the desirability of concentrated versus dispersed ownership on corporate performance.[5]

In this paper we advance the literature by addressing systematically the three types of above-mentioned problems found in the existing studies. In particular, in analyzing the performance effects of ownership, we (a) use panel data on a complete population of medium and large firms that went through the natural experiment of mass privatization in a model economy (Czech Republic) and that constitute the bulk of the country's economic activity,[6] (b) cover a four-year period after privatization when accounting rules conforming to the international (IAP) standard were already in place and (c) control for endogeneity of ownership using a first-difference specification together with instrumental variables from rare data

2 The key studies are indeed based on small samples related to short periods around privatization. For example, Frydman, Gray, Hessel and Rapaczynski (1999) use a 1990–93 sample of about 200 firms pooled from the Czech Republic, Hungary and Poland; D'Souza and Megginson (1999) analyze a total of 85 companies from 28 countries; Boubakri and Cosset (1998) use a 79 firm sample covering 29 countries; Barberis, Boycko, Shleifer, and Tsukanova (1996) use a sample of 260–340 Russian shops during the 1992–93 period; Bilsen and Konings (1998) use survey data for 1990–94 on about 260 firms divided among Bulgaria, Romania, and Hungary; Grosfeld and Nivet (1997) use a sample of 173 of the largest 500 companies in Poland during the 1988–1994 period; and Claessens and Djankov (1999) use data on approximately 700 manufacturing firms from the Czech Republic during 1993–97. See also Claessens (1997) and Filer and Hanousek (2002) for a discussion of these issues.

3 Gupta et al.'s (2000) econometric evidence indicates that better performing firms tend to be privatized first. Moreover, as we indicate below, Djankov and Murrell's (2002) survey of studies dealing with the impact of privatization on performance indicates that one-half of the studies do not treat this issue at all. Our examination of the other half suggests that many treat the issue in a relatively haphazard way.

4 See for example Pohl, Anderson, Claessens, and Djankov (1997), Smith, Cin, and Vodopivec (1997), Claessens and Djankov (1999), and Frydman, Hessel, and Rapaczynski (2000).

5 An important recent exception is Grosfeld and Tressel (2001).

6 Since we use data on the entire population of large and medium sized firms that went through privatization in the Czech Republic, one may think of our data as a country sample drawn from the population of centrally planned economies that went through mass privatization. The Central European economies have served as models for other transition countries in that early on they carried out important reforms and policy makers from other countries and international institutions such as the World Bank and the International Monetary Fund have used them as examples to follow. In this context, the Czech Republic has served as the example of rapid large-scale privatization in a previously unreformed and virtually completely state-owned economy, while Hungary has been the example of piece-meal privatization of individual firms in a previously reformed and partially privately owned economy.

on pre-market initial conditions of these firms. Moreover, we also develop a more systematic analytical framework for evaluating the performance effect of post-privatization ownership and distinguish between instantaneous and permanent effects of ownership changes, and we use more detailed data on the extent of ownership by specific types of owners.[7]

The fact that we use data from a model transition economy that started almost completely state-owned and underwent virtually complete privatization means that we are analyzing a population of firms that experienced one of the greatest recorded changes in ownership. Since a number of other countries, including Russia, Ukraine, China, and Vietnam, have also started from almost complete public ownership, obtaining an understanding of the effects of the privatization process is of considerable interest. Unlike studies of partial privatization, we also benefit from a large variation in the values of the variables whose effect we analyze.

Finally, by carrying out a detailed study of one model economy, we are able to take into account specific legal and institutional features that relate to ownership and control, and avoid the problem of not being able to control adequately for complex cross- country differences in the institutional and legal frameworks that confront comparative studies with a limited number of country-specific observations.[8]

We find, contrary to expectations and results of many earlier studies, that the effects of privatization and different types of ownership on firm performance are very limited and that many types of private owners do not bring about performance that is different from that of firms with substantial state ownership. We do find some significant effects of specific types of private ownership. In particular, a positive effect of concentrated ownership is discernible but only in some instances and for selected performance indicators, and a positive effect of foreign ownership is detectable primarily in the case of majority ownership and appears to be driven by the behavior of foreign industrial firms. The concentrated foreign owners (industrial companies) yield superior performance compared to all other types of owners in terms of growth of sales and in some specifications also profitability (strategic restructuring), and concentrated domestic owners (industrial companies and investment funds) reduce employment relative to others (defensive restructuring).

7 The present paper belongs to a second generation of studies that are being carried out to analyze corporate performance in the post-privatization period and employ large samples or populations of firm-level data from specific types of privatization in a given country. These studies are able to avoid some of the aforementioned problems and take into account specific institutional settings. Thus, Angelucci, Estrin, Konings and Zólkiewski (2002) use a large panel of manufacturing firms covering the years 1997–98 for Bulgaria and Romania, and 1994 and 1998 for Poland, Carlin, Fries, Schaffer and Seabright (2001) employ an EBRD cross-sectional survey of 3,300 firms in 25 transition countries and Lízal and Švejnar (2002) use 1992–98 panel data on the population of medium and large Czech industrial firms to examine investment behavior and the extent of credit rationing and soft budget constraints.

8 The leading studies in this area (e.g., Boubakri and Cosset, 1998, Frydman et al., 1999, D'Souza and Megginson, 1999) are forced by the paucity of data to use pooled cross-country estimations.

The structure of the paper is as follows. In Section 2, we provide information on the privatization process that generates our data, while in Section 3 we discuss the relevant features of the legal system and the hypothesized implications of different types of ownership on firm performance. In Section 4, we describe the data and basic statistics and in Section 5 we outline our empirical strategy. We present our empirical estimates in Section 6 and we draw conclusions in Section 7.

2. Privatization in the Czech Republic

The privatization program in the Czech Republic was carried out in the first half of the 1990s under three different schemes: restitution, small-scale privatization and large-scale privatization. The first two schemes started in 1990 and were most important during the early years of the transition. Large-scale privatization, by far the most important scheme, began in 1991 and was completed in early 1995.[9] The privatization program allowed various privatization techniques. Small firms were usually auctioned or sold in tenders. Many medium businesses were sold in tenders or to pre-determined buyers in direct sales. Most large and many medium firms were transformed into joint stock companies and their shares were distributed through voucher privatization, sold in public auctions or to strategic partners, or transferred to municipalities.

The voucher scheme was part of the large-scale privatization process and it attracted considerable interest and publicity.[10] Two waves of voucher privatization took place in 1992-93 and 1993-94, respectively. The early post-privatization ownership structure emerged as shares from the second wave were distributed in early 1995. Rapid reallocation of shares across new owners took place in 1995–96 during the so-called "third wave" of privatization as new owners, including the investment privatization funds (IPFs), reshaped their initial post-privatization portfolios of acquired companies. Depending on the investor, the swapping of shares in 1995–96 was aimed at (a) optimal portfolio diversification, (b) obtaining concentrated ownership in specific firms and industries and (c) achieving conformity with legal requirements aimed at preventing excessive stakes being held by privatization funds.[11] The 1995–96 ownership changes were massive, unregulated and frequently unobservable to outsiders, including researchers. Investors, especially the IPFs,

9 The privatization process has been extensively described and analyzed. See e.g., Švejnar and Singer (1994), Kotrba (1995), Coffee (1996), and Kočenda (1999). For development of ownership structures in voucher-privatized firms, see Kočenda and Valachy (2002).

10 The voucher scheme is sometimes erroneously referred to as the large-scale privatization program itself.

11 The regulation of IPFs evolved gradually through Decree no. 383/1991, its Amendment No. 62/1992, and Act No. 248/1992. The most important clauses restricted each privatization fund from investing more than 10% of points acquired in the voucher scheme in a single company and obtaining in exchange more than 20% of shares in any company. Privatization funds established by a single founder were allowed to accumulate up to 40% of shares in a given company, but this cap was later reduced to 20%. Many privatization funds circumvented the cap through mergers. The Act also prohibited IPFs founded by financial institutions from

engaged in direct swaps of large blocks of shares, and off-market share trading was common. More stable and, from the standpoint of firm performance, more meaningful patterns of ownership emerged in 1996. We analyze the 1996–99 performance effects of various patterns of ownership and their changes after the dust of large-scale privatization and early post-privatization ownership swaps settled.

3. Forms of Ownership and Hypothesized Effects on Performance Concentrated or Dispersed Ownership?

In addition to the debate about the merits of privatization and private v. public ownership, a major issue that has received renewed attention, without resulting in a consensus, is whether concentrated or dispersed ownership is more conducive to good corporate performance. The literature that focuses on the agency problem arising from the separation of ownership and control usually argues for the desirability of concentrated ownership because it results in superior monitoring of managers (who might otherwise loot the firm) and hence maximization of shareholder value and availability of external finance for the firm (see e.g., a survey by Shleifer and Vishny, 1997). As Burkart, Gromb and Panunzi (2000) have shown, however, the agency problem may exist even when a large shareholder is present if this shareholder loots the firm at the expense of small shareholders. Governments and local shareholders have raised similar issues with respect to the potential dissipation of profits through transfer pricing by foreign firms.

On the other hand, models of asymmetric information and optimal delegation of authority (e.g., Aghion and Tirole, 1997) point to the importance of managerial initiative and incentives to acquire information, highlighting the fact that concentrated ownership with little delegation of formal authority to managers may be deleterious to firm performance[12]. Similarly, the literature pioneered by Holmstrom and Tirole (1983) points out that concentrated ownership reduces market liquidity and hence lowers the benefits of market monitoring on corporate performance. Finally, Bolton and von Thadden (1998) argue that concentrated ownership may or may not be desirable, showing that an alternative is ownership dispersion with trading in secondary markets or ease of takeovers generating concentration whenever necessary for intervention in managerial decision-making. As we discuss below, from a government perspective, the idea of being able to intervene selectively when needed is incorporated in the mechanism of a golden share.

purchasing shares of other financial institutions to prevent excessive concentration of financial capital (for details see Kotrba and Švejnar, 1994).

12 See Grosfeld and Tressel (2001) for an articulation of this and the following interpretations.

Since we are able to identify all owners with ownership stakes of 10 percent or more, we classify all firms into categories that allow us to test the validity of the competing predictions from the above theories. Depending on their stakes, different blockholders have different capacity to influence corporate governance. In particular, the Czech law provides important rights of ownership and control to owners with *majority* ownership (more than 50 percent of shares), *blocking minority* ownership (more than 33 percent but not more than 50 percent of shares) and what we define as *legal minority* ownership (at least 10 but not more than 33 percent of shares). Majority ownership grants the owner the right to staff management and supervisory boards, to alter and/or transfer firms' assets and to adopt most crucial strategic decisions at general shareholders' meetings. Through management and supervisory boards, majority ownership also facilitates more direct executive control of the company. The blocking minority ownership gives the right to block a number of decisions, such as those related to increasing or reducing assets and implementing major changes in business activities that the majority shareholder may strive to implement at the general shareholders' meeting. Finally, legal minority ownership can be considered a form of dispersed ownership since its concentration is low and its direct impact on routine business decisions is limited. Legal minority is potentially important, however, because the law entitles the holder of this stake to call the general shareholders' meeting and obstruct its decisions by delaying their implementation through lengthy court proceedings. Effective legal minority shareholders (including the state) may thus use their ownership position to delay or completely block the implementation of decisions by stronger shareholder(s)[13].

Overall, the majority and blocking minority represent different degrees of concentrated ownership, while the legal minority may be viewed as a form of moderately dispersed ownership. Highly dispersed ownership arises when the stake of the largest holder held does not reach legal (10 percent) minority. We are also able to distinguish whether the government keeps a golden share that gives it the right to veto certain managerial decisions, such as the subject of business activities and sales of assets, and indirectly influence all managerial decisions. Institutional evidence suggests that the golden share may be an important mechanism enabling the state to exert a degree of influence over firms in which it no longer holds a sufficient ownership stake.[14]

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13 Interesting effect is observed in the case of portfolio companies that are primarily interested in capital gains. These companies have been observed to buy 10 percent positions in firms where they can sell the stake at a premium to the dominant shareholder whose business strategy is to avoid excessive scrutiny by an institutionally strong minority shareholder.

14 The golden share was introduced by Act No. 210/1993, modifying Act No. 92/1991. The act set the conditions for property transfer from the state to others with the aim of protecting special interests of the state in firms privatized in large-scale privatization. The veto rights associated with the golden share usually relate to the scope and line of business activity and depend on each company's charter. When the state sells its golden share, it gives up its rights in the company and the golden share ceases to exist. The instrument of the golden share in the Czech Republic does not conform fully to that found in other countries since it is limited to being solely an instrument of state control and does not serve as a means of attracting free or less expensive credit.

3.1 Types of Ownership

As mentioned earlier, most empirical work has focused on relatively broad categories of ownership. In this paper, we assess whether finer ownership distinctions that reflect different business activities of the owners provide a meaningful understanding of the effects of ownership on corporate performance. In particular, we examine the effects of six types of domestic and two types of foreign ownership that may have differing implications for corporate objectives, constraints and governance. The six types of domestic owners are the state, industrial company, bank, investment fund, portfolio company, and individual, while the two types of foreign owners are an industrial company and all other foreign owners.[15] Since the literature does not provide clear-cut predictions about the relative performance effects of these types of owners, we briefly outline plausible hypotheses based on other studies and local institutional context.

The state as an owner may pursue various goals, including economic efficiency, tax revenues, or social goals such as employment. The results of Gupta, Ham and Švejnar's (2000) analysis suggest that in the Czech case revenue maximization was important in the privatization phase but other goals, such as employment generation, were also important in the post-privatization phase when unemployment was on the rise. The ownership of a firm by an industrial company may be expected to increase profitability through cost cutting, integration of activities and expansion aimed at exploiting economies of scale. Bank ownership is expected to impose pressure on the firm's management to improve profitability (Cornelli, Portes, and Schaffer, 1996),[16] while investment (mutual) funds are expected to pursue profitable opportunities and, when desirable, take significant equity positions. Funds may hence place emphasis on sound corporate governance and restructuring of firms. Portfolio companies in the Czech Republic are diversified investment vehicles that engage in business with both corporate and private customers. Their ownership positions in large firms are more limited than those of the funds, but the experience in advanced market economies indicates that portfolio companies often force management to become more profitable. Individual ownership is widely perceived to give the single residual claimant having strong incentives to monitor the management and achieve superior firm performance. Finally, in a country with low labor cost and favorable profit repatriation rules, foreign owners are expected to aim at generating profits and, if the local products can be sold through their global

15 Since insiders have not been important in the Czech Republic, we do not analyze this type of ownership. We also do not examine whether a given owner belongs to a larger ownership group. With considerable additional data collection, this could be an interesting topic for future research.

16 Ownership involvement of Czech banks in other companies resembles the situation in Germany. Allen and Gale (1995), with reference to the German financial market, argue that the fact that the market for corporate control collapses when stock markets are thin could be made up for by the role of banks as delegated monitors holding equity and exercising their voting rights. Czech banks, with their numerous holdings, were given the above option. However, as shown by Lízal and Kočenda (2001), the newly-created banks also had a number of serious structural weaknesses.

distribution network, also on increasing output and hence employment. The issue that arises is whether profits generated by firms with foreign owners are declared or hidden through transfer pricing. Naturally, in an underdeveloped legal and institutional setting, any one type of ownership could be associated with managers or key shareholders looting the firms, directly or through transfer pricing.

4. The Data and Basic Statistics

4.1 Performance Data

We start our analysis by providing an understanding of whether corporate restructuring associated with different types of ownership occurs more in terms of revenue or cost (the two main components of profit). We do so by using the rate of change in sales revenue and in labor cost.[17] Profitability is widely viewed as the best ultimate measure of corporate performance, and we use two measures of profitability as our dependent variables: the annual rate of change of operating profit on sales (profit/sales or return on sales) and the annual change in the return on assets (ROA), measured as the ratio of the change in operating profit between periods *t-1* and t to total assets in period *t-1*. By using the profit/sales ratio, we take advantage of the fact that this indicator is based on two flow measures that are less sensitive to inflation and accounting conventions than many other indicators. By using assets in period *t-1* in calculating the change in ROA, our measure is not affected by the possible phenomenon of privatized companies simply writing off unproductive assets.[18]

Combined with the estimating framework that we describe below, as well as theoretical and empirical results from other studies, the four indicators of performance give us an opportunity to generate a number of analytical insights. First, since wages in public and private firms in the Czech Republic moved in tandem (Münich, Švejnar, and Terrell, 2005), the relative rate of change of labor costs between public and private firms reflects primarily changes in employment. A comparison of the relative evolution of sales/labor cost hence yields a close approximation of the relative evolution of sales/employment, or labor productivity.[19]

Second, the four indicators permit us to draw inferences about the extent to which firms with different ownership engage in the two types of restructuring that have been viewed as key after privatization of SOEs – defensive (reactive) and

17 We do not use other measures of performance, such as material costs, because the sample size would be substantially reduced due to limited information on other variables in the data.

18 Our measure would provide a biased indicator of a change in ROA, however, if productive assets were sold and, as a result, both assets and profit (rather than just assets) diminished. However, only about 5% of the firms in our sample actually reduced their assets and, as we discuss below, firms that substantially reduced assets were removed from our sample when we eliminated outliers.

19 This is especially the case as we control for the industry in which the SOEs and private firms operate.

Table 1: Summary Statistics of the Rate of Change of Performance Indicators: 1996–1999

Annual rate of change of	Mean	Std. Dev.	Min	Max	No. Firms	No. Obs.
ROA*	0.001	0.098	-0.393	0.387	1540	2905
Profit / Sales	-0.267	0.982	-2.995	2.985	1289	2164
Sales	0.009	0.426	-1.000	2.820	1371	2592
Labor Costs	0.010	0.364	-1.000	2.842	1539	2949

The ratio of the number of observations to number of firms varies due to an unbalanced nature of the panel.

* ROA is defined as a ratio of change in profits between two consecutive periods to total assets at the beginning period. Formally: [(Profit(t)-Profit(t-1))/Total Assets(t-1)].

strategic restructuring.[20] Defensive restructuring is primarily related to short-term measures, such as layoffs and reductions in wages, while strategic restructuring refers to deliberate investments in the development of firms' advantages, such as introducing new products and finding new markets, and it results in increased sales revenues and profits.

Third, by examining the simultaneous effects of different types of ownership on the change of sales, labor cost and profitability, we are able to draw tentative conclusions about the presence of phenomena such as looting of the firm, inefficiencies, non-labor costs, and non-sale income.

Our working data set contains 2,529–2,949 observations on an unbalanced panel of 1,371–1,540 medium and large firms from all economic sectors during the period 1996–1999. As we indicate in Table 1, the exact number of observations and firms varies slightly across the four performance indicators. The observations represent a cleaned data set from the entire population of firms that were listed on the Prague Stock Exchange (PSE) in 1996. Since virtually all large and medium-sized firms privatized in large-scale privatization were listed on PSE, the data set contains most of these firms. In addition to performance variables, our data set contains detailed measures of ownership structure, sector in which the firm operates and the firm's privatization history (including performance and institutional data from the pre-privatization period). The data sample was compiled by the authors from information provided by Aspekt, a commercial database, the PSE, The National Property Fund (the privatization agency) of the Czech Republic, and the Business Register of the Czech Republic.

It is well known that firm-level data from the transition and emerging market economies often suffer from accounting deficiencies and usually contain missing values and outlier observations that may bias the estimated coefficients (e.g., Filer

20 See Aghion and Carlin (1996), Grosfeld and Roland (1997) and Aghion, Blanchard and Carlin (1997) for a discussion of these concepts.

and Hanousek, 2002). Firms operating in the Czech Republic started adopting international accounting (IAP) standards in 1992, and our discussions with international accounting firms located in the country indicate that this process was by and large completed in 1995. Our 1996–99 data are hence from a period in which IAP already dominated local accounting standards. Moreover, the data are reported by firms that had to conform to the standards demanded since the mid 1990s by the main regulatory institutions, namely the PSE, the National Property Fund and the Czech National Bank. The data are hence relatively reliable and free of the accounting deficiencies that plague earlier studies.

We have adopted a three-step approach to handling missing observations and outliers in the original data set of 2648, 2972, 2682, and 3050, year-to-year rate of change observations for sales, labor cost, profit/sales, and ROA, respectively. First, we eliminated the few (rate of change) observations that were based on inconsistent values in the levels of variables, such as negative values of sales or labor cost. This resulted in 2644, 2972, 2679, and 3050 observations for the rate of change of sales, labor cost, profit/sales, and ROA, respectively.

Second, since the data still contained a number of observations with fairly extreme values, we examined the sensitivity of parameter estimates to the trimming of these extreme values of variables, identifying points where the results became relatively insensitive to further trimming. We found that the estimates ceased being sensitive to trimming at the point where the year-to-year rate of change in the performance indicators was constrained to the wide interval of (-100%, 300%) for sales and labor costs, (-300%, 300%) for profit over sales and (-40%, 40%) for ROA.[21] Imposing these wide limits led to a relatively modest reduction in the number of observations and resulted in 2592 observations for the rate of change in sales, 2949 for the rate of change in labor cost, 2168 for the rate of change in profit over sales, and 2905 for the change in ROA. We have used Heckman's (1979) procedure to correct for the possible sample selection bias brought about by the two-step data cleaning procedure.[22]

Third, we explored the possibility of creating a balanced data set with the same firm-year pairs across the four performance indicators. We found that this would require reducing the number of observations for the rate of change of sales, labor costs, profit over sales, and ROA, by 572 (22%), 929 (31%), 148 (7%), and 885 (30%), respectively, resulting in a sample with only 1210 firms and 2020 observations. We have deemed this further reduction in the number of observations to be excessively large and used the larger sample from step two above in our analysis. For comparison, we have generated Heckman-corrected estimates based on the

21 In contrast, the estimated coefficients change dramatically and non-monotonically as we add the outlying observations beyond this borderline to the sample.

22 In particular, using the original set of observations we first ran a Heckman-type probit equation, predicting the probability that a given observation is included in the subsample on the basis of the following variables: the initial values of the performance indicators and their squares and products, as well as dummy variables capturing the presence of a given firm in a particular privatization wave.

balanced sub-sample and found them to be broadly similar to those based on the larger sample.

On average, within the four-year (1996–99) period we have data for three consecutive years to compute annual rates of change of performance variables (Table 1).[23] In terms of the number of firms and observations, our sample is larger than samples used in previous and most ongoing studies in this area. More detailed summary statistics of performance indicators by ownership type and ownership extent are presented in appendix tables A1 and A2. We have also carried out a number of checks against official and private records to verify that our ownership information is reliable and that we hence meet the criticism of earlier privatization studies raised by Filer and Hanousek (2002).

4.2 Ownership Data

An important feature of our data is that it permits us to analyze the effect of ownership on performance using two measures of ownership. First, as in most studies, we evaluate the performance effects associated with different types of a single largest owner (SLO). In doing so, we have the advantage that we can distinguish among the aforementioned six domestic and two foreign types of SLOs. Second, we assign all owners into three categories that have figured prominently in the privatization debate and are widely believed to have different effects on corporate governance and performance – state, domestic private and foreign ownership. Having included all owners in one of these three categories, we examine whether majority, blocking minority and legal minority ownership by each of these three groups of owners affects the firm's performance.[24] With both specifications of ownership, we also assess if the state affects corporate performance by retaining a golden share that gives it the right to block certain managerial decisions.

As may be seen in Table 2, domestic industrial companies are the most frequent SLOs with 1,244 observations, followed by domestic investment funds (423 observations), domestic individuals (335) and the Czech state (174). Foreign industrial companies are by far the most frequent SLOs among the foreign investors (236 observations), with the total number of foreign SLO observations being 303. Ownership concentration, measured by the average stake held by a SLO, is between 38 and 59 percent, which is rather high in comparison to ownership concentration in developed countries (Demsetz and Lehn, 1985) and it resembles more the continental European than Anglo-American ownership concentration patterns.

23 There are 34 sales and 28 labor cost observations for which the rate of growth is -1. Hence, only a small number of firms ended production during the 1996–1999 period.

24 In this analysis, we hence focus on the effects of majority and blocking or legal minority ownership irrespective of how many different owners of the same type comprise the majority or minority groups.

Table 2: Ownership Extent and Categories: Summary Statistics

Panel A: Type of Ownership by Single Largest Owner (SLO)

Type of single largest owner (SLO)	Num. of obs.	Mean size of stake (%)	Number of Observations				
			Majority held by SLO	Blocking Minority held by SLO	Legal Minority (Moderately Dispersed Ownership)	Other (Highly Dispersed Ownership)	Golden Share held by State
Domestic Ownership							
Industrial Co.	1244	48.83	547	412	272	13	42
Bank	33	46.42	11	14	7	1	1
Invest. Fund	423	37.61	96	119	205	3	19
Individual	335	38.92	82	99	150	4	13
Portfolio Co.	80	45.06	22	35	22	1	5
State	174	43.18	49	63	58	4	66
Foreign Ownership							
Industrial Co.	236	58.81	139	60	30	7	6
Others	67	51.23	26	26	15	0	3
Total	**2592**	**46.16**	**972**	**828**	**759**	**33**	**155**

Panel B: Ownership Extent

Type of aggregate ownership	Num. of obs.	Mean size of stake (%)	Number of Observations				
			Majority	Blocking Minority	Legal Minority (Moderately Dispersed Ownership)	Other (Highly Dispersed Ownership)	Golden Share held by State
Domestic	2115	44.84	758	679	656	22	80
Foreign	303	57.14	165	86	45	7	9
State	174	43.18	49	63	58	4	66
Total	**2592**	**46.16**	**972**	**828**	**759**	**33**	**155**

Note: This table contains basic ownership statistics associated with the performance variable of sales. Statistics for other performance indicators are similar. Ownership concentration categories include majority (more than 50% of shares), blocking minority (from more than 33 to 50% of shares), legal minority (at least 10% but not more than 33% of shares), and other (less than 10% of shares). All ownership categories are mutually exclusive. The golden share is an additional measure that is not associated with any particular extent of ownership.

Foreign owners as a group tend to hold majority ownership stakes in the acquired firms (panel B of Table 2). The situation is just the opposite for domestic private owners and the state, both of whom have average stakes around 43–45 percent and display absolutely and relatively more cases of blocking and legal minority ownership than majority ownership. Moreover, the state retains a golden share primarily in firms in which it or domestic private owners are the SLO. Finally, there are 33 observations with highly dispersed ownership in the sense that no type of owner has even a legal (10 percent) minority ownership. These observations come from 25 firms that are larger than average in terms of total assets, but otherwise tend to have quite diverse characteristics.[25]

In panels A and B of Table 3, we present two transition matrices depicting how ownership changed between 1996 and 1999 by SLO and extent of ownership, respectively. The ownership of origin (1996) is listed in the rows on the left-hand side of each panel and the destination (1999) ownership is shown in the column headings on the top of each panel. In each row, the diagonal entry gives the percentage of companies that remained in the same ownership category, while the off-diagonal entries show the percentages of companies that switched from the original ownership given by the relevant row to the new ownership given by the relevant column. As may be seen from Panel A, the flows across the eight types of SLOs show that domestic and foreign industrial firms are stable types of owners in that 69 percent and 75 percent of firms that had SLOs in these two categories in 1996, respectively, had SLOs in the same categories also in 1999. Together with domestic investment funds and individually owned companies, these two ownership forms are also the main recipients of inflows of firms from other categories, especially domestic portfolio companies, banks and foreign other (non-industrial) firms. Indeed, domestic industrial companies become the most frequent new SLOs of firms from all the original categories of ownership, while foreign industrial companies take over as SLOs primarily from foreign non-industrial companies and banks. Domestic investment funds are a favorite SLO destination for firms from bank and portfolio company ownerships, while domestic individual owners become new SLOs relatively evenly across all the original ownership categories except for foreign industrial firms.

When measured by the extent of state, domestic private and foreign ownership (Panel B), majority foreign and majority domestic ownership forms are the most stable forms, retaining 73 percent and 68 percent of their 1996 firms in 1999. Majority domestic ownership, followed by blocking minority domestic ownership, are the two main ownership forms to which firms switched from almost all other categories. There was also a tendency toward concentration of foreign ownership as majority foreign ownership was a significant destination for firms with blocking

25 The firms belong to various sectors, with 7 being in trade and 4 in construction and building materials sectors. In 5 firms foreign owners have the largest, albeit relatively small, stakes. The state holds the golden share in two of these firms, both of which are water supply utilities.

Table 3A: Effect of the Single Largest Owner (SLO) Type on Performance

Instrumented Estimates (Standard errors in parentheses)

	Sales	Labor Cost	Profit / Sales	ROA
State (Constant)	-0.141^{10} (0.076)	0.034 (0.053)	-0.197 (0.141)	0.004 (0.012)
Initial Ownership (P_{ij1}) – Time-varying Effect (β_j)				
Domestic Ownership				
Industrial Co.	-0.027 (0.029)	-0.063^{1} (0.023)	0.015 (0.078)	-0.002 (0.006)
Bank	0.025 (0.065)	0.043 (0.055)	0.005 (0.154)	0.015 (0.014)
Invest. Fund	0.015 (0.033)	-0.071^{1} (0.026)	-0.080 (0.088)	-0.006 (0.007)
Individual	0.022 (0.037)	-0.027 (0.031)	-0.081 (0.095)	0.001 (0.008)
Portfolio Co.	0.042 (0.068)	-0.012 (0.051)	-0.098 (0.134)	-0.005 (0.012)
Foreign Ownership				
Industrial Co.	0.107^{1} (0.042)	0.026 (0.031)	0.180^{10} (0.111)	0.013 (0.009)
Others	0.003 (0.097)	-0.055 (0.073)	-0.221 (0.192)	-0.006 (0.015)
Subsequent Ownership ($P_{ij\tau}$) – Time-varying Effect (θ_j)				
Domestic Ownership				
Industrial Co.	-0.026 (0.027)	-0.041^{10} (0.025)	0.011 (0.093)	0.004 (0.008)
Bank	-0.167 (0.150)	-0.094 (0.091)	0.338^{10} (0.212)	0.118^{5} (0.052)
Invest. Fund	-0.096^{10} (0.051)	-0.104^{1} (0.034)	0.062 (0.124)	0.004 (0.014)
Individual	0.050 (0.086)	-0.054 (0.053)	0.025 (0.153)	0.004 (0.014)
Portfolio Co.	-0.116^{5} (0.058)	0.089 (0.097)	-0.091 (0.217)	0.021 (0.020)
Foreign Ownership				
Industrial Co.	0.061^{10} (0.036)	0.087^{1} (0.026)	0.094 (0.152)	0.007 (0.010)
Others	-0.072 (0.098)	-0.015 (0.076)	-0.391^{1} (0.134)	0.009 (0.017)

and legal foreign minority ownership. Finally a significant proportion of firms with foreign ownership of all types switched to domestic majority or minority ownership over time.

Overall, we observe substantial ownership changes during the relatively stable post-privatization period under study. In terms of the categories in Table 3, 7 to 48

Table 3B: Effect of the Single Largest Owner (SLO) Type on Performance

Instrumented Estimates (Standard errors in parentheses)

Ownership Change ($\Delta P_{ij\tau}$) – Time-invariant Effect (δ_j)				
Domestic Ownership				
Industrial Co.	0.047 (0.034)	-0.015 (0.029)	0.043 (0.107)	-0.002 (0.009)
Bank	0.072 (0.182)	-0.037 (0.122)	-0.099 (0.384)	-0.152[1] (0.061)
Invest. Fund	0.106 (0.068)	0.154[1] (0.051)	0.087 (0.154)	-0.012 (0.016)
Individual	-0.062 (0.102)	-0.087 (0.062)	0.133 (0.180)	-0.013 (0.017)
Portfolio Co.	-0.057 (0.075)	-0.166 (0.107)	0.235 (0.274)	-0.044[5] (0.023)
Foreign Ownership				
Industrial Co.	0.066 (0.070)	-0.032 (0.052)	0.112 (0.191)	-0.021 (0.016)
Others	0.030 (0.111)	-0.009 (0.087)	0.223 (0.209)	-0.013 (0.022)
Golden Share	0.014 (0.025)	0.062[1] (0.019)	-0.017 (0.090)	0.009 (0.006)
Initial value (X_{ij1})	0.000 (0.000)	0.000 (0.000)	0.000[10] (0.000)	-0.315[1] (0.043)
Voucher-Privatization Dummies				
First Wave	0.036 (0.067)	-0.093[10] (0.052)	0.024 (0.125)	0.000 (0.010)
Second Wave	0.057 (0.067)	-0.117[5] (0.051)	0.040 (0.130)	-0.009 (0.010)
Both Waves	0.064 (0.069)	-0.097[10] (0.054)	-0.022 (0.136)	0.004 (0.011)
Adj. R square	0.017	0.044	0.008	0.110
Num. of Obs.	2592	2949	2168	2905

Note: The dependent variables are the rate of change of sales revenue, labor cost, and profit/sales, and the change in ROA, respectively. Numbers in parentheses are standard errors. Number 1, 5 and 10 denote significance at 1%, 5% and 10% level, two-tail test, respectively. Industry, privatization, and year dummies are included.

percent of our sample changed category by the type of SLO and 15 to 31 percent by extent of ownership, with the greatest (smallest) shift being toward an industrial company (bank) as the SLO. Data not reported here show that ownership changes were relatively evenly distributed over the 1996–99 period.

5. The Econometric Model

5.1 Model Specification

Our main goal is to analyze the performance effects of the principal types of ownership that we observe after the large-scale privatization in 1996. In addition, we want to control for and estimate the effects of the changes in ownership that took place in the 1996–99 post-privatization period that we analyze. In order to do so, we adapt the Ashenfelter and Card (1985) and Heckman and Hotz (1989) panel data treatment evaluation procedure for our context and supplement it with instrumental variables.

Let X_{ijt} be a given performance indicator, with subscript i denoting an individual firm with ownership type j, in year t, and let y_{ijt} be the percentage change of X_{ijt} from t - 1 to t. Moreover, let P_{ijt} denote ownership type j of firm i in year t. A logarithmic model of performance may be specified as

$$p_{t-1}^{new} - p_{t-1}^{old} = \Delta \tag{1}$$

which may be expressed in the annual rate of change (first-difference) specification as an estimating equation[26]

$$\delta p_{t}^{n-1} \tag{2}$$

For ease of interpretation, all dummy variables in equation (2) are coded relative to the constant α which, depending on the specification of ownership, contains the performance effect of state SLO or state majority ownership. The column vector β_j therefore reflects the effects of all the other types of 1996 post-privatization ownership P_{ij1} relative to state SLO or state majority ownership.[27] Similarly, vector δ_j captures the instantaneous effect observed in any year τ after 1996 if a firm changed its 1996 ownership to a new ownership category $\Delta P_{ij\tau}$, and vector θ_j reflects the permanent effect associated with the new type of ownership $P_{ij\tau}$ established at time τ[28]. Coefficients β_j and θ_j hence give the initial and subsequent permanent effects of

26 Equation (2) may also be viewed as coming from a framework such as that invoked in the endogenous growth literature (e.g., Temple, 1999; Barro and Sala-i-Martin, 1995), where the rate of change of the dependent variable may depend on its initial level (e.g., rate of change of performance being related to an initial level of investment) and some other variables. In the context of the debate about the performance effects of ownership v. competition, we focus on estimating the effects of ownership, while controlling for the extent of competition by the firm-specific fixed effects, the effect of initial performance interacted with the time trend, and the industry-specific and annual time dummy variables interacted with time.

27 Equivalently, the coefficients β_j may be interpreted as the linearly time-varying effects of various non-state types of ownership, relative to SLO or majority state ownership, on the (log) level of corporate performance. Coding the ownership dummy variables so that the effects of non-state ownership forms is measured relative to the effect of state ownership is useful because firms in which the state retains ownership are the ones that are least privatized and under the null hypothesis also least restructured. The approach also accords with our desire to investigate change in performance as firms switch from state to private ownership.

28 The term "permanent" effect is used to denote the effect that our data predict would last period after period and it distinguishes this effect from the one-year instantaneous effect.

ownership and our principal goal is to obtain unbiased estimates of β_j and to the extent possible also θ_j. In estimating β and θ in equation (2), we control for other factors that affect performance and may be correlated with ownership. Thus vector α controls for firm-specific (fixed effect) differences in performance across firms, vector γ reflects the effect of initial post-privatization level of performance $X_{jjijij1}$ on the future rate of change of performance, and vector ϕ represents the effect of D, industry and annual dummy variables as well as dummy variables reflecting the form of privatization of the firm (first or second wave, both waves, or outside of the voucher scheme). Finally, $\varepsilon_{ijt} = \upsilon_{ijt} - \upsilon_{ijt-1}$ is the error term.

Our specification thus controls for the effects on the rate of change of performance of fixed differences among firms that were or were not part of the voucher scheme, inter-firm differences in the initial post-privatization performance, annual economy-wide shifts (such as macro shocks or degree of openness to trade) and industry-specific fixed effects (proxying for factors such as the degree of competition or differences in technology). In the context of the debate about the performance effects of ownership versus competition, we focus on estimating the effects of ownership, while controlling for competition by the firm-specific fixed effects, the effect of initial performance interacted with the time trend, and the industry-specific and annual time dummy variables interacted with time.

In addition to worrying about omitted variables bias, which we address by including the various control variables, we consider two other key econometric issues, measurement error and endogeneity (selection) of ownership. Measurement errors in ownership and performance, as well as other variables, can induce standard attenuation as well as more complicated biases in estimated coefficients. As discussed above, the earlier studies of privatization often suffer from mis-measurement of the ownership variables and performance indicators, including outliers that may seriously affect the estimated coefficients. In collecting the present data set, we have placed particular emphasis on identifying precisely individual owners and changes in ownership, as well as collecting several indicators of performance from a period when the IAP accounting system was in place. We have also tested for and eliminated outliers that affect the estimates.

Endogeneity (selection) of ownership is another serious issue. Gupta et al. (2000) find that better performing firms tend to be privatized first and since most studies compare the performance of privatized firms to that of firms that are still in state ownership, there is a danger that the inherently superior performance of the firms selected for privatization is attributed to privatization rather than the selection. Djankov and Murrell's (2002) survey of studies dealing with the impact of privatization on performance indicates that one-half of the studies do not treat this issue at all. Our examination of the other half suggests that many treat the issue in a relatively haphazard way. In the present study, we address this problem as follows. First, we use the first-difference specification in equation (2) with the aforementioned covariates as a panel data treatment evaluation procedure to control for the possibility that firms are not assigned to different ownership categories at random and that certain types of owners (e.g., foreigners) may acquire firms that are inherently superior or inferior performers.[29]

In estimating β and θ in equation (2), we control for other factors that affect performance and may be correlated with ownership. Thus vector α controls for firm-specific (fixed effect) differences in performance across firms, vector γ reflects the effect of initial post-privatization level of performance *X*Coefficients β_j and θ_j hence give the initial and subsequent permanent effects of ownership and our principal goal is to obtain unbiased estimates of β_j and to the extent possible also $\theta_{jj\,jijij1}$ on the future rate of change of performance, and vector ϕ represents the effect of *D*, industry and annual dummy variables as well as dummy variables reflecting the form of privatization of the firm (first or second wave, both waves, or outside of the voucher scheme). Finally, $\varepsilon_{ijt} = \upsilon_{ijt} - \upsilon_{ijt-1}$ is the error term.

Our specification thus controls for the effects on the rate of change of performance of fixed differences among firms that were or were not part of the voucher scheme, inter-firm differences in the initial post-privatization performance, annual economy-wide shifts (such as macro shocks or degree of openness to trade) and industry-specific fixed effects (proxying for factors such as the degree of competition or differences in technology). In the context of the debate about the performance effects of ownership versus competition, we focus on estimating the effects of ownership, while controlling for competition by the firm-specific fixed effects, the effect of initial performance interacted with the time trend, and the industry-specific and annual time dummy variables interacted with time.

Second, since first-differencing does not fully address all types of endogeneity, especially those where the effect is time-varying, we also employ an instrumental variable strategy.

5.2 Instrumental Variables

Unlike other studies, we use a unique set of firm-specific instrumental variables from the pre-privatization (pre-1992) period. The instrumental variables reflect economic, institutional, industry, and geographic characteristics of the SOEs in the pre-market period, and we use them to instrument the initial post-privatization ownership that we observe in the market economy in 1996.

For each firm we have collected detailed information from all the proposed privatization projects that were submitted to the government before privatization.[30]

29 This approach is used in some studies, such as Frydman et al. (1999).

30 Privatization of each enterprise was based on an officially accepted privatization project. The management of each enterprise had to submit a privatization proposal, but any domestic or foreign firm, institution or individual could present a competing privatization project. All proposals were to be considered on an equal

We use the number of privatization projects *per se* as an important IV since many SOEs attracted several privatization project proposals, reflecting the degree of investor interest and expected future performance of the firm.[31] Moreover, for each privatized firm we use as IVs the pre-privatization data on registered (share) capital, net asset value, total number of shares, number of shares entering voucher privatization, number of shares allocated through voucher privatization, value of shares allocated through voucher privatization in voucher points, geographic and industry location of the firm, and the structure of share ownership among various domestic and foreign parties as proposed in the winning privatization project. The share ownership variables include the share that the government intended to keep for the short or long term.[32] Finally, our set of IVs contains annual observations on the SOE's sales, profit, debt, and employment during the three consecutive years preceding privatization. The three-year panel permits us to capture the evolution of enterprise performance before privatization. For the sake of comparability across firms, we scale these indicators by the total number of shares. The summary statistics related to the instrumental variables are contained in Appendix Tables A3–A5.

We use the Hausman (1978) specification test for assessing endogeneity of the initial post-privatization ownership, comparing the results of first-difference OLS estimation with those from the first-difference IV method in which we treat ownership as potentially endogenous and instrument it by the IVs described above. The test is carried out by differencing the two sets of parameter estimates and standardizing the vector of differences by the difference in the covariance matrices of the two sets of estimates. The resulting quadratic form is asymptotically chi-squared with degrees of freedom equal to the number of parameters being tested.[33] Results of the Hausman test confirm that 1996 ownership should be treated as endogenous.[34]

footing by the privatization authorities, which worked with the investors to ensure that the final submitted proposals reflected at least in part government objectives in terms of ownership structure and other characteristics. Each project proposals had to contain recent economic and financial information about the enterprise and describe the proposed method of privatization, as well as the proposed organization of the privatized enterprise. See Kotrba and Švejnar (1994) for a description.

31 In the case of larger firms, a number of proposals were submitted for privatizing a particular small asset that was not connected with the firm's production process (e.g., the firm's recreational facility in a national park). In order to avoid mixing these privatizations with those covering principal productive activities, we only consider projects aiming at privatization 10% or more of the enterprise's assets.

32 Short-term government ownership reflects the expectation of the government of being able to sell appreciated shares shortly after privatization, while long-term government ownership indicates an expectation of slower appreciation of the value of the privatized firm and/or its strategic character in the economy. Parts of the shares retained by the government were also classified as intended for restitution or future sale through an intermediary.

33 In practice, some diagonal elements of the covariance matrix are negative. As usual, we carry out the test only for parameters corresponding to the positive diagonal elements, with a corresponding correction to the degrees of freedom, using the generalized inverse matrix (procedure YINVO in TSP 4.5).

34 We reject the null hypothesis of ownership being exogenous in regressions including all performance variables but profit/sales (significant on 7% test level). However, in the case of profit/sales neither model shows a good fit of the data. This fact may to a large extent explain the non-rejection of the null hypothesis.

Unlike for 1996 ownership, the pre-privatization IVs are not adequate predictors of the 1996–99 changes in ownership. Moreover, we do not find other variables that can serve as reasonable instruments for this purpose. As a result, we control for possible endogeneity problems associated with changes in ownership in the 1996–99 period by including in equation (2) ownership group fixed effects δ_j for firms undergoing ownership changes.[35]

These δ_j effects may be interpreted as proxying unobserved performance characteristics of the acquired firms (i.e., new owners cherry picking winners or taking over losers) or reflecting the instantaneous (short-term) effects of new ownership on performance. In order to check the robustness of our results, we have also estimated models that, analogously to including X_{ij1} as a regressor, control for $X_{ij\tau}$ – the performance achieved by the previous owner at the time τ when there is a change of ownership in 1996–99. This specification did not produce materially different results from those of equation (2).

6. Empirical Results

Our estimates are generated by the Huber (1967)–White (1982) procedure yielding heteroskedasticity-adjusted residuals in the presence of instrumental variables and we have also checked that the residuals are free from serial correlation.

6.1 Instrumental Variable Equations (First Stage)

In Appendix Tables A6 and A7 we report the estimated marginal effects from the first stage logit regressions for the probability that a firm has a given SLO or extent of ownership, respectively. The first stage regressions have a relatively good fit, with the scaled (pseudo) R^2s ranging from 0.11 to 0.52. To verify the robustness of the logit results, we also ran OLS regressions in which we predicted the actual share of each ownership category and subsequently constructed predicted ownership dummy variables. Differences between the two sets of estimates are negligible.

The estimates in Tables A6 and A7 reflect a number of interesting and plausible patterns. The region of the firm is an important predictor for a number of categories of ownership, with foreign industrial (and majority and blocking minority foreign) firms for instance tending to acquire firms in Prague and its surroundings (Central Bohemia), as well as near the German and Austrian borders (Southern, Western and Northern Bohemia and Southern Moravia). Ownership proposed in the winning privatization project is also a strong predictor, with a 1 percent increase in the extent of proposed foreign ownership for example reducing the probability of eventual

35 Analogously to including X_{ij1} as a regressor, we have also estimated models controlling for $X_{ij\tau}$, the effect of performance achieved by the previous owner at the time of change of ownership τ on future performance. This specification did not produce materially different results from those of equation (2).

ownership by a domestic industrial company by about 1 percent. The number of privatization projects submitted for a given firm has a strong positive effect on the probability that the firm is owned by domestic industrial company, bank or investment fund, and that it has majority or legal minority domestic ownership. Finally, firm size, measured by the number of shares, has a positive effect on ownership by banks, foreign non-industrial owners and domestic majority owners, but a negative effect on foreign industrial ownership. Overall, the IVs have relatively strong and intuitively expected effects, most of them are strongly pre-determined through time and they pass the Sargan test of overidentifying restrictions.

6.2 The Effects of Ownership on Performance

In Tables 4 and 5, we present the estimated coefficients of the instrumented equation (2) for the SLO and extent of ownership, respectively.[36] The top panel of each table contains estimates of the permanent effect β_j of the initial (1996) post-privatization ownership P_{ij1}, the second panel gives the estimates of the permanent effect θ_j of the subsequent ownership $P_{ij\tau}$ established after 1996, and the thirds panel presents the estimated instantaneous effect δ_j of the post-1996 change in ownership $\Delta P_{ij\tau}$.

In examining the results, we note the extent to which different types of ownership result in defensive restructuring (reducing labor cost and possibly also sales) versus strategic restructuring (increasing sales revenues, labor productivity and/or profits). We also highlight outcomes that are consistent with looting of the firm. Since the latter outcomes are inferred from the relative effects on sales, labor cost and profitability (e.g., increased sale and/or reduced labor costs not being accompanied by higher profits), these findings are also consistent with other phenomena such as changes in non-labor costs, and non-sales income.

The estimated coefficients in the two tables make it clear that the performance effects of privatization and different types of ownership are surprisingly limited and that many types of private ownership do not generate effects that are different from those of substantial state ownership. Moreover, the overall fit of these regressions suggests that ownership explains a very small part of total variation in the rate of change of corporate performance after privatization.

6.2.1 Single Largest Owner

As may be seen from the first panel of Table 4, the only initial post-privatization SLO that has a positive effect on sales is foreign industrial company. All five types

36 The corresponding OLS estimates are reported in Appendix Tables A8 and A9, respectively. In Tables 4 and 5, the constant reflects the 1996–97 rate of change in performance of firms that have state as a SLO and majority owner, respectively, were partially privatized outside of the voucher scheme, and operate in the miscellaneous ("other") category of the nineteen industries for which we control. The estimated coefficients on the various forms of ownership represent the average annual ownership effects relative to the effect of state SLO or majority ownership.

Table 4A: Effect of Ownership Extent on Performance

Instrumented Estimates (Standard errors in parentheses)

	Sales	Labor Cost	Profit / Sales	ROA
Majority State (Constant)	-0.175[10] (0.103)	0.026 (0.054)	-0.192 (0.178)	0.005 (0.015)
Initial Ownership Size (P_{ij1}) – Time-varying Effect (β_j)				
Majority Domestic	-0.067 (0.113)	-0.077[5] (0.036)	-0.001 (0.137)	0.001 (0.011)
Majority Foreign	0.299[1] (0.117)	0.015 (0.046)	-0.044 (0.169)	0.015 (0.012)
Blocking Minority State	0.083 (0.107)	-0.017 (0.033)	-0.145 (0.168)	0.001 (0.012)
Blocking Minority Domestic	0.014 (0.108)	-0.065[5] (0.034)	-0.069 (0.141)	-0.009 (0.011)
Blocking Minority Foreign	-0.098 (0.268)	-0.063 (0.047)	0.063 (0.213)	-0.013 (0.018)
Legal Minority State	-0.091 (0.137)	-0.030 (0.046)	-0.051 (0.157)	-0.012 (0.014)
Legal Minority Domestic	0.058 (0.102)	-0.049 (0.032)	-0.153 (0.136)	-0.010 (0.011)
Legal Minority Foreign	-0.075 (0.196)	0.015 (0.089)	0.222 (0.199)	0.003 (0.018)
Other than Majority or Minority	0.358[10] (0.212)	0.068 (0.059)	0.141 (0.195)	-0.020 (0.018)
Subsequent Ownership Size ($P_{ij\tau}$) – Time-varying Effect (θ_j)				
Majority Domestic	-0.030 (0.038)	-0.017 (0.036)	0.164[10] (0.096)	0.015[10] (0.009)
Majority Foreign	0.086[10] (0.049)	0.037 (0.029)	-0.145 (0.163)	0.009 (0.019)
Blocking Minority State	-0.171[5] (0.086)	-0.136 (0.096)	0.552 (1.085)	-0.054 (0.062)
Blocking Minority Domestic	-0.056[10] (0.032)	-0.045[10] (0.027)	0.008 (0.093)	0.006 (0.008)
Blocking Minority Foreign	-0.067 (0.086)	0.052 (0.040)	0.079 (0.154)	0.015[10] (0.009)
Legal Minority State	-0.106 (0.078)	0.353 (0.280)	0.568[5] (0.248)	-0.025 (0.031)
Legal Minority Domestic	0.006 (0.044)	-0.018 (0.025)	0.045 (0.123)	0.017[5] (0.009)
Legal Minority Foreign	-0.120 (0.080)	-0.007 (0.034)	-0.049 (0.168)	-0.003 (0.021)
Other than Majority or Minority	-0.387[10] (0.218)	0.440[10] (0.240)	0.445 (0.434)	-0.073 (0.060)

Table 4B: Effect of Ownership Extent on Performance

Instrumented Estimates (Standard errors in parentheses)

Ownership Change ($\Delta P_{ij\tau}$) – Time-invariant Effect (δ_j)				
Majority Domestic	0.059 (0.048)	0.004 (0.042)	-0.066 (0.117)	-0.016 (0.010)
Majority Foreign	-0.052 (0.071)	-0.060 (0.048)	0.088 (0.231)	-0.012 (0.024)
Blocking Minority State	0.073 (0.097)	-0.029 (0.0162)	-1.385 (1.167)	0.037 (0.066)
Blocking Minority Domestic	0.069[10] (0.040)	0.033 (0.033)	0.140 (0.112)	-0.015 (0.001)
Blocking Minority Foreign	0.019 (0.115)	0.069 (0.069)	-0.101 (0.200)	-0.019 (0.013)
Legal Minority State	-0.024 (0.126)	-0.398 (0.294)	-0.609 (0.411)	0.023 (0.037)
Legal Minority Domestic	-0.027 (0.063)	-0.042 (0.036)	-0.110 (0.156)	-0.017 (0.011)
Legal Minority Foreign	0.344[1] (0.124)	0.012 (0.052)	0.078 (0.279)	-0.034 (0.031)
Other than Majority or Minority	0.263 (0.229)	-0.171 (0.293)	0.145 (0.474)	-0.072 (0.063)
Golden Share	0.000[10] (0.022)	0.058[1] (0.019)	-0.002 (0.093)	0.012[5] (0.006)
Initial value (X_{ij1})	0.000 (0.000)	0.000 (0.000)	0.000[10] (0.000)	-0.322[1] (0.042)
Voucher-Privatization Dummies				
First Wave	0.053 (0.074)	-0.089[10] (0.052)	0.053 (0.125)	0.001 (0.010)
Second Wave	0.077 (0.073)	-0.115[5] (0.052)	0.051 (0.130)	-0.008 (0.010)
Both Waves	0.062 (0.077)	-0.096[10] (0.055)	0.001 (0.135)	0.006 (0.011)
Adj. R square	0.019	0.038	0.008	0.108
Num. of Obs.	2592	2949	2168	2905

Note: The dependent variables are the rate of change of sales revenue, labor cost, and profit/sales, and the change in ROA, respectively. Numbers in parentheses are standard errors. Number 1, 5 and 10 denote significance at 1%, 5% and 10% level, two-tail test, respectively. Industry, privatization, and year dummies are included.

of domestic non-state SLOs, as well as the foreign non-industrial SLO, register effects that are not statistically different from the effect of the state SLO. In terms of labor costs (employment), only firms with domestic industrial companies and investment funds as SLOs show a negative effect relative to the state. Finally, only firms with foreign industrial companies as SLOs have a positive effect on profit/sales and no SLO type generates a significant effect on ROA. The post-privatization foreign industrial owners thus increase profitability by enhancing the rate of growth of sales, without having a differential effect from state firms on the rate of growth of labor cost (employment). Their domestic counterparts and investment fund SLOs reduce the rate of growth of labor cost, but do not display a corresponding positive effect on profit. The restructuring carried out by foreign industrial firms is of a strategic nature, while that performed by the domestic industrial company and investment fund SLOs is of a defensive type and is also consistent with the phenomenon of dissipation of profit (looting).

The permanent effects of the SLOs that come into existence after 1996 display a number of similarities to, but also more statistical significance than, the effects of immediate post-privatization ownerships. The basic pattern persists in that (a) most types of private owners do not show significant deviations from the sales, labor cost and profitability effects given by the base category of state SLOs, (b) foreign industrial firms raise sales and (c) domestic industrial and investment fund owners reduce labor cost. The new patterns are that firms acquired after 1996 by investment funds and portfolio companies experience a reduction in sales, foreign industrial SLOs increase not only sales but also labor costs and they no longer have a positive effect on profitability, bank SLOs have a positive effect on profit/sales and ROA, and non-industrial foreign SLOs have a negative effect on profit/sales. These results suggest that the more recent foreign industrial owners acquire firms to expand production but they no longer hold back the rate of growth of labor cost (employment), investment funds reduce the scale of operations, bank and portfolio company SLOs increase efficiency by reducing non-labor costs and/or increasing non-sales income, and domestic industrial and foreign non-industrial SLOs may suffer from looting (transfer pricing).[37]

Interestingly, there are only three instantaneous effects associated with the changes in ownership after 1996. Moreover, two of them (higher labor cost for firms acquired by investment funds and negative effect on ROA for firms acquired by banks) may represent a short term effect that is subsequently offset by an opposite permanent effect (second panel in the Table 4).

The effect of government control through the institution of a golden share is to raise the rate of increase of labor costs with no corresponding effect on the rate of change of sales or profitability. With the SLO specification of ownership, the government therefore appears to pursue a socially oriented goal of increasing employment and/or wages without a corresponding positive effect on sales or negative effect on profitability.

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37 In the case of banks, the permanent ROA effect in part offsets a negative instantaneous effect observed at the time of the shift to bank ownership (third panel in Table 4). The fact that the instantaneous effect is negative for ROA and not for profit/sales suggests that the banks acquire firms with (a) normal performance in terms of profit/sales and increase this measure of profitability over time and (b) relatively large and unproductive assets, as measured by below average ROA, and raise the value of this indicator over time.

6.2.2 Extent of Ownership

The estimated effects of the extent of ownership by the three key ownership groups, reported in Table A5 in the Statistical Appendix, complement the results with respect to the SLOs. Majority and minority post-privatization ownerships by most types of private owners do not generate effects that are statistically different from the base effect of majority state ownership. The notable exception is majority ownership by foreign companies which has a strong positive effect on the rate of change of sales, thus generating an effect that parallels that of foreign industrial SLOs.[38] The difference is that majority foreign-owned firms, unlike foreign industrial SLOs, do not produce a positive effect on profitability. This difference may be brought about by the different composition of the majority and SLO foreign groups, rising non-labor costs or falling non-sale income in the majority foreign owned firms, or dissipation of profit by majority foreign owners through transfer pricing. Firms with majority and blocking minority domestic private ownership, like firms with domestic industrial company and investment fund SLOs in Table 4, are the only ones that significantly reduce labor costs (employment). Since no type of post-privatization ownership registers significant effects with respect to either indicator of profitability, the reduction in labor cost by concentrated domestic owners may be accompanied by increased non-labor cost or falling non-sales income, or looting.

Overall, the effects of initial post privatization ownership indicate that concentrated foreign ownership increases sales revenue, while highly as well as moderately concentrated domestic owners reduce labor cost (employment) relative to others. These asymmetric findings with respect to sales and labor cost effects of concentrated domestic and foreign owners are provocative because it has been widely presumed that both domestic and foreign private ownership, especially in highly concentrated forms, would lead to substantial strategic restructuring and increases in sales – domestically and/or on the world markets.

The permanent effects of ownership changes that took place after 1996 show some similarities but also significant differences from the effects of initial post-privatization ownership. A post-1996 shift to majority foreign ownership has a positive effect on the rate of change of sales revenue that is not accompanied by an increase in labor cost or profitability. This suggests that foreign owners that acquire majority stakes in firms after privatization engage in productivity-enhancing strategic restructuring and either incur increased non-labor costs and/or falling non-sale revenue, or they siphon off profits. In contrast, shifts to blocking minority state and domestic ownership bring about negative effect on both sales and labor cost, indicating that these somewhat less concentrated owners react defensively by downsizing the newly acquired companies.

38 There is also a positive effect of highly dispersed ownership. This group is comprised of a small number of firms, however, and there is an offsetting effect associated with subsequent ownership by this group.

A switch to majority domestic ownership results in a positive permanent effect on both measures of profitability. Interestingly, positive permanent effects on ROA are also observed with shifts to blocking minority foreign and legal minority domestic ownerships. Moreover, the relatively rare shifts to legal minority state ownership also generate sizable positive effects on profit/sales.

As may be seen from Table 5, firms in which the state retains a golden share register a positive effect on sales, labor cost and ROA. These effects complement the estimates from the SLO specification and suggest that the state pursues an objective of increasing employment and output (revenue), while also inducing profit-oriented restructuring relative to assets. Since the state retains golden shares primarily in state- owned and domestic private firms (Table 2), the effect of a golden share moderates the tendency in some of these firms to reduce output (sales) and/or employment.

7. Concluding Observations

With the former Soviet bloc and many other developing countries having rapidly privatized their state-owned enterprises, and the populous economies of China, India and Vietnam being in the process of privatization, it is important to have a solid understanding of the effects of privatization and different forms of ownership on performance. While theory generates conflicting predictions, most surveys of the empirical literature suggest that a shift from state to private ownership tends to improve economic performance. However, much of the literature suffers from serious data problems and inadequate treatment of endogeneity (selection) of ownership, thus leaving the results in doubt. In this paper, we analyze this issue using rich panel data covering an entire population of firms that went through mass privatization in a model transition economy (Czech Republic), having the benefit of sizable variation in key variables during a large natural experiment and addressing carefully the principal data issues, including omitted variables bias, measurement error and endogeneity (selection) of ownership.

Overall, our econometric estimates present a much less sanguine picture than the generally accepted stylized facts, suggesting that the expectations and early findings of positive effects of privatization on corporate performance were premature. Contrary to many earlier studies, our results indicate that the performance effects of privatization and different types of ownership are on the whole surprisingly limited and that many types of private owners do not generate performance that is different from that of firms with state ownership. This lack of difference in performance is provocative because it has generally been assumed that various private owners would perform better than the state and the extent of inefficiency and looting of firms associated with various types of private ownership has been underestimated.

The key exceptions to the above result are concentrated foreign owners (industrial companies), which yield superior performance compared to all other types of owners in terms of growth of sales and in some specifications also profit (strategic restructuring), and concentrated domestic owners (industrial companies and investment funds), which reduce employment relative to others (defensive restructuring). These findings are consistent with the agency theory prediction that concentrated ownership results in superior corporate performance and they go against theories stressing the positive effects of managerial autonomy.

Apart from its effect as an owner, the state plays an interesting part by retaining control through a golden share in some firms. In particular, it increases employment and in one of the two specifications it also generates a positive effect on ROA and sales revenue. The state hence pursues both a social (employment generating) objective and corporate restructuring. Since our analysis covers the period of rising unemployment, the state appears as a more economically and socially beneficial agent than has been argued in some earlier studies (e.g., Djankov and Murrell, 2002, and Shleifer and Vishny, 1994).

Statistical Appendix

Table A1: Pre-Privatization Characteristics of Firms

Variable	Mean	Std. Dev.	Min	Max
Panel A				
Registered Capital (in thousands of korunas)	419,607	1,877,644	3,141	49,200,000
Net Asset Value (in thousands of korunas)	489,480	2,178,180	3,490	56,000,000
Total Number of Shares	412,827	1,870,709	3,141	49,200,000
Number of Shares Entering Voucher Privatization	220,490	656,943	2,202	14,800,000
Number of Shares Allocated through Voucher Privatization	204,935	629,464	1,537	13,800,000
Value of Shares in Terms of Voucher Points	6,903,206	24,200,000	67,300	611,000,000
Regions	**Mean**	**Std.Dev.**	**Min**	**Max**
Panel B				
Prague	15.83%	0.3651	0	1
Central Bohemia	8.14%	0.2735	0	1
Southern Bohemia	7.77%	0.2677	0	1
Western Bohemia	10.28%	0.3038	0	1
Northern Bohemia	11.32%	0.3169	0	1
Eastern Bohemia	12.72%	0.3333	0	1
Southern Moravia	18.71%	0.3902	0	1
Northern Moravia	15.24%	0.3595	0	1
Industrial Sectors				
Panel C				
Agriculture	18.20%	0.3859	0	1
Heavy Machinery	29.88%	0.4579	0	1
Light Machinery	17.46%	0.3797	0	1
Constructions	13.02%	0.3366	0	1
Transportation	4.07%	0.1976	0	1
Trade	9.10%	0.2877	0	1
R & D	1.48%	0.1208	0	1
Services	4.29%	0.2027	0	1
Financial	0.96%	0.0976	0	1
Other	1.55%	0.1237	0	1

Note: The number of observation is 1352 for each variable

Table A2: Proposed Allocation of Shares Among Parties (in %)

Variable	Mean	Std Dev.	Min.	Max
Foreign Owner	1.3225	7.6277	0	75
Domestic Owner	3.7663	12.8294	0	74
Restitution	0.5222	3.0640	0	58
Fund of National Property (Temporary)	8.4615	16.6760	0	84
Fund of National Property (Permanent)	0.1709	2.3046	0	51
Sale Through Intermediary	2.0666	8.5860	0	75
Municipality Transfer	3.4379	13.3587	0	94
Other	3.0377	8.0087	0	81
Total Number of Privatization Projects	3.0178	7.0905	1	77

Note: The number of observation is 1352 for each variable

Table A3: Performance Indicators prior to Privatization

Variable per Share		No. of observations	Mean	Std. Dev.	Min	Max
Sales						
	3 years to privatization	1210	3.6350	40.3716	0.001050	1297.0630
	2 years to privatization	1210	3.5091	46.8384	0.000000	1614.1270
	1 year to privatization	1346	2.3407	7.0245	0.001787	200.0090
Profit						
	3 years to privatization	1196	0.2650	1.8867	-1.587883	43.7188
	2 years to privatization	1269	0.3058	3.5251	-2.234356	117.8678
	1 year to privatization	1338	0.1919	1.3306	-10.135990	38.4093
Debt						
	3 years to privatization	916	0.6610	2.0698	0.000249	31.8724
	2 years to privatization	1021	0.6183	1.8527	0.000121	38.1252
	1 year to privatization	1155	0.6284	2.1576	0.000092	32.1283
Employment						
	3 years to privatization	1221	0.0061	0.0150	0.000002	0.4177
	2 years to privatization	1281	0.0057	0.0142	0.000002	0.3998
	1 year to privatization	1348	0.0050	0.0132	0.000002	0.3812

Table A4: First Stage Logit Regressions: Marginal Effects of the Ownership Type *(dP(x=1)/dx)*

Variable	Domestic Industrial Company	Domestic Bank	Domestic Investment Fund	Domestic Individual Owner	Domestic Portfolio Company	Foreign Industrial Company	Foreign Other Owners
Regional Dummies							
Prague	0.022	-0.001	-0.049	-0.063[10]	-0.068[5]	0.219[1]	0.000
Central Bohemia	0.141[5]	0.023	-0.124[10]	-0.005	-0.046	0.182[1]	0.039[5]
Southern Bohemia	0.127[5]	0.000	-0.030	-0.164[5]	-0.039	0.121[5]	0.036[10]
Western Bohemia	0.050	0.000	-0.026	-0.071[10]	0.002	0.149[5]	0.017
Northern Bohemia	0.020	0.000	-0.079	-0.004	-0.029	0.183[1]	0.038[10]
Eastern Bohemia	0.084	0.003	-0.09[10]	-0.026	-0.020	0.082	0.028
Southern Moravia	0.130[5]	0.015	-0.076[10]	-0.026	-0.016	0.113[10]	-0.007
Intended Ownership (percent)							
Foreign Owner	-0.011[1]	0.000	-0.005	0.000	0.000	0.000	0.000
Domestic Owner	0.004[1]	0.002[1]	-0.004[10]	0.000	0.001	-0.004[1]	0.000
Restitution	0.014	0.004	-0.002	-0.009	-0.014	0.004	0.000
Fund of National Property (Temporary)	-0.002	0.001[5]	-0.003[10]	-0.001	0.001[10]	-0.002[5]	0.001[5]
Fund of National Property (Permanent)	0.002	0.000	-0.008	-0.005	0.004	0.000	0.000
Sale Through Intermediary	0.002	0.000	0.003[10]	0.000	0.000	-0.003[1]	0.001
Municipality Transfer	-0.025[1]	0.000	-0.002	-0.005	0.000	-0.002[5]	0.001[5]
Other	0.008[1]	0.000	-0.007	-0.011[5]	0.001	-0.004[1]	-0.003
Quantitative Privatization Characteristics							
Privatized in Voucher Scheme	0.000	0.001[1]	0.004[5]	0.001	0.001	-0.005[1]	0.002[1]
Total Number of Privatization Projects	0.005[1]	0.001[1]	0.002[10]	-0.001	-0.003	-0.001	-0.021
Total Number of Shares (mil.)	0.088	0.053[5]	0.166	0.365	-0.142	-0.214[5]	0.140[5]
Total Number of Shares (mil.) [Squared]	-0.003	-0.005	-0.084[1]	-0.125	-0.033	-0.042	-0.014[10]
Total Number of Shares in the Voucher Scheme (mil.)	-0.048	-0.168	-0.001	0.109	-0.448	0.050	-0.512[10]
Sold Shares (mil.)	-0.025	0.135	0.197	-0.653	0.730	0.312	0.402[10]
Sold Points (mil.)	-0.002	0.583	-0.005[5]	-0.302	-0.004[10]	0.003[5]	0.216
Share Average Price in Voucher Scheme	0.000	0.000	0.002[5]	-0.001	0.001[10]	0.000	0.000
Share Average Price in Voucher Scheme [Squared]	0.000	0.000	0.000	0.000	0.000[10]	0.000	0.000
Constant	-0.433	-0.206[5]	-0.432	-0.131	-0.164	0.175	-0.289[1]
Pre-privatization Characteristics	yes	yes	yes	yes	yes	yes	yes
R-square	0.175	0.464	0.219	0.157	0.142	0.386	0.325

Number 1, 5 and 10 denote significance at 1%, 5% and 10% level, two-tail test, respectively.

Table A5: First Stage Logit Regressions: Marginal Effects of the Ownership Size *(dP(x=1)/dx)*

Variable	Majority Domestic	Majority Foreign	Blocking Minority State	Blocking Minority Domestic	Blocking Minority Foreign	Legal Minority State	Legal Minority Domestic	Legal Minority Foreign	Other than Majority or Minority
Regional Dummies									
Prague	-0.138[1]	0.147[1]	-0.033	0.089[10]	0.054[5]	0.045[10]	-0.084	-0.054	0.000
Central Bohemia	-0.092[10]	0.118[1]	-0.006	0.063	0.082[1]	0.000	-0.019	0.000	-0.01
Southern Bohemia	-0.042	0.038	0.000	-0.006	0.080[1]	0.06[5]	-0.043	0.000	0.000
Western Bohemia	-0.186[1]	0.075[5]	0.051[5]	0.141[5]	0.081[1]	0.047	-0.031	-0.002	0.000
Northern Bohemia	-0.096[10]	0.096[1]	0.05[5]	0.040	0.058[5]	0.04	-0.005	0.037[1]	0.000
Eastern Bohemia	-0.046	0.073[10]	0.049[5]	0.069	0.021	0.063[5]	-0.079	0.000	0.01
Southern Moravia	-0.101[5]	0.000	0.034	0.180[1]	0.000	0.052[5]	-0.111[5]	0.01	0.005
Intended Ownership (percent)									
Foreign Owner	-0.001	0.003[1]	0.000	0.000	0.002[1]	0.000	-0.008[5]	0.000	0.000
Domestic Owner	0.003[5]	-0.002[1]	0.001[5]	0.002	-0.001	-0.001	0.000	-0.001	0.001
Restitution	0.013[10]	0.000	0.000	-0.007	0.001	0.002	-0.003	0.004[5]	0.000
Fund of National Property (Temporary)	0.000	-0.001[10]	0.002[1]	0.004[5]	0.001[10]	-0.001	-0.007[1]	0.002[1]	0.000
Fund of National Property (Permanent)	-0.022	-0.001	0.001	0.019[10]	0.000	0.000	-0.009	0.000	0.000
Sale Through Intermediary	0.004[5]	0.000	0.000	0.004[5]	0.000	-0.004	-0.003	0.001[10]	0.000
Municipality Transfer	-0.013[10]	-0.001	0.001[10]	-0.003	0.000	0.001	-0.007[5]	0.001	-0.002
Other	0.006[1]	-0.013[1]	0.001	0.001	0.000	-0.001	-0.005[10]	0.001	-0.008[5]
Quantitative Privatization Characteristics									
Privatized in Voucher Scheme	0.002	-0.001[10]	0.000	0.004[1]	0.000	-0.002[5]	0.002	0.001	-0.001[5]
Total Number of Privatization Projects	0.004[5]	-0.001	0.000	-0.005[10]	0.001[10]	-0.003[10]	0.006[1]	-0.024	0.000
Total Number of Shares (mil.)	0.407[1]	0.146	0.005	-0.079	-0.007	-0.122[10]	0.039	-0.066	0.017
Total Number of Shares (mil.) [Squared]	-0.050[1]	-0.061	0.060	0.002	-0.375	-0.021[10]	-0.009	-0.025	-0.002
Total Number of Shares in the Voucher Scheme (mil.)	-1.388[5]	-0.148	-0.064	0.022	-0.647[10]	0.813[1]	0.205	-0.954	0.067
Sold Shares (mil.)	0.715	0.017	0.064	-0.011	0.673[10]	-0.656[1]	0.050	0.937	-0.100
Sold Points (mil.)	-0.386	-0.001	-0.149	0.566	0.581	0.004[5]	-0.006[5]	0.002[10]	0.002[5]
Share Average Price in Voucher Scheme	-0.001	0.001[5]	0.000	-0.001	0.001	0.005[1]	0.002[5]	0.000	0.000
Share Average Price in Voucher Scheme [Squared]	0.000	0.000[5]	0.000	0.000[10]	0.000[10]	0.000[1]	0.000[5]	0.000[5]	0.000
Constant	-0.264	-0.042	-0.224[10]	-0.680[1]	-0.078	-0.108	-0.224	-0.107[5]	0.011
Pre-privatization Characteristics	yes	yes	yes	yes	yes	yes	yes	yes	yes
R-square	0.245	0.321	0.12	0.11	0.2	0.317	0.179	0.523	0.513

Number 1, 5 and 10 denote significance at 1%, 5% and 10% level, two-tail test, respectively.

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4 | Rent Extraction by Large Shareholders: Evidence Using Dividend Policy in the Czech Republic

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1. Introduction

Theoretical papers suggest that large shareholders have a dual impact on firms. On the one hand, significant owners have a strong incentive to monitor management to ensure that a firm's value is maximized, while on the other hand, their behavior is motivated by the possibility to extract rents and enjoy the private benefits of control.[1] Hence, as argued in (Shleifer, Vishny, 1997), the overall effect of large shareholders on firms is ambiguous and has to be tested empirically.

In this paper we provide evidence that large shareholders extract rents from firms and expropriate minority shareholders, by showing that some corporate ownership patterns are consistently associated with higher/lower target dividend payout ratios and different levels of dividend smoothing in the cross-section. Moreover, by comparing dividends paid across various ownership structures we quantify the rent extraction associated with the presence of large shareholders and show that it is substantial. We consider several levels of ownership concentration and several types of single largest owner, and investigate the difference between domestic and foreign owners.

We find that the presence of a significant minority shareholder prevents majority owners from extracting rent by increasing the target payout ratio. This finding is much stronger for domestic owners than for foreigners. Our results are consistent with the hypothesis that strong minority owners play a crucial role in dividend policy, especially in the weak corporate governance environment of an emerging economy.

We use data from the Czech Republic for the period 1996–2003. This dataset allows us, first, to account for endogeneity of ownership and, second, to separate the effect of ownership from the broader institutional corporate governance framework. The unique modern economic history of the Czech Republic helps to explain the ownership endogeneity problem, as the initial ownership structure of companies was set exogenously by government bureaucrats during privatization in 1991–1994. The dataset we use in this study includes detailed variables from the privatization process as well as variables capturing pre-market firm-level conditions, which we employ as instruments for ownership. After privatization, ownership rights were fully honored, which helped early corporate development,[2] but the evolution of institutional structures was considerably slower; corporate governance was virtually nonexistent, and corporate law was only weakly enforced.

1 Shleifer and Vishny (1986) were the first to formally investigate the role of large investors in firms, and Shleifer and Vishny (1997) provide a systematic survey of the costs and benefits associated with the pre-sence of large shareholders in firms. More recently, Bolton and von Thadden (1998) model the tradeoff between the costs and benefits of concentrated versus dispersed ownership and Burkart et al. (2000) show how large shareholders and the private benefits they enjoy influence takeovers.

2 Using data from transition countries Johnson et al. (2002) find that property rights are the most important determinant of investment by entrepreneurs. Weak property rights discourage firms from reinvesting their profits, even when bank loans are available.

As a result, corporate governance mechanisms, which are present in developed economies and which play a key role in the relationship between corporate insiders and outsiders, including dividend policy, were missing.[3] These conditions forced shareholders to act based on fundamental rights derived from ownership only, and hence the environment of the Czech Republic fits closely our model's assumptions of large shareholders' behavior. In this way, privatization and the fact that corporate law and governance developed from scratch in the Czech Republic help focus our analysis on the effect of ownership only.

This paper is the first empirical study of dividends from a transition country in Central and Eastern Europe. Since many CEE countries underwent a similarly quick transition from a state-directed to a market economy, our findings based on data from the Czech Republic may to a large extent be valid for them as well.

The structure of the paper is as follows: in the next section we survey the literature; in section 3 we provide an institutional outline and explain in detail how private ownership developed in the Czech Republic over the 1990s; in section 4 we define ownership variables, describe our model, and present our econometric technique; section 5 contains a description of our data and summary statistics; in section 6 we present our results; section 7 contains some robustness checks; section 8 summarizes the paper and concludes.

2. Literature

The existing empirical evidence on rent extraction by large shareholders deals with developed economies only and gives mixed results. Demsetz and Lehn (1985) show that the private benefits of control affect ownership structure in the U.S., and Zingales (1994) argues that expropriation by large shareholders is significant in Italy. On the contrary, Bergström and Rydqvist (1990) and Barclay and Holderness (1989, 1992) do not find evidence of substantial expropriation in Sweden or the United States, respectively. In the paper closest to our own, Gugler and Yurtoglu (2003) suggest that this problem is present in Germany. The authors show that dividend change announcements provide new information about conflicts between a controlling owner and small outside shareholders in Germany, and document how small shareholders use dividends to limit rent extraction by

3 In their international study Laporta et al. (2000) offer evidence that countries with laws protecting the rights of minority shareholders are associated with higher dividend payout ratios and show that companies pay out a smaller proportion of earnings in those countries where laws are more relaxed about overinvestment and empire building. Other economic institutions are important determinants of dividend policy as well. Dewenter and Warther (1998) compare dividend policies of U.S. and Japanese corporations and link them to institutional differences in the structure of corporate ownership. Japanese firms face fewer agency conflicts and information asymmetries than do U.S. firms. Consistent with the agency theory of dividends, Japanese firms experience smaller stock price reactions to dividend omissions and initiations, they are less reluctant to omit and cut dividends, and their dividends are more responsive to earnings changes. See (Hanousek, Kočenda, 2003) for a brief account of the impact of Czech mass privatization on corporate governance.

controlling owners.[4] Faccio et al. (2001) find evidence of systematic expropriation of outside shareholders in Western Europe and East Asia at the base of extensive corporate pyramids. They show that corporations in Europe pay significantly higher dividends than in Asia and that in Europe other large shareholders contain the controlling shareholder's expropriation of minority shareholders whereas in Asia they collude in that expropriation.

Our paper is novel since by working in the Czech transition environment we can fully account for ownership endogeneity and focus on the fundamental rights de-rived from ownership. We also benefit from a large sample that covers the majority of the country's economic activity.

Our work is also linked to a rich empirical literature on corporate dividend policy. According to the free cash flow theory[5] dividends are a control mechanism used by shareholders to divert free funds, which managers have power over within corporations, away from those managers. The shareholders' goal is to prevent managers from indulging in perk consumption, empire building/overinvestment, or manage-ment entrenchment.[6] In support of the free cash flow theory Lang and Litzenberger (1989) find that the market reacts favorably to dividend announcements made by firms with characteristics suggesting that they might otherwise overinvest their funds. Brook et al. (1998) show that firms poised to experience large, permanent cash flow increases after four years of flat cash flow tend to boost their dividends before cash flow jumps, but are hesitant to adjust them afterwards.

The competing argument to free cash flow is based on the idea that management uses dividend policy to communicate to investors the level and growth of income or future prospects of the company because ordinary accounting reports are in-sufficient or inadequate to convey this information.[7] In their test of the signaling hypothesis versus other agency models Bernheim and Wantz (1995) find support for the signaling theory. Similarly, Offer and Siegel (1987) show that equity analysts revise their earnings forecasts following the announcement of an unexpected dividend change. Also, in their event study of stock price reactions to dividend change announcements Amihud and Murgia (1997) find some dividend-signaling patterns in Germany. On the other hand, DeAngelo et al. (1996) argue that dividend changes lag behind earnings changes and conclude that managers do not signal their negative in-formation with dividends. An even stronger argument appears in

4 Similarly, Gugler (2003) estimates the effect of ownership on dividend policy using data from Austria. He finds that the ownership and control structure of a firm are significant determinants of its dividend policy.

5 First mentioned by Easterbrook (1984), reinvented by Jensen (1986), and modeled in a dynamic setting in (Zwiebel, 1996).

6 Shleifer and Vishny (1989) model management entrenchment as one possible driving force behind inefficient investments undertaken by managers with free cash flows at hand.

7 This literature was started by Bhattacharya (1979) and Miller and Rock (1985), and was extended by John and Williams (1985) and Bernheim (1991).

a study by Benartzi et al. (1997). They find no evidence that changes in dividends carry information about future earnings changes.

Both the signaling theory and the free cash flow theory were developed for firms with dispersed ownership structures and hence with managerial control. Similar to other continental European countries, the ownership of Czech firms is rather concentrated in the period we analyze.[8] For a firm with concentrated ownership, the free cash flow and signaling rationale for paying dividends still applies, but in this case dividends are used to solve the agency issues and/or the asymmetry of information between a dominant shareholder who colludes with management (appoints the management) and the remaining shareholders. Therefore, corporate dividend policy in a firm with concentrated ownership is predominantly determined by how the conflict among the firm's shareholders about distribution of profits (benefits) is resolved. Legally, all shareholders have the same cash flow rights in the Czech Republic. Paying dividends follows this principle, as cash reaches all shareholders proportionally, but a dominant shareholder seeking to realize the private benefits associated with ownership does not. In other words, in contrast to the case of dispersed ownership, where the main corporate governance issue is to solve the moral hazard between management and shareholders, good governance in concentrated ownership structures predominantly means equal treatment (per unit of stake in the firm) of all shareholders. From the minority shareholders' point of view, dividend payments alleviate the free cash flow problem or serve as a signal.

3. Institutional Environment

3.1 Privatization

Since the ownership structure of companies is a key explanatory variable in our study we describe in detail how these structures developed. Since 1989 the Czech Republic has undergone overwhelming economic changes that have resulted in the quick introduction of a modern market economy. At the beginning of the transition process, almost all productive assets were state-owned, separation of ownership and control did not exist, there was no modern corporate law and financial markets, and corporate governance structures were only about to start evolving.

The ownership structures of most Czech companies were set during the mass privatization of medium-sized and large enterprises in the first half of the 1990s.[9] The majority of the shares of these companies were offered through a voucher

8 High ownership concentration is present in most continental European countries. See (La Porta et al., 1999) for a description of prevailing ownership structures in Europe. Additional relevant descriptions are in (Gugler, 2003) for Austria, (Gugler , Yurtoglu, 2003) for Germany, and (Kočenda, 1999) or (Mejstřík et al., 1995) for the Czech Republic.

9 This section is based on (Gupta et al., 2001), (Hanousek et al., 2007) and (Hanousek et al., 2008). The Czech privatization process has been described in detail in (Švejnar, Singer, 1994), (Kotrba, 1995), and (Coffee, 1996).

scheme to the general public. All citizens aged 18 years and over could buy, for a tiny nominal fee, a package of vouchers worth 1,000 points. With these points they could bid for the shares on offer or they could place (part of) their points in investment privatization funds, which could then bid for shares. After bidding was completed, points were exchanged for shares and secondary market trading started at the Prague Stock Exchange.[10] A large number of investment privatization funds emerged on a voluntary basis. Although funds were started by various sponsors (domestic and foreign banks, corporations, and individuals), most funds were sponsored by domestic banks, with several banks starting more than one fund. Funds ended up with about 70 % of all the points. Bank-sponsored funds acquired most of the points, with the ten largest bank-sponsored funds holding 67 % of all the points acquired by all the funds (or about 44 % of all the points initially bought by individuals). Control of the largest privatization funds by majority state-owned banks was an unexpected outcome for the government and had a major impact on the emerging corporate governance structure in the mid-1990s.[11]

The privatization process was designed to find private owners of firms very quickly rather than to look for optimal ownership structures. The decision-making of the Ministry of Privatization was rapid and rule-based, and the initial ownership structures emerging from privatization in 1994 can be considered exogenous with respect to future performance, capital structures, and dividend policies of firms. The suboptimality of the first ownership structures was confirmed by the rapid reallocation of shares across new owners in 1995–1996.[12] The 1995–1996 ownership changes were massive, unregulated, and frequently unobservable to outsiders. Investors – especially privatization funds – engaged in direct swaps of large blocks of shares and off-market share trading was common. The first ownership patterns that were consistent with market economy principles emerged in 1996 and hence we chose this year as the beginning of our analysis.

In 2003, the last year of our analysis, the Czech Republic was characterized by private ownership, competitive product markets with unregulated prices, business law to

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10 Before privatization, firms were transformed into joint stock companies. After incorporation the firms' current management had to submit privatization proposals and other individuals and institutions submitted competing proposals. The privatization proposal was a business plan which determined the equity share offered in the voucher scheme to the public and the stake that remained in state hands in the form of temporary or permanent holdings. The Ministry of Privatization picked and approved the winning proposal. If a direct domestic or foreign investor had been identified who was willing to buy (part of) the firm, the required stake in the firm was sold to the investor and the rest was offered in the voucher scheme. The level of managerial and employee ownership was low. In the first wave, only a limited number of firms ended up with managerial or employee ownership; in the second wave, more firms did, but the ownership stakes were low. Also, only very limited restructuring happened prior to privatization.

11 See (Kočenda, 1999) for a detailed description of how chains of ownership linked banks, investment privatization funds, and industrial companies.

12 Cull et al. (2001) document how quickly the post-privatization dispersed ownership structure became increasingly concentrated in 1995–1996 and Kočenda and Valachy (2002) show development of ownership structures during post-privatization period.

a large extent compliant with EU rules, a private banking sector, a stock market, and an economy with links to all the major developed countries of the world. In May 2004 the country was integrated into the EU.

3.2 Legal Framework

A new corporate law which reflected market economy principles was introduced in 1993. Since lawmakers were well behind the economic activity, Czech law was incomplete and kept changing literally every year.[13] As a result, only very fundamental and robust ownership rights were effectively enforced. The high legal uncertainty and weak/slow law enforcement[14] suggest that, in the period we analyze, shareholders acted based on fundamental rights derived from ownership. More subtle rights, e.g., rights protecting minority shareholders, were either nonexistent or very poorly enforced. The ownership structures that were evolving in this environment reflected its specific conditions, and large shareholding was quite naturally the most important control device. Only highly concentrated owners are able to control managers effectively and, on the other hand, because of the underdeveloped legal system and financial market, dispersed ownership structures cannot enjoy benefits from greater market liquidity and better risk diversification.[15] Overall, Czech corporate ownership structures are very different from those of large publicly-traded firms from developed countries, for which the vast majority of the empirical research on dividends exists.

3.3 Taxes

Taxation is one of the key determinants of corporate dividend policy, and different treatment of various types of owners might explain varying dividend policies across ownership structures.[16] We argue that this cannot be the case in the Czech Republic, since the marginal tax rate on cash dividends is the same for all types of shareholders and stock repurchases are not used at all. Czech companies distribute dividends from after-tax profits. In the period of our analysis the same dividend

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13 To illustrate the situation we describe the evolution of the income tax law in detail. The modern tax system implemented from 1993 onwards was completely novel for most of the citizenry as well as for the public administration. Regulatory institutions and enforcement procedures developed gradually and the tax law was amended many times. During 1993–2002 there were 43 amendments – approximately one modification every quarter. Not only did the income tax law change substantially in character, it also became extensive. The first version of the law contained fewer than 14,000 words, whereas the one in 2002 was composed of nearly 57,000 words. Income tax law modifications were typically introduced to correct previous mistakes or to launch new policies, though sometimes they emerged in reaction to lobbying. Even tax advisors complain that the law is too difficult for them to follow, so that the ordinary public has little chance of grasping it.

14 Settling business disputes in court takes a long time: for example, lawsuits related to purchase agreements took on average 452, 594, and 655 days to settle in court in 1998, 1999, and 2000, respectively (from the statistics of the Ministry of Justice of the Czech Republic).

15 See the survey by Shleifer and Vishny (1997).

16 See (Allen et al., 2000) and (Dhaliwal et al., 1998), for example.

tax treatment applied to individuals and corporations. In the case of individuals, income from dividends was taxed at source separately from all other income using a flat tax rate.[17] The same treatment and rate applied to corporations (including financial institutions). If the receiver was foreign the taxation of dividends was governed by a treaty between the Czech Republic and the country of the receiver. These treaties prevented double taxation of dividends and existed with all major developed countries.[18] Overall, tax considerations or tax clientele effects cannot drive cross-sectional differences in dividend policies.

During 1996–2003 individuals were exempted from capital gains tax if they held shares for at least 6 months. On the other hand, corporations paid standard income tax on capital gains; the corporate income tax rate was on average close to 30 percent and decreased gradually. Pension, mutual, and investment funds had a preferential lower income tax rate. The described taxation applied to capital gains realized by trading on the stock market, whereas share repurchases were taxed in the same way as cash dividends independent of shareholder type. As expected, we do not observe any share repurchases in the period of our analysis in the Czech Republic.

4. Model

4.1 Ownership Structures

Our data allows us to track ownership in line with how Czech corporate law assigns control rights to different ownership levels. Following Hanousek, Kočenda, and Švejnar (2007) we distinguish three ownership categories: majority ownership (more than 50 percent of the shares)[19], blocking minority ownership (more than 33.3 but not more than 50 percent of the shares), and legal minority ownership (at least 10 but not more than 33.3 percent of the shares).[20] A majority owner has the right to select the management and a supervisory board, to decide whether the company distributes profits as dividends or reinvests them, and to adopt almost all decisions at general shareholders' meetings. Blocking minority ownership gives the right to block some decisions at general shareholders' meetings, mainly those related to implementing major changes in business activities and changing the firm's capital

17 In 1996–1998 the dividend income tax rate was 25 percent and from 1999 it was lowered to 15 percent.

18 The foreign owners in our sample are mainly from the EU and we have very few foreign owners incorporated in offshore centers or low-income-tax countries.

19 We define the majority as holding more than 50 percent of the shares or alternatively as holding more than 66.6 percent of the shares.

20 Czech law does not require reporting of stakes of less than 10 percent. This does not restrict our analysis, since by having data on all owners with 10 percent or more we are able to estimate the effect of the most relevant degrees of concentration and dispersion of ownership, ranging from a single owner having majority ownership, to no single owner having legal minority ownership.

structure.[21] Finally, legal minority ownership can be considered a form of dispersed ownership, since its direct impact on business decisions is limited. On the other hand, corporate law entitles minority shareholders to call a general shareholders' meeting to decide on issues put on the meeting's agenda by a minority shareholder.[22] The ability to identify owners according to these categories is key to understanding corporate control in the Czech Republic.

Based on these ownership levels we define the following concentration of ownership dummy variables: Majority: the company is controlled by a single majority owner and the next largest owner holds less than 10 percent of the equity. Monitored majority: the majority owner is checked by the presence of at least one significant minority owner (either a blocking minority or legal minority owner). Minority: the largest owner is only a blocking minority owner. Dispersed: all shareholders have less than 10 percent of the equity. In addition to concentration we are able to identify types of owners: industrial firm, private individual, financial institution, and state. The domicile of the owners is either Czech or foreign.[23]

4.2 Hypotheses

The motives of owners regarding the distribution of profits might vary across ownership stake sizes. Majority owners may maximize shareholder value[24] but they can also loot firms at the expense of small shareholders.[25] After controlling for capital structure and investment opportunities, shareholder value maximization is associated with high dividend payouts. In contrast, if the majority shareholder's goal is to loot the firm, dividends are paid less often and the target payout ratio is low.

These predictions are altered if the behavior of the majority owner is monitored by the presence of a significant minority shareholder. Bargaining between a majority and powerful minority shareholder(s) induces the majority shareholder to pay dividends and not to misappropriate profits.[26] Hence we expect the monitored

21 A blocking minority owner may block a decision to change the articles of incorporation, liquidate the company, issue priority or convertible bonds, issue equity, and increase or decrease equity capital in some other way.

22 There were some cases in which minority shareholders obstructed a company's operations by delaying the implementation of stronger shareholders' decisions through lengthy court proceedings.

23 Type and domicile ownership structure is identified by the type and domicile of the single largest owner (SLO).

24 Majority owners are expected to have access to more information about the firm and to be able to use more efficient control mechanisms, most importantly a credible threat to dismiss management. In the context of the Czech Republic it was documented that a firm's value and profitability increase with ownership concentration. See (Hanousek et al., 2004), (Claessens, 1997), (Claessens, Djankov, 1999), or (Claessens et al., 1997). This contrasts with a finding by Demsetz and Lehn (1985) from the U.S., that no significant relationship between ownership concentration and profit rates exists.

25 In the Czech Republic, this behavior was extensively documented by Cull et al. (2001).

26 This result is documented by Gugler and Yurtoglu (2003) for Germany. They show that dividend change announcements provide new information about the conflict between a controlling owner and small outside

majority ownership structure to be associated with a higher probability of paying dividends and with a higher target payout ratio relative to the majority ownership structure. An alternative explanation of our findings could be that the largest owner's rate of time preference varies with the size of the ownership stake, which results in the dividend payout being correlated with the concentration of ownership structure. If this is so, the investment levels vary with the concentration of ownership structure as well. We did check the difference in mean levels of investment across our ownership groups but found no significant results.[27] This gives more solid ground for our main explanation.

Firms with dispersed ownership structures might not suffer from misappropriating efforts of the majority shareholder, but dispersed owners might be weak in exercising their power against management. On the other hand, since in dispersed ownership the private benefits of control are diluted among a large number of shareholders, dividend payments are the only effective way to disseminate profits and we expect these firms to have a high target payout ratio. We also expect some dividend smoothing, as the free cash flow theory predicts for cases when asymmetric information is high.

For many reasons we expect foreign owners to behave differently from Czech owners. Foreign owners have better business, managerial, and corporate governance expertise than do Czech owners. On the other hand, foreign owners are less familiar with local corporate, employment, and other laws relevant to the operations of the firms they own, and they have to overcome some additional, e.g., language or cultural, barriers. Therefore, the agency conflicts and asymmetric information between foreign owners and management/other domestic owners are different than those between management and Czech owners. With better business know-how and knowledge of technology, foreign investors can assess the profitability of firms[28] and collect these profits as dividends to prevent managers from misappropriating them.[29] Due to their ability to tap more developed capital markets foreign owners have easier access to external finance sources relative to Czech owners. At the same time, we expect foreign owners to loot firms less

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shareholders. "Majority-controlled and unchecked" firms have the smallest target payout ratio, "majority-controlled and checked" firms have the largest target payout ratio, and minority-controlled firms lie in between. This implies that minority shareholders with large stakes press successfully for dividends to be paid out, consistent with the rent extraction hypothesis.

27 One has to be aware that we do not have investment variables in our data, as cash flow statements are typically not available. To reconstruct investment we use year-on-year changes in fixed assets plus depreciation scaled by total assets.

28 In the context of the Czech Republic, this argument is supported by Claessens and Djankov (1999) and Hanousek et al. (2004), who show that foreign ownership is associated with improved performance.

29 Hines (1996) finds that U.S. corporations pay dividends out of their foreign profits at roughly three times the rate they do out of their domestic profits. In a related paper, Desai et al. (2002) analyze dividend remittances by foreign affiliates of U.S. multinational firms. The fact that parent firms are willing to incur tax penalties by simultaneously investing funds while receiving dividends from foreign affiliates allows Desai et al. to argue that payout policies are largely driven by the need to control managers of foreign affiliates by diverting funds.

than Czech owners, since foreign owners have a bigger reputation at stake and are subject to more stringent corporate governance (discipline imposed by more developed capital markets) in their home countries. Also, the foreign owners in our sample are predominantly industrial firms and financial institutions, while we have many individuals and state institutions among Czech owners as well. Overall, we expect firms with foreign ownership to have a higher target payout ratio and to pay dividends more often relative to Czech owners and we provide the key results for ownership concentration separately for domestic and foreign owners.

In our sample the majority owners from the financial sector are banks, bank-sponsored funds, and insurance companies. Banks are usually described in the literature as good monitors, and a combination of equity ownership and debt claims can reduce the shareholder-debtholder conflict. In the Czech Republic, banks seem to serve an especially positive role in corporate governance, since the profitability and value of firms under bank ownership is high.[30] Despite increasing profitability, however, the effect on dividend policy has to be qualified by the fact that paying high dividends could endanger banks' loans. After controlling for this effect we expect financial institutions with large shareholdings to impose financial discipline and aim at high dividend payout ratios. We expect no looting from banks, as they are subject to much stricter regulation and care more about their reputations than do industrial firms and individuals. We also expect low dividend smoothing, since information asymmetry in the case of bank ownership is small.

Finally, the most common owners among state-controlled firms are municipalities and especially the National Property Fund.[31] This suggests that dividends paid within this category will be determined by the political process, with no aim for a specific target payout ratio or level of dividend smoothing.

4.3 Estimation

Our specification of dividend payouts builds upon the seminal model by Lintner (1956):[32]

$$D_{i,t} = \beta_i + \alpha_i \tau_i \pi_{i,t} + (1-\alpha_i) D_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

where $D_{i,t}$ is the dividend per share company i pays in year t, $\pi_{i,t}$ denotes the earnings per share company i reports in year t, τ_i is the target payout ratio of company i, and $\varepsilon_{i,t}$ is the error term. Parameters α_i and $1 - \alpha_i$ correspond to the weight placed on current earnings and lag dividends, respectively. In order to test our hypothesis that

30 See (Claessens, Djankov, 1999) and (Claessens et al., 1997).

31 The National Property Fund manages shareholdings of the Czech state and sells these ownership stakes over time by direct sales or auctions mainly to foreign investors.

32 As noted by Benartzi et al. (1997): "[...] the conclusion we draw from [our] analysis is that Lintner's model of dividends remains the best description of the dividend setting process available."

dividend payments vary with ownership in our sample we augment specification (1) by ownership:

$$D_{i,t} = \sum_j [\beta_j + \alpha_j \tau_j \pi_{i,t} + (1-\alpha_j) D_{i,t-1}] OWN(j)_{i,t} + \zeta_{i,t} \tag{2}$$

where $OWN\,(j)_{i,t}$ is a dummy variable equal to 1 if company *i* belongs to ownership structure *j* in year *t* and zero otherwise. With respect to the chosen ownership structure $OWN\,(j)_{i,t}$, parameter τ_j of model (2) reflects the target payout ratio of ownership structure *j*, and parameters α_j and $1 - \alpha_j$ correspond to the weight placed on current earnings and lag dividends, respectively. The ownership structure as entered in (2) can be easily specified to account for majority/monitored majority/minority/dispersed concentration level as well as its interaction with domicile and type of owner.

Direct application of Lintner's model suffers on several fronts in an emerging market environment. First, we do not observe a majority of firms paying dividends (less than ten percent of our sample do so) and hence direct application of Lintner's model leads to biased results due to sample selection (see (Heckman, 1979)). Second, due to weak market supervision and regulation enforcement we have to address the problem of missing financial data for firms that do not pay dividends (in the case of the Czech Republic this reduces the original data panel to less than half of a fully defined data point). Third, we study dividend payments shortly after privatization, when ownership is potentially endogenous with respect to corporate performance (e.g., state versus private, domestic versus foreign). Since profit influences dividends we therefore expect a bi-directional link between ownership structure and the decision to pay dividends.

To address sample selection biases (missing data and the relatively low frequency of dividends observed) and ownership endogeneity we model dividend payments as a two stage process. In the first stage, firms decide whether a dividend will be paid or not, while in the second stage the size of the dividend payment is decided. Technically, this approach is a Heckit regression, in which we model separately the decision to pay dividends as a 0–1 variable (the first stage) and in the second stage we estimate specification (2) for those firms paying dividends. Based on the thorough discussion provided by Angrist and Krueger (2001) we use a linear probability model instead of probit in the first stage. The linear probability model allows us to instrument ownership and provides consistent estimates under standard assumptions, while probit regression with plugged predicted values of ownership "does not generate consistent estimates unless the nonlinear model happens to be exactly right, a result which makes the dangers of misspecification high" (ibid). Also, the linear probability model can be corrected for sample selection. We redo the first stage using probit as a robustness check.

Besides its easy implementation, each estimation stage sheds light on the dividend decision process: 1. linear probability regression (2SLS/IV) used as the first step provides a clear-cut decision if the company pays dividends in a given year; 2. the ordinary least squares method, which we run on a subset of companies that decided to pay dividends, estimates what influences the size of dividends in a Lintner-type specification augmented by various ownership structures. Formally, the whole estimation logistics are described in the next section.

4.3.1 Two Stage Process for Dividend Payout

Stage 1: We estimate the decision to pay dividends (the 0–1 variable) as a linear probability regression model:

$$\begin{aligned}\mathbf{I}[D_{i,t}>0]= \quad & \sum_j p(j)\cdot OWN(j)_{i,t}+CONTROLS_{i,t}+\\ & +EFFICIENCY_{i,t}+t\cdot TAX_{96-98}+\\ & +d\cdot DIV_{i,t-1}+\lambda_1\cdot M1_{i,t}+\eta_{i,t}\end{aligned} \tag{3}$$

where $OWN\ (j)_{i,t}$ is a dummy variable equal to 1 if company i belongs to ownership structure j in year t and coefficient $p(j)$ is the probability with which the ownership structure j pays dividends. As controls ($CONTROLS_{i,t}$) we use financial variables: total assets, debts to total assets, bank loans to debts, cash holdings to total assets, and the growth rate of average sales in the industry the firm is part of, excluding the firm itself. After controlling for capital structure and investment opportunities, the only variables that might drive the decision to pay dividends from outside the shareholders' perspective are efficiency measures: profit (or total sales) to total assets and total sales to total labor costs. We include these variables in model (3) as $EFFICIENCY_{i,t}$. To account for a change in dividend taxation in the period of our analysis we include a dummy variable TAX_{96-98} which is equal to 1 for the time period with a higher dividend income tax rate (1996–1998). We also include dummy variable $DIV_{i,t-1}$, which is equal to 1 if the firm paid dividends in the last year. We estimate model (3) using the instrumental variable approach (the set of instruments for ownership variables is described and discussed in detail in the next subsection).

Variable $M1_{i,t}$ in (3) stands for an inverse Mills ratio, which we use to address the issue of missing financial data. The Mills ratio comes from the following probit regression (which we run as a "0 stage"), with missing financial data in our sample as a binary response:

$$\begin{aligned}\mathbf{I}[MissF]= \quad & f(const, TNS_i, NSVP_i, MissF\_91/93,\\ & AP_i, IPF_i, II_i)+\upsilon_{i,t}\end{aligned} \tag{4}$$

where TNS_i denotes the original total number of shares[33] in the voucher privatization scheme (in 1992); $NSVP_i$ denotes the number of shares offered under the voucher privatization scheme; $MissF\_91/93_i$ stands for a set of 0/1 indicators of missing financial data (profit, sales, debt, and number of employees) prior to privatization (in 1991–1993); AP_i is the average price for which the shares were sold in the voucher scheme; IPF_i and II_i denote total holdings (in percent) of the investment privatization funds after the voucher scheme (here we consider also disaggregation to the five largest owners) and individual investors, respectively.

Stage 2: We estimate the decision about the size of dividends paid on a subset of firms paying dividends (i.e., $D_{i,t} > 0$). The final specification we use is an extension of (2):

$$\begin{aligned} D_{i,t} = \; & \sum\nolimits_j [\beta_j + \alpha_j \tau_j \pi_{i,t} + (1-\alpha_j) D_{i,t-1}] OWN(j)_{i,t} + \\ & + CONTROLS_{i,t} + \lambda_2 \cdot M2_{i,t} + v_{i,t} \end{aligned} \tag{5}$$

We follow the established dividend literature (e.g., (Fama, French, 2001)), and use the following control variables ($CONTROLS_{i,t}$) to isolate corporate dividend policy from firms' capital budgeting and borrowing decisions: Firm Size (total assets, $TA_{i,t}$; we expect a positive relationship), Leverage (debts as a fraction of total assets, $\frac{TL}{TA}_{i,t}$; we expect a negative relationship), Bank Power (bank loans as a fraction of debts, $\frac{BL}{TL}_{i,t}$; we expect a negative relationship, but this effect might interact with the aggregate leverage measure), Cash Holdings (cash as a fraction of total assets, $\frac{CH}{TA}_{i,t}$; we expect a positive relationship), and Investment Opportunities (growth rate between the current year and the following year for average sales in the industry the firm is part of, excluding the firm itself, $grSA_{i,\frac{t+1}{t}}$; we expect a negative relationship).[34] We also include dummy variables for every year. Since less than ten percent of firms in our sample pay dividends, we add the inverse Mills ratio, $M2_{i,t}$, computed from regression (3) to remove the sample selection bias.

33 This is equal to the book value (or subscribed capital), since the original shares were issued at a nominal value of 1,000 CZK per share.

34 Accounting variables: earnings, total assets, debts, bank loans, cash holdings, and sales come from audited accounting statements as published by companies in their filings to the Prague Stock Exchange. We use consolidated statements if available. All accounting statements are based on Czech accounting law and standards. Cash is defined as the sum of two items in Czech accounting statements: "Cash in hand" and "Cash in transit". Sales are named as "Sales of own production, services, and goods bought for resale" in the Czech accounting statements. We include Bank Power to control for the possibility that a commercial bank is a shareholder and a debtholder at the same time. This is quite common in our sample.

While estimating (5) we test for ownership endogeneity by employing a Hausman-type test for specification. In contrast to the first stage, ownership endogeneity is rejected in all second stage specifications and hence we employ simple OLS regression.

4.3.2 Instruments Used for Endogeneity of Ownership in Dividend Payment Process

As instruments for ownership variables we use pre-privatization data coming from detailed information on all proposed privatization projects that were submitted to the government before privatization, and data related to voucher privatization (voucher privatization bids) available at the Ministry of Finance. We have available all existing pre-privatization financial data, together with the ownership structure specified in the winning privatization proposal. Despite the fact that all our IVs are strictly predetermined through time, we employ the Sargan test of overidentifying restrictions and use only a subset of variables that do not interfere with the formal test at the 10% significance level or stricter.[35]

The full set of available instruments consists of a set of regional (REG_i) and industrial (IND_i) dummies; basic accounting variables (sales, profit, and debt) from 1991–1993 (FIN_i); TNS_i, the total number of shares (the share of each company was set at the same nominal value before large-scale privatization); the set of variables collected from the database of privatization projects: NP_i, which refers to the number of privatization projects submitted to the government in 1991; $VPOWN_i$, which stands for the ownership structure proposed by the government in 1991 in the winning privatization project – expressed as the percentage intended for certain ownership types (state, municipalities, foreign and domestic owners, intermediaries, etc.); and the information coming from the voucher privatization scheme: AP_i, the average price per share of a company in the voucher privatization scheme (this reflects the demand for a particular firm in the privatization process). In addition, since we have a relatively unique dataset on privatization outcomes, we also have information on the proportion of company shares allocated to investment privatization funds IPF_i (in the estimation we consider five additional variables containing the holdings of the five largest investment funds) and individual investors II_i, respectively, during large-scale privatization in 1992–1994.[36]

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35 Some of the pre-determined variables do not pass the test of being strictly exogenous and hence we do not use them in certain equations. For example, the percentage of the firm's shares to be sold to foreign owners (as proposed in a winning project) typically does not pass the Sargan test.

36 The effects of variables such as the firm's total number of shares and shares allocated to institutional and individual investors may be nonlinear, so we use a Taylor series expansion of the third order to obtain a specification that can take into account potential nonlinearities.

5. Data and Summary Statistics

Our analysis is based on data from 1996 to 2003 on the complete population of 1,664 medium-sized and large firms privatized in 1991–1994 and consequently traded on the Prague Stock Exchange. These firms accounted for most of the country's economic activity in the late 1990s. Financial and ownership data come from the private database ASPEKT.[37] Data for the privatization period come from the Ministry of Privatization of the Czech Republic. To estimate the dividend equations we use data from 1996–2003 (the post-privatization market economy period). We use data from 1991–1994 (the privatization period) as instrumental variables that allow us to control for endogeneity of ownership.

Companies with dispersed ownership seem to be big, not profitable, and dividend-paying. The most effective firms are those with monitored majority ownership, but they seem to pay the lowest dividends among the concentration structures we consider. Majority controlled firms are the smallest and seem to pay the largest dividends (Table 1). The total number of dividends paid is evenly spread over the whole period we analyze.[38] In the category Foreign and Financial we observe just a few dividend payments. In the category Czech (or Foreign) and Industrial, the SLOs seem to be well spread across many industries. We observe very few dividends paid by firms in which the SLO is an individual (Czech or Foreign).

6. Results

Table 2 reports estimates from the stage one regression describing the decision to pay dividends for the entire sample of 1,664 firms over the period 1996–2003, and Table 3 reports estimates from the stage two regression describing the conditional decision about the size of dividends paid over the same period. All regressions contain the full set of ownership structure dummies; the residual group of firms not assigned to any ownership category is denoted as "Other". We present three specifications, which differ based on how we cut the sample according to ownership: domicile, concentration combined with domicile, and type.

A Czech largest owner has a positive but small effect on the probability of paying a dividend, 0.11, significant at the 1% level (the "Domicile" column in Table 2). If the largest owner is foreign, the probability of paying a dividend is positive and the effect is very large: 0.35, significant at the 1% level. In line with this, the target dividend payout ratio (the "Domicile" column in Table 3) for foreign-owned firms of 0.46 (significant at the 1% level) is substantially higher than that for Czech-owned firms at 0.12 (significant at the 5% level). These results are consistent with

37 ASPEKT collects data mainly from the Prague Stock Exchange and the Czech Statistical Office. This database is the Czech source for AMADEUS, a pan-European database containing financial statements data.

38 We observe the following number of positive dividend payments: 1996 – 71, 1997 – 86, 1998 – 75, 1999 – 61, 2000 – 63, 2001 – 58, 2002 – 54 (468 observations in total).

Table 1: Ownership Concentration: Descriptive Statistics

The sample consists of 1,664 firms over the period 1996–2003. These firms are all medium-sized and large companies privatized in the Czech Republic by 1994. The ownership concentration structures are: Majority: the company is controlled by a single majority owner (more than 50 percent of the equity) and the next largest owner holds less than 10 percent of the equity. Monitored majority: the majority owner (more than 50 percent of the equity) is checked by the presence of at least one significant minority owner (either a blocking minority, more than 33.3 percent of the equity, or a legal minority owner, more than 10 percent of the equity). Dispersed: All shareholders have less than 10 percent of the equity. The "Obs" column shows the number of firm-year observations in a given category. Variables profit/ /total assets, debts/total assets, sales/total assets, and sales/staff costs are weighted by total assets. Only firms with debts less than twice the size of total assets are included.

	Ownership concentration	Mean	Std	Obs
Total assets (mil. CZK)	Majority	1.009	7.935	1,775
	Monitored majority	1.431	8.167	2,235
	Dispersed	1.920	9.037	1,866
Dividend / Profit	Majority	0.040	0.681	1,775
	Monitored majority	0.026	0.291	2,235
	Dispersed	0.032	0.158	1,866
Profit / Total assets	Majority	0.019	0.156	1,719
	Monitored majority	0.042	0.242	2,204
	Dispersed	-0.005	0.120	1,853
Debts / Total assets	Majority	0.398	0.283	1,719
	Monitored majority	0.626	0.358	2,204
	Dispersed	0.347	0.238	1,853
Sales / Total assets	Majority	0.935	0.781	1,719
	Monitored majority	1.441	0.874	2,204
	Dispersed	0.799	0.580	1,853
Sales / Staff costs	Majority	8.003	37.294	1,719
	Monitored majority	15.915	38.511	2,204
	Dispersed	6.310	7.718	1,853

the hypothesis that foreigners use dividends to distribute profits more often and aim at a higher target payout ratio than Czechs (the difference in the target payout ratios is significant at the 1% level).

The main results are reported in the "Concentration" column in Tables 2 and 3. The probability that a firm with a Czech majority owner pays a dividend is 0.09 (significant at the 5% level). If the Czech majority owner is accompanied by a significant minority shareholder the probability increases to 0.16 (significant at the 1% level). The same pattern holds for foreigners. The probability that a firm with a foreign majority owner pays a dividend (0.26, significant at the 1% level) is a lot lower than that if the majority owner is accompanied by a significant minority

Table 2 Stage 1: Decision to Pay Dividends

Dependent variable: 0/1, indicating whether dividends are paid or not.

The sample consists of 1,664 firms over the period 1996–2003 for a total of 5,437 firm-year observations. These firms are all medium-sized and large companies privatized in the Czech Republic by 1994. The dependent variable in all regressions is a zero-one variable; one if a firm pays a dividend in a given year and zero otherwise. All estimates are 2SLS/IV estimates with White heteroskedasticity-consistent standard errors reported in parentheses under the coefficient estimates. We use data from 1991–1994 (the privatization period) as instrumental variables that allow us to control for endogeneity of ownership. The last but one row reports the results of the Sargan test of overidentifying restrictions. All regression equations contain the full set of ownership structure dummies, and the residual group of firms not assigned to any category is denoted as "Other". Detailed descriptions of the ownership variables, control variables, and instrumental variables are provided in sections 4.1, 4.3.1, and 4.3.2, respectively.

Ownership	Domicile		Concentration		Type	
	Czech	Foreign	Czech	Foreign	Czech	Foreign
All sample	0.110*** (0.033)	0.352*** (0.051)				
Majority			0.095** (0.050)	0.261*** (0.075)		
Monitored majority			0.161*** (0.048)	0.578*** (0.211)		
Minority			0.064 (0.044)	0.427*** (0.144)		
Financial					0.236*** (0.070)	1.223*** (0.415)
Industrial					0.145*** (0.038)	
Individual					0.063 (0.065)	
State					0.257*** (0.048)	
Dispersed or unknown	0.172*** (0.036)		0.175*** (0.04)		0.185*** (0.04)	
Other			0.119*** (0.037)		0.061 (1.091)	
Total assets	0.002*** (0.001)		0.002*** (0.001)		0.001* (0.001)	
Debts / Total assets	-0.009 (0.011)		-0.006 (0.012)		0.007 (0.013)	
Bank loans / Debts	-0.006 (0.025)		-0.015 (0.026)		-0.029 (0.031)	
Cash / Total assets	-0.024 (0.105)		-0.083 (0.124)		-0.041 (0.124)	
Investment opportunities (industry-level)	-0.040* (0.022)		-0.051** (0.024)		-0.044* (0.025)	
Dividend 1 year before dummy	0.592*** (0.022)		0.590*** (0.023)		0.585*** (0.023)	
Tax dummy (1996–1998)	-0.014 (0.010)		-0.019* (0.011)		-0.027*** (0.011)	
Earnings / Total assets	0.042* (0.022)		0.045* (0.026)		0.069** (0.033)	

Table 2 Stage 1: Decision to Pay Dividends *(continued)*

Ownership	Domicile		Concentration		Type	
	Czech	Foreign	Czech	Foreign	Czech	Foreign
Sales / Total assets	-0.003 (0.004)		-0.001 (0.005)		-0.001 (0.005)	
Sales / Staff costs	0.102* (0.062)		0.107* (0.066)		0.111 (0.071)	
Mills (Sample selection)	-0.083*** (0.024)		-0.077*** (0.023)		-0.091*** (0.028)	
Number of observations	5,437		5,437		5,437	
Test overidentif. (*p*-value)	1.16 (.160)		1.05 (.366)		1.10 (.268)	
Adjusted R^2	0.42		0.39		0.37	

Notes: *, **, *** denotes significance at the 10%, 5%, and 1% level, respectively.

shareholder (0.58, significant at the 1% level). The associated target payout ratios for these ownership structures (the "Concentration" column in Table 3) are as follows: positive but not significant for the Czech majority ownership structure; 0.82 (significant at the 1% level) for the Czech monitored majority ownership structure; 0.61 (significant at the 1% level) for the foreign majority ownership structure; and 0.86 (significant at the 1% level) for the foreign monitored majority ownership structure. The difference in target payout ratios for Czech majority controlled and Czech monitored majority controlled firms is significant at the 10% level, but the same test of difference of target payout ratios for firms with a foreign largest owner is significant only at the 34% level. This set of results supports our hypothesis that significant minority shareholders limit rent extraction by increasing the probability that a dividend is paid and increasing the target payout ratio. This holds both for Czech and for foreign largest owners after controlling for firm size, performance, investment opportunities, leverage, and bank influence on the firm. Rent extraction and dilution of minority shareholders seems to be associated predominantly with Czech owners.

Ownership by financial institutions (the "Type" column in Table 3) is associated with a high target payout ratio of 0.54 (significant at the 1% level) and no dividend smoothing, since the weight put on current earnings is 1.0 (significant at the 1% level). In line with the predictions of the free cash flow theory this result confirms that financial institutions act as sophisticated monitors that do not rely on dividend smoothing as a controlling mechanism and collect about half of the profits as dividends every year. If the largest owner is a financial institution, the effect on the probability of paying dividends depends on the domicile (the "Type" column in Table 2). A Czech financial institution has a positive effect on the probability of paying dividends (coefficient 0.24 significant at the 1% level). In contrast, the coefficient associated with a foreign financial institution is 1.22 (significant at the 1% level).

Table 3 Stage 2: Conditional Dividend Payments

Dependent variable: Dividend paid in year *t* by company *i*.

The sample consists of 1,664 firms over the period 1996–2003 for a total of 468 firm-year observations with a positive dividend payment. These firms are all medium-sized and large companies privatized in the Czech Republic by 1994. The dependent variable in all regressions is the dividend paid in year *t* by company *i*. Coefficient α represents dividend smoothing and τ is a target dividend payout ratio in the Lintner-type model. All estimates are OLS estimates with standard errors reported in parentheses under the coefficient estimates. For each specification we perform a Hausman endogeneity test and according to the results we treat ownership as exogenous. All regression equations contain the full set of ownership structure dummies, and the residual group of firms not assigned to any category is denoted as "Other". Detailed descriptions of the ownership variables and control variables are provided in sections 4.1 and 4.3.1, respectively.

Ownership	Domicile		Concentration		Type	
	α	τ	α	τ	α	τ
Czech	0.490*** (0.027)	0.125** (0.062)				
Foreign	0.600*** (0.105)	0.464*** (0.093)				
Czech majority			0.473*** (0.031)	0.134 (0.319)		
Czech monitored majority			0.451*** (0.139)	0.823*** (0.236)		
Czech minority			0.801*** (0.075)	0.138* (0.085)		
Foreign majority			0.715*** (0.106)	0.607*** (0.065)		
Foreign monitored majority			0.853** (0.380)	0.858*** (0.258)		
Financial					0.998*** (0.101)	0.540*** (0.083)
Industrial					0.471*** (0.029)	0.563*** (0.089)
Individual					0.112 (1.570)	-0.081 (1.713)
State					0.128 (0.592)	0.498 (2.279)
Dispersed or Unknown	0.748*** (0.127)	0.966*** (0.121)	0.711*** (0.12)	0.925*** (0.11)	0.704*** (0.124)	0.925*** (0.117)
Other			-0.303 (0.408)	-0.201 (0.319)		
Total assets	0.392 (0.455)		0.456 (0.042)		0.438 (0.454)	
Debts / Total assets	-89.1** (44.9)		-76.8** (40.6)		-95.8** (44.8)	
Bank loans / Debts	9.30 (15.90)		8.97 (14.88)		7.97 (15.74)	
Cash / Total assets	-1,651 (1,388)		-1,603 (1,497)		-2,113 (1,352)	
Investment opportunities (industry-level)	-29.4 (61.8)		-70.9 (57.4)		-36.1 (61.0)	
Year dummies	YES		YES		YES	
Mills (Sample selection)	35.8*** (12.3)		48.7*** (11.9)		48.5*** (12.7)	
Number of observations	468		468		468	
Hausman test (*p*-value)	0.66		0.26		0.71	
Adjusted R^2	0.60		0.66		0.61	

Notes: *, **, *** denotes significance at the 10%, 5%, and 1% level, respectively.

If the largest owner is an industrial firm the target payout ratio is 0.56 (significant at the 1% level) and we observe significant dividend smoothing; the weight associated with current earnings is 0.47 (significant at the 1% level). Industrial owners smooth dividends considerably more than do owners from the financial sector; the difference in weights placed on current earnings is significant at the 1% level. Ownership by private individuals has no effect on the probability of paying dividends (the coefficient 0.06 is not significant) and the target payout ratio is not significantly different from zero either. This seems to suggest that private individuals as largest owners do not pay dividends and extract rents instead. The state as an owner is associated with a positive probability that dividends are paid (0.26, significant at the 1% level), but decisions about dividend payments do not seem to be consistent with Lintner's model, as neither the weight coefficient nor the target payout ratio coefficient are significant. We believe this is because dividends are paid according to the fiscal needs of the government or municipalities, with no aim to establish a target payout ratio.

In Tables 2 and 3, the ownership category "Dispersed or unknown" contains firms of two types that we cannot distinguish: firms with dispersed ownership without any legal obligation to disclose their owners, and firms that do not report their ownership structure. This makes interpretation of the results difficult, since, for example, firms with both Czech and foreign ownership might have reasons not to disclose their ownership structures. For the "Dispersed or unknown" ownership structure the probability of paying dividends is on average 0.18 (significant at the 1% level in all specifications) and the target payout ratio is large, on average 0.94 across all three specifications (significant at the 1% level). This suggests that dividends are used to distribute profits if there is no large shareholder with a strong incentive to extract rents or to dilute, but our data do not allow us to draw any strong conclusion.

The coefficients in front of the control variables have similar signs as found in the previous literature in both regressions: firm size has a positive and significant effect on the probability of paying dividends and seems to increase the target payout ratio. Leverage and the strength of bank presence has a small negative effect on the probability of paying dividends and a strong negative effect on the size of dividends. Investment opportunities on the industry level have a negative effect both on the probability of paying dividends and on the target payout ratio. The large positive effect of dividend history (on average 0.59, significant at the 1% level in all specifications) supports the use of Lintner's model. The lowering of dividend income tax positively contributes to the probability of paying dividends. Finally, the earnings-per-total--assets and sales-to-staff-costs measures of efficiency have a positive and weakly significant effect on the probability of paying dividends.

7. Robustness Checks

7.1 Variables Definition

The use of different earnings measures in Equations (3) and (5): operating profit before income tax, profit including/excluding extraordinary items, or after tax profit, has no impact on the results reported in Tables 2 and 3.

We use total sales instead of total assets as a measure of a firm's size, bank loans as a fraction of total assets instead of debts as a fraction of total assets as an alternative measure of leverage, and cash holdings including or excluding marketable securities.[39] These changes in control variables again have no impact on our results in Tables 2 and 3.

7.2 Investment Opportunities

As alternative measures of investment opportunities we use the growth rate of total assets, earnings, or value added in the industry the firm is part of (excluding the firm itself). We tried growth rates both between the current year and the following year, and between the previous year and the current year. In all these specifications the results are unchanged.

Finally, we use the firm-level growth rate of total assets (or total sales) in combination with industry dummy variables instead of various industry-level growth rates. Tables 4 and 5 have the same structure as Tables 2 and 3, respectively, and report results from these regressions. The coefficients in front of the ownership variables remain to a large extent unchanged and confirm the corporate dividend behavior found in the main specification: firms with a dominant majority owner pay dividends less often and their target payout ratio is small. In contrast, firms with a majority owner and at least one strong minority owner pay dividends more often and the target payout ratio is large.

8. Conclusion

The key agency costs in firms with concentrated ownership shift from the traditional principal-agent conflict to the dominant shareholder's incentive to consume private benefits at the expense of other minority shareholders. The question whether this rent extraction takes place, how significant it is, and whether minority shareholders are able to monitor large shareholders in order to preclude such consumption is answered in this paper.

39 We add the item "Cash and investments" to the cash variable used in the main specification. In Czech accounting statements this item includes short-term investments in very liquid financial assets.

Table 4 Stage 1: Decision to Pay Dividends, Firm-level Growth Rates, and Industry Dummies

Dependent variable: 0/1, indicating whether dividends are paid or not.

The sample consists of 1,664 firms over the period 1996–2003 for a total of 6,188 firm-year observations. These firms are all medium-sized and large companies privatized in the Czech Republic by 1994. The dependent variable in all regressions is a zero-one variable; one if a firm pays a dividend in a given year and zero otherwise. All estimates are 2SLS/IV estimates with White heteroskedasticity-consistent standard errors reported in parentheses under the coefficient estimates. We use data from 1991–1994 (the privatization period) as instrumental variables that allow us to control for endogeneity of ownership. The last but one row reports the results of the Sargan test of overidentifying restrictions. All regression equations contain the full set of ownership structure dummies, and the residual group of firms not assigned to any category is denoted as "Other". Detailed descriptions of the ownership variables, control variables, and instrumental variables are provided in sections 4.1, 4.3.1, and 4.3.2, respectively. Alternative measures of growth opportunities: firm-level growth rates and industry dummies, are described in section 7.2.

Ownership	Domicile		Concentration		Type	
	Czech	Foreign	Czech	Foreign	Czech	Foreign
All sample	0.120*** (0.028)	0.386*** (0.057)				
Majority			0.100** (0.047)	0.357*** (0.086)		
Monitored majority			0.224*** (0.048)	0.454*** (0.176)		
Minority			0.062 (0.044)	0.401*** (0.153)		
Financial					0.290*** (0.069)	0.845*** (0.339)
Industrial					0.157*** (0.028)	
Individual					0.013 (0.045)	
State					0.265*** (0.044)	
Dispersed or unknown	0.181*** (0.041)		0.188*** (0.04)		0.187*** (0.04)	
Other			0.120*** (0.035)		0.480 (0.863)	
Total assets	0.002*** (0.001)		0.002** (0.001)		0.001* (0.001)	
Debts / Total assets	0.003 (0.003)		0.003 (0.004)		0.008* (0.004)	
Bank loans / Debts	0.015 (0.210)		0.003 (0.022)		-0.013 (0.025)	
Cash / Total assets	-0.002 (0.080)		-0.066 (0.113)		-0.017 (0.072)	
Investment opportunities (firm-level)	0.004 (0.200)		0.474 (0.313)		0.315 (0.403)	
Dividend 1 year before dummy	0.515*** (0.022)		0.510*** (0.023)		0.517*** (0.023)	
Tax dummy (1996–1998)	-0.012 (0.010)		-0.015 (0.012)		-0.030*** (0.011)	
Earnings / Total assets	0.003 (0.003)		0.004 (0.004)		0.008* (0.005)	
Sales / Total assets	-0.005 (0.004)		-0.005 (0.005)		0.003 (0.005)	
Sales / Staff costs	0.054* (0.031)		0.060* (0.033)		0.054 (0.034)	
Industry dummies	YES		YES		YES	
Mills (Sample selection)	0.031*** (0.005)		0.035*** (0.006)		0.024*** (0.005)	
Number of observations	6,188		6,188		6,188	
Test overidentif. (*p*-value)	1.20 (.139)		0.94 (.598)		1.24 (.104)	
Adjusted R^2	0.38		0.32		0.37	

Notes: *, **, *** denotes significance at the 10%, 5%, and 1% level, respectively.

Table 5 Stage 2: Conditional Dividend Payments, Firm-level Growth Rates and Industry Dummies

Dependent variable: Dividend paid in year *t* by company *i*.

The sample consists of 1,664 firms over the period 1996–2003 for a total of 467 firm-year observations with a po-sitive dividend payment. These firms are all medium-sized and large companies privatized in the Czech Republic by 1994. The dependent variable in all regressions is the dividend paid in year *t* by company *i*. Coefficient α represents dividend smoothing and τ is a target dividend payout ratio in the Lintner-type model. All estimates are OLS estimates with standard errors reported in parentheses under the coefficient estimates. For each specification we perform a Hausman endogeneity test and according to the results we treat ownership as exogenous. All regression equations contain the full set of ownership structure dummies, and the residual group of firms not assigned to any category is denoted as "Other". Detailed descriptions of the ownership variables and control variables are provided in sections 4.1 and 4.3.1, respectively. Alternative measures of growth opportunities: firm-level growth rates and industry dummies, are described in section 7.2.

Ownership	Domicile		Concentration		Type	
	α	τ	α	τ	α	τ
Czech	0.486*** (0.028)	0.044 (0.072)				
Foreign	0.588*** (0.105)	0.366*** (0.112)				
Czech majority			0.442*** (0.032)	-0.232 (0.369)		
Czech monitored majority			0.481*** (0.153)	0.776*** (0.226)		
Czech minority			0.810*** (0.076)	0.127 (0.088)		
Foreign majority			0.682*** (0.105)	0.532*** (0.079)		
Foreign monitored majority			0.890** (0.383)	0.858*** (0.248)		
Financial					1.016*** (0.100)	0.538*** (0.084)
Industrial					0.453*** (0.030)	0.470*** (0.109)
Individual					-0.227 (1.627)	0.144 (0.930)
State					-0.251 (0.610)	-0.001 (0.168)
Dispersed or unknown	0.780*** (0.134)	0.908*** (0.118)	0.723*** (0.130)	0.879*** (0.110)	0.705*** (0.131)	0.902*** (0.124)
Other			-0.443 (0.438)	0.002 (0.085)		
Total assets	0.426 (0.475)		0.553 (0.442)		0.517 (0.468)	
Debts / Total assets	-110.3** (47.7)		-109.5*** (42.5)		-121.8*** (47.4)	
Bank loans / Debts	8.05 (16.54)		10.13 (15.62)		8.08 (16.31)	
Cash / Total assets	-1,751 (1,368)		-1,863 (1,501)		-2,152* (1,325)	
Investment opportunities (firm-level)	111.9** (46.8)		165.9*** (45.1)		156.7*** (46.9)	
Year dummies	YES		YES		YES	
Industry dummies	YES		YES		YES	
Mills (Sample selection)	37.1*** (12.4)		49.4*** (12.2)		50.9*** (12.8)	
Number of observations	467		467		467	
Hausman test (*p*-value)	0.97		0.98		0.32	
Adjusted R^2	0.62		0.66		0.63	

*, **, *** denotes significance at the 10%, 5%, and 1% level, respectively.

We find that corporate dividend policy in an emerging market economy depends on concentration and domicile of ownership. Firms with a dominant majority owner pay dividends less often and their target payout ratio is small. In contrast, firms with a majority owner and at least one strong minority owner pay dividends more often and the target payout ratio is large. We interpret these results as evidence that dominant owners extract rents from firms and that strong minority shareholders can prevent this behavior. This dividend pattern holds both for domestic and for foreign largest owners, though domestic owners do enjoy significantly higher rents. The results are robust to alternative definitions of key ownership variables, the way we measure firms' investment opportunities and efficiency, and the use of an alternative estimation technique.

Our analysis of expropriation from the perspective of dividends does provide quantitative evidence on the expropriation that takes place within Czech companies. Expropriation by corporate insiders is not simply a matter of redistribution amongst shareholders only. It is damaging more generally, as corporate insiders might choose to invest in projects with low or negative returns just because they create opportunities for expropriation. Investment decisions are hence distorted and corporate growth is slower than it could be. Such inefficient investment behavior, if undertaken by a large number of firms, has adverse effects on the whole economy. This is of an exceptional interest in countries like the Czech Republic which are struggling to catch up with the developed economies of Western Europe. Each dollar available for investing should be allocated to growth opportunities with the highest returns and the investment decision should not be based on what projects make expropriation easy. To address these problems regulators should, first, strengthen the rights of minority shareholders to enable them to limit expropriation. Second, and more importantly, regulators should support the development of sound and transparent financial markets like those prevalent in Western Europe, as they seem, based on extensive both anecdotal and research evidence, to police dominant owners most effectively. We expect similar results to hold in countries with a comparable institutional framework, i.e., where fundamental ownership rights are honored but capital markets and corporate governance mechanisms are underdeveloped.

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5 | Returns to Human Capital under the Communist Wage Grid and during the Transition to a Market Economy

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1. Introduction

During a significant part of the twentieth century, over one-third of the world's population lived under the communist system. A large proportion of those who were in the labor force had their wages set according to a centrally-determined wage grid. While the effects of the grid *per se* have never been formally analyzed, there has been some evidence that the earnings structures in centrally planned economies were very compressed and that there was decompression during the transition to a market system. In this paper we use new micro data to (a) analyze returns to human capital under the communist wage grid and (b) examine how wages and returns to human capital changed in the emerging market economy as the grid was supplanted by free wage setting in the sector composed of newly created private (*de novo*) firms and a modified wage grid in the public sector and many privatized firms.

In analyzing the shift from the Communist wage grid, we have selected the Czech Republic because it is an excellent prototype of a sudden change of regimes among the leading transition economies. In the other transition countries, such as Poland and Hungary, central planners started losing control well before the 1989 revolutions and their adherence to the wage grid diminished as bargaining between firms and planners gained in importance (see e.g., Rutkowski, 1994). In the Czech Republic, the system remained intact until the very end of the communist regime and evidence from large firm-level data sets indicates that there was no significant rent sharing by workers (Basu et al., 1999). Moreover, while the Polish and Hungarian economies had significant private sectors already before the transition, the Czech economy was almost 100 percent state owned until 1990 and then it underwent one of the most rapid and extensive privatizations in the former Soviet bloc.[1]

The human capital studies carried out on the transition economies to date have examined returns in a cross-sectional setting, using one set of individuals at an early point in time during transition and in some cases also another set of individuals (sometimes from a different survey design) at a point in time during communism.[2] We complement these studies in several ways:

(a) We estimate the determinants of wages and returns to human capital using data on the *same* individuals during a large part of the communist period and the first six years of transition.

(b) We make use of the panel data to develop and asses if some individuals had high or low wage premiums related to unobservable characteristics and whether these premiums carried over into the transition period. In particular, we develop

1 See e.g., Dyba and Švejnar (1995).

2 See for example Bird, et al. (1994), Chase (1998), Flanagan (1996, 1998), Jones and Illayperuma (1994), Krueger and Pischke (1995), Nesterova and Sabirianova (1999), Orazem and Vodopivec (1997) and Rutkowski (1996).

and apply a method decomposing the variance of worker-specific wages into components due to observable determinants and unobservable determinants in the old versus new regime.

(c) We use actual years of schooling as a measure of education rather than imputed years based on the highest degree obtained. We use the information on actual years of education and highest level attained for each individual to test for the bias created by using imputed measures of schooling and to measure *sheepskin effects* (jumps in wages when degrees are received, controlling for years of education).

(d) We test directly whether education and experience gained in the communist versus post-communist periods generate the same rate of return during the transition period.

(e) We examine the impact of firm ownership on returns to human capital during the transition. Privatization and the creation of new firms are key aspects of the transition process and understanding their impact on the wage structure is of great importance.

(f) We estimate changes in the structure of wages by industry and field of study (given attained education) to assess the impact of changes in the structure of the economy on wages.

(g) Finally, existing studies by Krueger and Pischke (1995), Chase (1998) and Flanagan (1998) provide somewhat contradictory estimates of the returns to education and experience during the communist and post-communist regimes in a similar context. We provide additional evidence and ideas about how one might reconcile the differences in the various findings.[3]

In order to carry out our analysis, we collected data on the work histories of 2,284 men from a stratified random sample of households in the Czech Republic. Most of the men worked under communism, all worked during at least part of the 1990–96 transition period, and many worked in December 1996, the date of our survey. Using these data, we analyze the evolution of the returns to education and experience in various parts of the 1948–89 communist era and during the 1991–96 period of transition from plan to market. To our knowledge, no other data set provides information on individuals for such long periods of communism and transition.[4]

We demonstrate that the communist system used the wage grid to set and maintain an extremely low rate of return to education. We also show that the transition resulted in a major increase in the rates of return to education, which reached

3 Krueger and Pischke (1995) deal with East Germany and Chase (1998) and Flanagan (1998) with the Czech Republic. Unlike Hungary and Poland, East Germany and the Czech Republic both adhered to the wage grid until the very end of the communist regime and hence provide interesting laboratories.

4 A potential weakness of the retrospective data set is recall error, as individuals may not accurately remember their past wages. As we discuss below, we check the magnitude and minimize the effect of this error in a number of ways.

West European levels by 1996. Unlike Flanagan (1998), we find this increase in all ownership categories of firms.[5] Hence, as the economy opened to world competition, returns to education in the public sector (state-owned enterprises, SOEs, and public administration) and privatized state-owned enterprises did not deviate significantly from the market-driven, *de novo* firms. The data suggest that at the start of the transition *de novo* firms were the market leaders in setting wages, but that state and privatized firms adjusted their wage grids and almost caught up with wages in the *de novo* firms by 1996.

We run regressions with different specifications of the education variable, using highest level (degree) attained vs. years of education, testing for sheepskin effects and estimating returns to fields of study. We find that those who have obtained (vocational) high school and university degrees experienced more rapid rates of increase in their returns than individuals with basic education (junior high school or apprentices). The sheepskin effect is prevalent and the effect is especially detectable in transition and for higher levels of education in both regimes. Certain fields of study have experienced tremendous increases in their returns (e.g., law), while others have not gained in the new market economy (e.g., health and education). We also show that the earlier studies may overestimate the rate of return to education by using years of education imputed from the highest degree obtained rather than actual years of schooling as an explanatory variable.

Our estimates of the effects of experience on earnings indicate that men's wage-experience profile was concave in both regimes and on average it did not change from the communist to the transition period. This finding differs from Chase (1998), Flanagan (1998) and to a lesser extent Krueger and Pischke (1995) who find wage-experience profiles becoming flatter during the new regime. When we estimate these profiles for workers in firms with different ownership types during the transition, we find that the *de novo* firms display a steeper and more concave profile than SOEs and public administration, hence paying a higher return to recent entrants' short experience than SOEs and public administration. We also find that private firms tend to pay higher wages than the SOEs and public administration, *ceteris paribus*.

We find that education and work experience gained during the transition do not have higher returns than education and experience gained under communism. In fact, returns on apprenticeship/vocational education are found to be lower for those who obtained this education during the transition, suggesting that the major investment in this type of education under communism was excessive. We also show that the inter-industry wage structure changed substantially as the transition unfolded between 1989 and 1996. In particular, men working in mining and quarrying lost much of their former wage premium, while those in trade, transport and telecommunications, and light manufacturing gained significantly. The changes are in part attributable to the *de novo* firms as they tend to pay a

5 Chase (1998) is not able to make this comparison since he does not have data on firm ownership.

higher wage premium, irrespective of a worker's human capital, in trade, transport & telecommunications and other sectors of the economy.

Finally, we develop and apply a new methodology for decomposing the variance of worker-specific wages into components due to observable and unobservable determinants in communism vs. transition. We find the variance in wages due to unobserved effects dominates the variance due to observable determinants. Moreover, while over one-half of total variance is brought about by new unobservable characteristics introduced by the transition, there is considerable persistence of unobservable, individual-specific wage effects (e.g., skill premiums) from communism into the transition.

The paper is organized as follows: In Section 2 we provide a brief institutional background, while in Section 3 we describe our data and methodology. Section 4 contains our empirical findings on returns to education under the communist grid and during the transition, while in Section 5 we present the corresponding returns to experience. In Section 6 we analyze the returns in transition to human capital obtained under communism. The shift in inter-industry wage differentials from the communist to the transition period is analyzed in Section 7. In Section 8 we present and apply a new method for decomposing the variance of worker-specific wages. We conclude the paper in Section 9.

2. The Wage Grids

As in other centrally planned economies, after the 1948 communist takeover of Czechoslovakia, the government introduced a wage grid in an attempt to leave little discretion for managers or unions to set wages at the enterprise level. However, some discretion remained as managers could award ìpersonal evaluation bonusesî that varied across workers with the same observable characteristics and could represent as much as 30% of the base wage. While in principle the trade unions and government jointly determined the grid and the level of wages within the grid, in practice the union and government officials by and large implemented the communist party policies as set out in the central plan.[6]

In Panel A of Table 1 we present the 1985 wage grid that was used for white collar workers in the last five years of communism.[7] The columns represent wage levels by industry. Most workers were placed into wage tariff (class) categories I–Ib,

6 See e.g., Windmuller (1970), Švejnar (1974), Adam (1984), and Flanagan (1998). In addition to personal evaluation bonuses, the managers could influence total compensation and hence compete for workers by offering various social benefits, such as subsidized housing. However, they could not change the centrally set wage rates.

7 We could not obtain a detailed grid for blue collar workers for the mid-late 1980s, but we believe that the experience profile was similar to that for white collar employees. As we show in Table 9 below, the interpolated wage-experience grid estimates for blue collar workers in 1982 and white collar workers in 1985 are quite similar. The grids that we present in Figure 1 for 1954, 1979 and 1998 cover both blue and white collar workers.

Table 1: Wage Grids for the Communist and Post-Communist Period

A: 1985–1989 Wage Grid for White-Collar Workers in Czechoslovakia[a]

Salary Class	(A) All Industries except those in (B)				(B) Heavy Industry and Construction			
	I	Ia	Ib	Max. bonus	II	IIa	…	Vb
1	1000	–	–	300	–	–	…	–
2	1100	–	–	300	–	–	…	–
3	1200	–	–	350	–	–	…	–
4	1300	–	–	400	–	–	…	–
5	1450	–	–	450	–	–	…	–
6	1600	1750	–	500	1700	1850	…	–
7	1750	1950	–	550	1850	2050	…	–
8	1950	2150	2350	600	2050	2250	…	3100
9	2150	2350	2600	650	2250	2450	…	3400
10	2350	2600	2850	700	2450	2700	…	3750
…	…	…	…	…	…	…	…	…
20	6300	–	–	1800	6500	–	…	–
21	7100	–	–	1900	7200	–	…	–

B: 1998 Wage Grid for the Public Sector in the Czech Republic[a]

	Years of experience											
Salary Class	< 1 yr.	1–2	3–4	5–6	7–9	10–12	13–15	16–19	20–23	24–27	28–32	>32
1	3250	3390	3550	3700	3850	4000	4170	4330	4490	4660	4820	4980
2	3560	3720	3880	4050	4210	4380	4540	4720	4900	5080	5250	5430
…	…	…	…	…	…	…	…	…	…	…	…	…
11	8800	9250	9710	10170	10620	11080	11540	11980	12440	12910	13370	13840
12	10000	10520	11030	11560	12070	12590	13120	13640	14170	14710	15230	15760

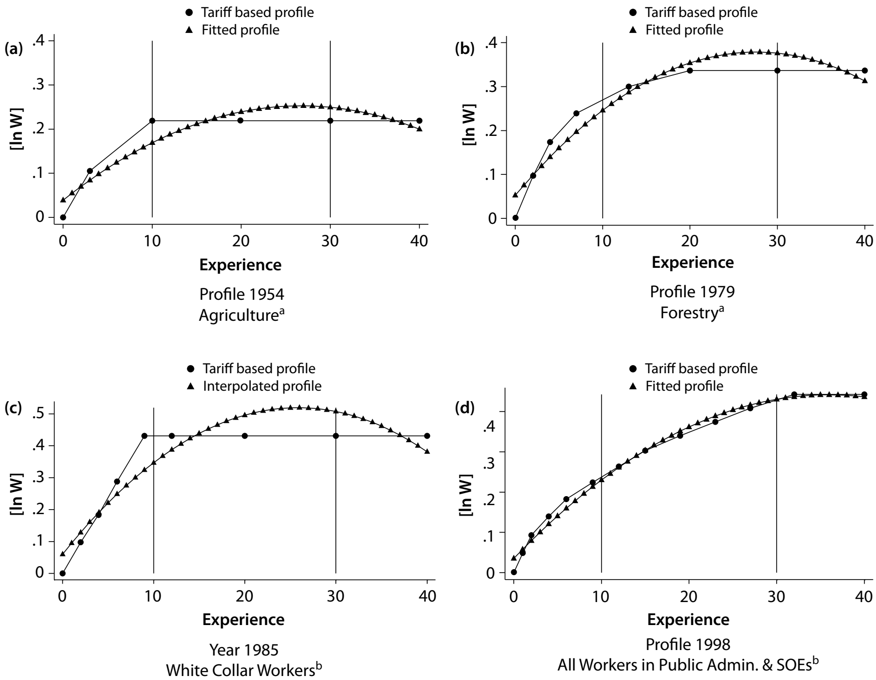
[a] See text for description.

Sources: Ministry of Labor and Social Affairs, (1985, 1986, 1998)

while workers in heavy and construction industries were allocated into wage tariff categories II–Vb. Within each wage tariff category, workers were placed into salary classes 1–21 on the basis of their education, experience, occupation, and the number of employees that they supervised. The grid was accompanied by a detailed handbook that permits one to determine the relationship between education or experience and wages.

Figure 1: Wage Experience Profiles from the 1954, 1979, 1985 and 1998 Wage Grids

(Actual Grid Data Points and Curve Fitted with a Quadratic Wage-Experience Function)



Sources: [a] Ministry of Agriculture (1952, 1979)
[b] Ministry of Labor and Social Affairs (1985, 1998)

The system underlying the grid evolved over time. For example, the earlier grids were sector-specific (e.g., the 1954 grid for agriculture and 1979 grid for forestry that we depict in Figure 1), while the later ones were economy-wide.[8] As is evident from the 1985 grid in Table 1, planners favored workers in heavy industries and construction over those in other sectors.[9] Adjustments were also made for the number of hours worked per week and, as mentioned earlier, managers could at their discretion award workers significant bonuses.

The wage dispersion across the various categories in the grid was modest, given that unskilled workers were the pillar of the regime and the communist ideology

8 See Ministry of Agriculture (1952) and Ministry of Labor and Social Affairs, (1985 and 1986).

9 For many years, planners favored "productive" sectors (industry, construction and agriculture) over the "unproductive" sectors (trade and services) and wages in the productive sectors were boosted above the others. In some years, the location of the job within the government hierarchy (headquarters vs. branch office) also mattered.

dictated that wage differentials between the skilled and unskilled be kept small.[10] Correspondingly, during the communist period wages were compressed and income distribution in Czechoslovakia and the other Central and East European (CEE) countries was one of the most egalitarian in the world (see e.g., Atkinson and Micklewright, 1992).

Since the collapse of communism at the end of 1989, market forces have increasingly determined wages and employment in the *de novo* firms. The public sector and most privatized SOEs, however, used modified wage grids throughout the 1990s.[11] In Panel B of Table 1 we present the wage grid used in the public sector in 1998. In comparison to its communist predecessor, this grid was substantially simplified by eliminating the industry dimension and creating 12 experience-related categories (columns), together with 12 salary classes (rows) based primarily on education. Information on the grids used by the private sector during the 1990s suggests that these grids and the accompanying rules were similar to those in the public sector, but that wage adjustments related to experience flattened out earlier than those in the public sector. The question that naturally arises is whether the rate of return on human capital under the transition grids matched or fell short of the market return provided by the new private firms.

3. Data and Methodology

3.1 Data

We use data from a retrospective questionnaire that was administered in December 1996 to 3,157 randomly selected households in all 76 districts of the Czech Republic. The questionnaire first asks for the wage and other characteristics of the jobs held in January 1989, the first month of the last year of the communist regime.[12] Since

10 Discussions with officials who used to administer the wage grid indicate that the process was taken very seriously and that administrators from various Soviet bloc countries compared notes and experiences. In this respect, the wage grid was an integral part of the centrally planned system.

11 In order to understand of this phenomenon, we examined the internal wage setting practices in hundreds of firms with diverse ownership. We have also discussed this and other issues with representatives of employers, trade unions and the Ministry of Labor and Social Affairs. Using the large firm-level data set collected by the Trexima Corporation, we found that as late as 1998 most state owned and privatized firms still used modified wage grids from the communist days. The privatized enterprises were not required to pay according to any grid and their adherence to it reflected inertia in (transaction costs related to changing) their compensation practices. The data and our discussions with the officials also indicate that in the mid 1990s foreign ownership was still concentrated in a few large companies (e.g., Skoda-Volkswagen, Tabak-Philip Morris, Czech Telecom) which may have changed compensation practices. However, most firms privatized to domestic owners continued their old personnel practices, usually employing personnel directors from the communist era. In contrast, the *de novo* private firms have been found to operate squarely outside the wage grid. Finally, government intervention in private sector wage setting has been minimal, although loose wage controls were in effect intermittently from 1991 to 1995.

12 The January 1989 date was selected as a point in time for which people were likely to remember their labor market characteristics since 1989 was the year of the revolution that toppled the communist regime. See

the "big bang" of liberalization started January 1, 1991 in Czechoslovakia, the questionnaire then traces the characteristics of all the jobs held by the surveyed individuals between January 1991 and December 1996. As a result, we have continuous labor market histories for each individual during the entire 1991–96 period. In particular, for each job we have the start wage and average hours of work, as well as the industry and ownership of the worker's firm. For the individuals employed in January 1991, we have also obtained information on wages and other characteristics at the start of the job held in January 1991. The starting dates of the jobs held in January 1991 span the entire 1948–89 communist period and we have used data from 1955 onward, while checking the robustness of our estimates by taking later starting points as well.[13] In particular, in order to test if our results are sensitive to the inclusion of observations from the 1950s, 1960s and 1970s, we have re-estimated our models with sub-samples that dropped observations on jobs that started before the1980s, 1970s and 1960s, respectively. As we report later, we found only negligible differences in the various estimates. Finally, for the 1991–96 period, we have collected information on each person's household and demographic characteristics, including changes in education.

The sample is representative of the 1996 population in terms of major demographic characteristics. It yields employment histories of 2,284 men who were employed for a minimum of two weeks during the period between January 1, 1991 and December 31, 1996. For the "mature" communist period of 1955–89, we use data on (a) the starting wages of 1,285 men who also held a job in January 1991 and (b) the cross section of wages of 1,955 men who were working during January 1989 (the first month of the last year of communism). For the transition period, we use cross section observations on wages and job characteristics of the 1,639 men who worked in December 1996, as well as the job start information on 2,107 men during the 1991–96 period. The data hence permit us to estimate (a) cross-sectional earnings functions using data from ongoing jobs at one point in time near the end of communism (January 1989) and one point in time in mature transition (December 1996), and (b) earnings functions using a long (1955–96) period of job start data under both regimes. The former estimates may be compared to Krueger and Pischke's (1995), Chase's (1998) and Flanagan's (1998) cross-sectional estimates, while the latter ones provide a new longitudinal analysis during the communist and transition periods.

Münich et al. (1997) for a description of the survey and sample design as well as the descriptive statistics of the sample relative to the Labor Force Survey data.

13 In fact, this question yields data on jobs that began as early as the 1940s: 0.3 percent of all the job starts reported occurred before 1951, 2.6 percent occurred during the 1951–60 period, 5.5 percent during 1961–70, 9.2 percent during 1971–80, 18.9 percent during 1981–90, and 63.5 percent during 1991–96. We concluded that the very early data points went too far back in time to be reliable and that they might be confounded with the systemic changes that accompanied the communist takeover of 1948. As a result, we restricted our observations on job starts to those that occurred from 1955 onward since by 1955 the revolutionary period, nationalization and currency reform that followed the communist *coup d'état* of 1948 were over and the centrally planned system was fully in place.

Different types of data sets have, by the nature of their design, different strengths and weaknesses. A potential weakness of retrospective data is the possibility of recall error. In our case, the potential problem is that individuals may not accurately remember their past wages. We expect this error to be relatively small, however, since wages set in the communist grid were clearly defined and did not change much through time. Moreover, the wages that we use from the relatively distant past are starting wages on the very last job held under communism, which we expect to be more readily recalled than wages during an arbitrary past job. With respect to wages during the transition period (1991–1996), we expect them to be remembered fairly accurately since there were few job changes: the average individual only held 1.6 jobs during this period.

Since we use the self-reported wage as a dependent variable rather than as a regressor, we avoid the usual problem of "errors in variables" with respect to the right hand side variables. Nevertheless, we check the magnitude of the recall error by performing two tests. First, we estimate the rate of return to education by using different starting points in the past and find the estimates to be invariant to whether we start in the 1950s, 1960s, 1970s, or 1980s. Second, we compare our basic estimates of rates of return to education with: (1) Chase's (1998) estimates based on a 1984 and 1993 Czech household surveys, (2) Flanagan's (1998) estimates based on the 1988 Czech Microcensus and the 1996 Czech Survey of Economic Expectations and Attitudes, and (3) our estimates using a 1984 Czech firm-level survey. We find that these rates of return are similar to analogously calculated rates of return from our retrospective data.

Finally, there are two potential concerns related to the design of our retrospective data set. First, the sample is not fully representative of the communist era in that it is less likely to include individuals who were old men during the communist regime. In particular, we include in our sample those who were alive in 1996 and were not fully retired (i.e., worked at least two weeks) between 1991 and 1996. We hence exclude men who worked under communism and either fully retired before 1991 or died before 1996.[14] While this exclusion could be a problem if the individuals who retired/died had systematically different (e.g., lower) wages than others, there is no evidence that this was the case. Second, the communist era starting wage goes back further for individuals with long job tenure than for those with short job tenure. To the extent that these two types of individuals have systematically different unobserved characteristics that are correlated with some of the explanatory variables, the resulting time varying coefficients have a "duration bias." This concern is alleviated by our finding that parameter estimates are not affected in a material way by whether we make the starting point of the data be in the 1950s (when the sample is arguably the least representative of the population of

14 The retirement age for men was 60 years of age, although many retirees continued to work on a full- or part-time basis.

starting wages), 1960s, 1970s, or 1980s (when the sample is the most representative of starting wages for the labor force in the 1980s).

In appendix Table A.1, we present the 1989 and 1996 means and standard deviations of the variables that we use in estimating the cross-sectional earnings functions. In appendix Table A.2, we report the corresponding information for the job start data during communism and the transition. As may be seen from the tables, the variables display sensible values and considerable variation both cross-sectionally and over time. Since manufacturing was the key part of the communist economy, over one-half of the men have apprenticeship education.

3.2 Estimation Strategy

In order to obtain estimates of the wage structure and returns to human capital at the end of communism (1989) and during the transition (1996), we first estimate the following augmented human capital earnings function with our 1989 and 1996 cross-sectional data:

$$\ln W_i = \alpha_0 + \alpha_1 E_i + \alpha_2 X_i + \alpha_3 X_i^2 + \alpha_4 P_i + A_i'\beta + \varepsilon_i \ , \qquad (1)$$

where ln W_i, the natural logarithm of the monthly earnings of individual i, is taken to be a function of the individual's educational attainment (E_i), number of years of his potential labor market experience (X_i), a dummy variable for whether the individual worked in Prague (P_i), and a set of ten industry dummy variables for the industry location of the individual's job ($\boldsymbol{A}_i$).[15] The variables $\boldsymbol{A}$ and P control for industry wage effects, compensating differentials, and agglomeration effects of the central city. We have also estimated the traditional Mincer (1974) equation by omitting $\boldsymbol{A}$ and P from equation (1), but the coefficients on education and experience were virtually the same. In what follows we report estimates of equation (1).[16] We limit our analysis to workers with full-time jobs. In addition to examining all workers in 1989 and 1996, we estimate the regression separately for workers in three different ownership types: public administration and SOEs (henceforth "state"), privatized enterprises, and *de novo* firms.

An important stylized fact from the human capital literature is that the effect of education on wages often depends on how the education variable E is measured. Unlike Krueger and Pischke (1995), Chase (1998) and Flanagan (1998), who have

15 The monthly nominal earnings are meant to be net of payroll and income taxes. This is the most common way that the Czechs recall their salary, since both of these taxes are taken out before they receive their pay. However, about 25 percent of the respondents preferred to report their gross rather than net earnings. As a result, we have included as a regressor a dummy variable to control for this discrepancy in reporting. In addition, net earnings in some cases include benefits provided by the state, through the employer, for raising children. We have therefore also included a dummy variable to control for the cases when the reported earnings include children benefits.

16 We have also tested for the effect of marital status in equation (1) and found it to be insignificant.

to impute E from the highest educational degree completed, we are able to use and test the relative merit of three different specifications of E: i) the actual self-reported number of years of education (net of grade repetition), ii) the highest level of attained schooling, and iii) a combination of i) and ii) above.[17]

The "number of years of education" specification yields an estimate of a constant marginal rate of return on an additional year of schooling and reflects the approach advocated by Layard and Psacharopoulos (1974). The "highest level of educational attainment" by type of degree obtained allows the rate of return to vary across types of completed education and reflects the criticism of the assumption of a constant rate of return to each year of education (Heckman, Layne-Farrar and Todd, 1996).[18] By including both of these variables, we are able to test between the competing specifications and see which one is better supported by the data in the communist and transitional contexts. Moreover, since we have data on actual years of schooling reported by the respondent,[19] rather than years imputed by the researchers from the reported school attainment, we can test the "sheepskin" hypothesis that "wages rise faster with extra years of education when the extra year also conveys a certificate" (Hungerford and Solon, 1987).[20]

As in most studies, our potential labor force experience variable X is calculated as the individual's age minus the sum of the individual's years of schooling and basic school enrollment age of six years.[21] In order to provide a good sense of the nature of the experience-earnings profile, we use two alternative specifications of experience: the traditional quadratic one and a spline function that fits the profile to three categories of years of experience.

Equation (1) enables us to compare cross-sectional estimates for late communism (1989) and mature transition (1996). For estimations covering the 1991–1996 period, we are able to include additional variables that capture important aspects of the transition and which are not relevant for the communist period. In particular, using our 1996 cross-section data, we estimate an equation that includes ownership

17 We would like to thank Orley Ashenfelter for suggesting the combined specification to us.

18 Our data permit us to estimate a specification with six categorical variables reflecting the highest degree attained: 1) junior high school (mandatory education of 9 years), 2) apprentices in 2 year programs, 3) apprentices in 3 year programs, 4) technical high school graduates and apprentices in 4 year programs who received the technical high school diploma, 5) academic high school graduates, and 6) university graduates and above.

19 The respondents were asked not to report any years of repeated grades.

20 The "sheepskin effect" refers to the fact that wages may not increase steadily with years of education within a given level of schooling but may jump up when a degree is received (see also Heckman et al., 1996). Using U.S. data, Hungerford and Solon (1987) find significant discrete jumps in the return to education upon receiving a degree.

21 The shortcoming of this variable is that it includes periods during which the individual may have been out of the labor market and acquired less labor force experience. This of course tends to be less of a problem in the case of men than women, who are likely to take long maternity leaves (Mincer and Polachek, 1974 and Mincer and Ofek, 1982).

dummy variables that capture whether the individual works in the state sector, privatized firm, or *de novo* firm. Finally, since we have data on wages at the start of jobs, we are also able to estimate continuous changes in the returns to human capital during the communist and transition periods. In order to capture these changes in a simple way, we extend equation (1) by estimating a time-varying-coefficient model by interacting the education (E) and experience (X and X^2) variables with an annual time trend τ, such that

$$\alpha_k = \alpha_k^t + \tau\, \alpha_k^\tau \quad for\ k = 1-3\,, \tag{2}$$

where subscripts k = 1-3 denote the coefficients on E, X, and X^2, respectively, and superscript t denotes the time invariant and superscript τ the time varying portion of the coefficient. We stratify the data by the pre- and post-January 1991 periods and estimate separate equations for the communist and transition periods, allowing intercepts to vary across the regressions.[22]

It has become customary in the literature on earnings functions to correct for coefficient bias that may be brought about by the self-selection of a segment of non-representative individuals (usually women) into the labor market. Since labor force participation rates of both women and men declined after the fall of communism, we have tested for the presence of a selectivity bias in our sample but found it not to affect the coefficients of interest.[23]

4. Empirical Findings on Returns to Education

We divide our discussion of the returns to education into four parts: In Section 4.1 we present the returns to a year of education; in Section 4.2 the returns to an educational level; in Section 4.3 the returns from a model that encompasses both years and levels to test for sheepskin effects; and in Section 4.4 the returns to the field of study within each level of schooling. All estimates control for heteroskedasticity using the White (1980) method.

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22 Since the dependent variable is in nominal terms, we include annual dummies to control for changes in prices in all the models with time-varying coefficients. We have also tested for the validity of a higher than linear time-varying-coefficient model but we have not found strong support for this higher order specification.

23 Paukert (1995) finds that between 1989 and 1994 labor force participation rates of men and women (over 15 years of age) fell between six and eight percentage points in the Czech Republic, Hungary, Poland and Slovakia, and that the absolute decline was about the same for men and women in each country. Our survey provides us with a number of variables that can be used to impose exclusion restrictions in that they are likely to affect the respondent's labor force participation decision but not his wage. In particular, we derived Heckman's (1979) λ by estimating a probit equation with the 1996 cross-section data, using as explanatory variables a marital status dummy, a dummy variable for the presence of children under 15 years of age in the household, the per capita household income minus the income of the respondent, a dummy variable for Prague, the district level vacancy rates (the number of vacancies per working age population), and the respondent's age, age^2, and education (in years). The estimation yields a positive and significant λ, but the estimated coefficients on education and experience remain unaffected by the correction procedure.

4.1 Returns to a Year of Education

In Table 2, we present our overall 1989 and 1996 cross-sectional estimates of the rates of return to a year of education based on equation (1).[24] For comparative purposes, we also report estimates from other studies in the Czech Republic and other selected countries. Our estimates suggest that in the last year of communism (1989), men's rate of return to a year of education was 2.7% and that it rose to 5.8% by 1996. The difference between the two coefficients is significant at 1% significance test level. Our findings are in line with the cross-sectional estimates of 2.4% for 1984 and 5.2% for 1993 obtained for the Czech Republic by Chase (1998), indicating that the return on education was low under the communist wage grid and that it rose substantially during the transition. Since both studies depict a lower starting level and a more pronounced increase in the return on education than the increase from 3.7% in 1988 to 4.5% in 1996 found by Flanagan (1998), we have gone back to Flanagan's data to re-estimate his equations and check for possible source of the discrepancy between his and our results. In replicating Flanagan's (1998) results we noticed two important facts. First, Flanagan's 1998 data set (*Microcensus* 1988) uses only data on heads of households. This may over-represent older and more able individuals, and hence account for the relatively higher rate of return on education reported by Flanagan for the communist period. Second, Flanagan's 1996 data set (the relatively small *Survey of Economic Expectations and Attitudes*) defines earnings as the sum of earned income and various social security benefits. Since the contribution of social security benefits to total income is more important for less educated workers, the construction of this dependent variable may explain the relatively low returns to education found in Flanagan's 1996 estimates.

The pattern of increased return on education is similar to that found by cross-sectional studies in other CEE countries, except for East Germany, in the early transition. As may be seen from Table 2, within a few years after the start of the transition, the rates of return on a year of education in CEE and Russia became similar to the rates in Western Europe, but not as high as the rates in the United States and Latin America.

Whereas this may be the first place where the rates of return to education for all of these transition countries are presented together, the stylized fact drawn from Table 2 is known. What is not yet known, however, is whether the rates of return to education vary with ownership. In the tables that follow, we report the rates of return by three important ownership categories: SOEs and public administration (State), privatized firms (Privatized) and private *de novo* firms (DeNovo). We are thus able to assess whether the new private entrepreneurs deviate from the communist era wage grid and reward human capital differently than their privatized and non-privatized SOE counterparts. This is an important question since post-

24 The complete set of our estimates of equation (1) using the 1989 and 1996 cross-sectional data is presented in appendix Table A.3.

Table 2: Estimated Returns to a Year of Education, Cross-sectional Data

Evidence for the Czech Republic and Other Countries

	Reference	Communism		Transition	
Country	**Years**	**Men**	**Men & Women**	**Men**	**Men & Women**
CEE					
Czech Republic (1)	1989, 1996	0.027		0.058	
Czech Republic (2)	1984, 1993	0.024		0.052	
Czech Republic (3)	1989, 1996	0.037		0.045	
East Germany (4)	1989, 1991		0.044		0.041
East Germany (5)	1988, 1991		0.077		0.062
Poland (6)	1987, 1992		0.050		0.070
Slovakia (2)	1984, 1993	0.028		0.049	
CIS					
Russia (7)	1991, 1994	0.031		0.067	
Latin America					
Argentina (8)	1989				0.103
Chile (8)	1989				0.120
Mexico (8)	1984				0.141
Venezuela (8)	1989				0.084
Europe					
West Germany (8)	1987				0.049
West Germany (5)	1988			0.075	0.077
Great Britain (8)	1984				0.068
Switzerland (8)	1987				0.079
United States (4)	1989			0.085	0.093

Note: Figures are reported coefficients from human capital (Mincer, 1976) earnings functions. All coefficients are statistically significant. CEE= Central and East Europe. CIS = Commonwealth of Independent States.

Sources:
(1) Authors' estimates, see Table A.3
(2) Chase, 1998
(3) Flanagan, 1998
(4) Bird et al., 1994
(5) Krueger and Pischke, 1995
(6) Rutkowski, 1997
(7) Brainerd, 1998
(8) Psacharopoulos, 1994

communist adjustments in the wage grid, reductions in government subsidies to the state sector, and the opening up of the economy to international competition induced important changes in the pay policies of the SOEs and privatized firms as well. Whether the returns to human capital are higher in the *de novo*, privatized or public sector firms depends on the relative magnitudes of these effects.

Table 3: Estimated Returns to a Year of Education

	Reference Years	Communism	Transition			
		All	All	State	Privatized	DeNovo
A: Cross-section data[a]	1989, 1996	0.0270*** (0.004)	0.0580*** (0.005)	0.0560*** (0.009)	0.0650*** (0.007)	0.0610*** (0.010)
B: Time-Varying Coefficients[b]	Annual change (1955-91; 91-96)	-0.0004 (0.001)	0.0093*** (0.002)	0.0098* (0.005)	0.0104*** (0.004)	0.0077*** (0.003)
	Base as of 1/1991	0.0170 (0.010)	0.0220*** (0.007)	0.0280** (0.012)	0.0270** (0.012)	0.0310** (0.012)

[a] Taken from Table A.3.
[b] Taken from Table A.6. Based on job-starts.
*, **, *** Statistically signigficant at the 10%, 5%, 1% level. Standard errors in parentheses.

In panels A and B of Table 3, we present estimated returns to a year of education using the cross-sectional and longitudinal data, respectively. In panel A, the 1996 cross-sectional estimates by ownership suggest that the privatized firms provide the highest rate of return to a year of education (6.5%), followed by the *de novo* firms (6.1%) and the state (5.6%).[25] However, these results – based on 384 observations for state enterprises, 504 for privatized firms and 604 for *de novo* firms – are not statistically different from one another, indicating no systematic difference in the education-based wage differentials across principal ownership forms.[26]

In panel B of Table 3, the time-varying-coefficients are presented as the 1991 base and the annual change. The coefficient on the annual change (interaction term) is miniscule and insignificant during the communist period, indicating that under the communist grid the rate of return to a year of schooling remained constant over time at a mere 1.7%. Moreover, a test of the difference between the point estimates from the longitudinal (1955–89) and cross-sectional (1989) data indicates that there was no statistically significant difference. In order to check if our estimates are sensitive to the starting date, we have also estimated the time-varying-coefficients model with observations going back to the 1960s, 1970s and 1980s, respectively. We find that all three estimated coefficients on the interaction terms are insignificant and the base coefficients on education are in the 0.15 to 0.21 range and within one standard error of each other. Our results hence suggest that wage differentials

25 The overall cross-sectional estimate for 1989 (2.7%) and 1996 (5.8%) are the same estimates presented in Table 3.

26 The lowest p value is 0.43 for the difference between State and privatized firms. Flanagan (1998) found the returns to a year of education in 1996 to be lowest in the new private firms (5.8%), highest in the privatized firms (7.2%) and intermediate (6.2%) in the state sector. However, since Flanagan does not report standard errors and relative tests of significance for these estimates, it is not possible to know if they are statistically different from one another or from our estimates as well. We note that in Flanagan's data the years of education are imputed and include both men and women which may account for the possible difference in his and our estimates. Finally, Flanagan's and our data also reveal lower payoffs to vocational education in the newly created private firms, but the difference in our data is not statistically significant. Again, Flanagan (1998) does not report formal tests for differences of coefficients and we hence cannot establish if the two studies yield similar or dissimilar results.

Table 4: Estimated Returns by Level of Educational Attainment, Cross-sectional Data[a]

	Communism (1989)	Transition (1996)			
	All	All	State	Privatized	DeNovo
A. Level of attainment					
- apprentices (2 years)	0.063 (0.051)	0.094 (0.057)	0.129 (0.121)	0.114* (0.065)	0.101 (0.137)
- apprentices (3 years)	0.077** (0.037)	0.112** (0.049)	0.097 (0.105)	0.156*** (0.058)	0.065 (0.115)
- vocational H.S. (4 years)	0.127*** (0.040)	0.294*** (0.050)	0.323*** (0.105)	0.327*** (0.058)	0.249** (0.118)
- academic H.S. (4 years)	0.135* (0.081)	0.351*** (0.107)	0.401*** (0.142)	0.266 (0.164)	0.342 (0.309)
- university	0.283*** (0.045)	0.544*** (0.059)	0.476*** (0.115)	0.673*** (0.072)	0.599*** (0.133)
B: Calculated annual returns within attainment level[b]					
- apprentices (2 years)	0.032	0.048	0.067	0.059	0.052
- apprentices (3 years)	0.026	0.038	0.033	0.053	0.022
- vocational H.S. (4 years)	0.032	0.076	0.084	0.085	0.064
- academic H.S. (4 years)	0.034	0.092	0.105	0.069	0.089
- university	0.044	0.076	0.040	0.127	0.102

[a] Taken fom Table A.4, education in levels.
[b] Using the estimated coefficients β on attainment in panel A and the years of education, annual returns are computed as exp(β)-1.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

based on education were low and stagnant under the decades of central planning, a finding that has not been documented before with micro data.

In contrast, our time-varying-coefficient estimates for 1991–96 show that the estimated rate of return to a year of education increased by almost 1% a year during the transition. While privatized firms recorded the fastest rate of annual increase (1.04%), followed by the state sector (0.98%) and *de novo* firms (0.77%), the differences across ownership categories are not statistically significant. This finding hence complements the cross-sectional estimates by showing that the rate of return rose steadily during the transition period and that on average firms with different ownership remained competitive in terms of education-based wage differentials.

4.2 Estimates Based on Attained Levels of Education

In panel A of Table 4, we report 1989 and 1996 cross-sectional estimates for several different levels of schooling, relative to the mandatory junior high school. (The full set of parameters is presented in Table A.4.) We use these estimates to calculate the annual returns to a year of education within each completed category of schooling (panel B).[27] The time-varying coefficients are presented in Table 5 and the full set of parameters is reported in Table A.7.

As may be seen from the first column of Table 4, at the end of the communist regime the earnings differentials between different types of schooling were small. For example, a university educated man earned just about 28% more than an otherwise identical man with a junior high school education. Similarly, men with a vocational high school degree earned 13% more than their counterparts with a junior high school education. Finally, the earnings of individuals with a two-year apprenticeship and junior high school were about the same.

By 1996 the returns to higher levels of education increased dramatically (column 2 of Table 4). University educated man earned 72% more (coefficient of .544) than his counterpart with junior high school education.[28] The difference between the 1989 and 1996 coefficients on university education is significantly different at the 0.01 confidence level. We also find that the difference between 1996 and 1989 in the returns to a vocational high school education is highly significant and that the percentage increase in this return is the largest among all the education levels. On the other hand, the return to an apprenticeship did not change significantly over time.

Examining the 1996 returns in Table 4 by firm ownership, one observes that privatized firms are the only ones valuing apprenticeship over junior high school education and that academic high school education is significantly valued only in the state sector. However, all firm types pay more to individuals with vocational or university degrees. The estimated coefficient on university education is highest in privatized firms (0.673), followed by *de novo* firms (0.599) and state enterprises and public administration (0.476). The difference between the university coefficients for privatized firms and state enterprises approaches statistical significance (p-value of 0.14), but in all other pair-wise comparisons across ownership categories, one cannot reject the hypothesis of equality of returns. Our estimates hence indicate that firms with different ownership display tendencies to remunerate different types of human capital differently but, as in the case of returns to a year of schooling, these differences are not statistically significant.

As may be seen from Panel B of Table 4, in late communism the calculated return to a year of education was almost the same in all levels of schooling, except possibly the university. Yet, by 1996 the return to a year of academic or vocational high

27 Each of the four schooling levels below university level represents a direct path from junior high school (the mandatory level of education). Hence, the annual return to a year of education within these levels of schooling relative to junior highs school (r^s) is calculated as the n^th^ root of the rate of return to the schooling level (R_s), where s represents the level of schooling and n represents the number of years of education in each level: $r_s = (R_s)^{1/n}$. However, the return to a year of university education represents a return above either academic or vocational high school, and hence it is calculated as $r_u = (R_u - \overline{R}_{hs})^{1/n}$, where the bar denotes the average value.

28 The return is calculated as [exp(coefficient)] – 1; in this case [exp(0.544)] – 1 = 72%.

Table 5: Estimated Returns by Level of Educational Attainment[a] (Time-Varying-Coefficients Model)

	Communism (1955–1989)	Transition (1991–1996)			
	All	All	State	Privatized	DeNovo
Apprentice (2 years)	0.057 (0.101)	-0.078 (0.106)	0.153 (0.167)	0.154 (0.156)	-0.066 (0.164)
Apprentice (2 years)·t	n.a. n.a.	0.079** (0.031)	0.024 (0.051)	0.061* (0.034)	0.062 (0.062)
Apprentice (3 years)	0.069 (0.075)	0.049 (0.069)	0.095 (0.112)	0.118 (0.103)	0.087 (0.078)
Apprentice (3 years)·t	0.000 (0.005)	0.053** (0.021)	0.065*** (0.022)	0.042* (0.022)	0.032** (0.015)
Vocational H.S. (4 years)	0.056 (0.082)	0.051 (0,074)	0.059 (0.124)	0.203* (0.117)	0.183** (0.091)
Vocational H.S.(4 years)·t	-0.001 (0.006)	0.077*** (0.022)	0.102*** (0.032)	0.047** (0.022)	0.032* (0.019)
Academic H.S.(4 years)	0.338* (0.178)	0.090 (0.113)	0.299 (0.186)	0.059 (0.240)	0.013 (0.186)
Academic H.S.(4 years)·t	0.010 (0.011)	0.033 (0.034)	0.037 (0.056)	0.104* (0.056)	0.032 (0.053)
University	0.179** (0.089)	0.268*** (0.082)	0.330** (0.133)	0.405*** (0.127)	0.316*** (0.112)
University·t	-0.005 (0.007)	0.100*** (0.025)	0.117*** (0.041)	0.076*** (0.026)	0.099*** (0.025)

[a] Taken from Table A.6.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

school education rose above the return to a year of apprenticeship, thus providing support for the hypothesis of uneven returns across educational categories. The estimates by ownership appear to amplify this finding.

When we estimate the time-varying-coefficient model on 1955–89 data, we find no change in the returns to educational attainment over time (Table 5). The small differences in returns among the various levels of education are also analogous to those based on the 1989 cross section data.[29] The 1991–96 estimates for all workers indicate that during the transition the rate of return on education rose significantly in all categories except for academic high school. The ownership-specific, time-varying estimates complement the cross-sectional estimates in Table 4 by showing that the increase in the rate of return on two-year apprenticeship has been driven by privatized firms. Moreover, while privatized and *de novo* firms provided a significant rate of return on vocational training already in 1991, the state sector registers faster growth in this return during the 1991–96 period, especially when

29 The 1955–90 results also indicate that men with academic high school and university degrees had higher starting wages than others and that the wages of high school and university graduates were not statistically different from each other (p-value of 0.96).

compared to *de novo* firms. Finally, the return for university education was also growing most rapidly among the state sector.

Overall, our findings from Tables 4 and 5 indicate that education-related wage differentials were small and stagnant under communism. Market forces have increased wages for those with vocational high school and university education, but the gains were nil for those with lower education. The results based on firm ownership indicate that university education appears to be valued by all firm types, but most by the privatized firm and least by the state enterprises.

4.3 Regressions with Years and Levels of Education

Screening theories of education suggest that diplomas serve as a signal of higher productivity and one should therefore expect diplomas to be rewarded in the labor market. Various studies using US data test for sheepskin effects by estimating the difference in wages of individuals with and without a diploma, conditional on years of schooling (see e.g., Hungerford and Solon, 1987, Card and Krueger, 1992 and Jaeger and Page, 1996.) Except for the Jaeger and Page (1996) study, however, the US estimates are based on data that do not have information on the highest degree attained by an individual and therefore have to impute the level attained from the "usual number of years" it takes to complete a given degree. In contrast, researchers of transition economies usually have only information on highest degree attained and must impute the number of years of schooling of an individual by using the usual number of years it takes to complete a degree. To the extent that individuals obtain a diploma with more or fewer years of study, estimates of sheepskin effects in the US and returns to a year of education in the transition countries are biased. We are fortunate to have information on both the individual's reported years of education (net of any repeated grades) and the highest degree attained. We can thus obtain unbiased estimates of the sheepskin effect and also test for the bias using imputed vs. actual years of schooling. We also show a new way of testing for the sheepskin effect by estimating returns to years of study that lead to a degree and those that do not.

In Table 6 we present the coefficients for a specification that includes years of education (net of grade repetition) and dummy variables for highest degree attained, estimated from the 1989 and 1996 cross sectional data and controlling for the variables listed in Equation 1. In both years, we find sheepskin effects for higher levels of education – vocational high school and university degrees in 1989 and these two degrees plus the academic high school diploma in 1996. We also find an overall effect associated with completing degrees in that we reject (at 1% in 1996 and 11% in 1989) the hypothesis that the coefficients on the five educational levels are jointly zero. The estimated coefficients on higher education also become greater over time but F tests on pair-wise differences of the coefficients between 1989 and 1996 do not find any of them to be statistically significant. Examining the sheepskin

Table 6: Sheepskin Effects

	Communism (1989)	Transition (1996)			
	All	All	State	Privatized	DeNovo
Years of Education	0.006 (0.007)	0.020** (0.009)	0.042*** (0.016)	0.002 (0.013)	0.000 (0.018)
Apprentices (1-2 years)	0.052 (0.054)	0.058 (0.061)	0.057 (0.119)	0.110 (0.071)	0.101 (0.142)
Apprentices (3-4 years)	0.060 (0.043)	0.056 (0.055)	0.001 (0.106)	0.150** (0.067)	0.066 (0.129)
Vocational H.S. (4 years)	0.100* (0.052)	0.209*** (0.062)	0.176 (0.113)	0.318*** (0.077)	0.250* (0.143)
Academic H.S. (4 years)	0.108 (0.088)	0.271** (0.112)	0.247* (0.137)	0.257 (0.170)	0.343 (0.316)
University	0.229*** (0.078)	0.367*** (0.093)	0.144 (0.155)	0.655*** (0.132)	0.601*** (0.199)

Note:
The regressions also include control dummies for child benefits, taxes and nine industries.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

effect by firm ownership during the transition, we find that the privatized and *de novo* firms place more importance on diplomas than the state sector and that the state sector is the only owner that values years of education.[30]

Since many other studies, including Krueger and Pischke (1995), Flanagan (1998) and Chase (1998), had to impute the information on years of education from data on attainment, we have taken advantage of the dual reporting in our data and re-estimated our regressions with the imputed years of education in order to assess the magnitude of the errors-in-variables bias of this indirect, but commonly used, measure. Normally, the imputed years of education would generate a downward bias that is associated with errors-in-variables. However, in our case the imputed years of education may generate an upward bias because the measure underestimates the number of years of schooling for people that study for additional years without obtaining a degree. Indeed, the coefficient on imputed years of schooling (the first row of Table 7) is higher than the coefficient on actual years attended (Table 3) for both communism (0.033 vs. 0.027) and transition (0.066 vs. 0.058). The associated standard errors are sufficiently large, however, not to permit us to reject the hypothesis that in both periods the coefficients on imputed and reported year of education are not statistically different from one another.[31] The downward and upward biases hence just about cancel one another out.

We also test for the sheepskin effect using data on years of education and attained degree. In particular, we test the hypothesis that years of education that lead to a

30 In fact, the coefficient difference between State and privatized firms and State and *de novo* firms is found to be statistically significant at 5% and 9%, respectively.

31 The P values for the F tests are 0.560 in 1989 and 0.558 for 1996.

Table 7: Estimated Returns for 'Imputed Years' and 'Additional Years' of Schooling[a]

	Communism (1989)		Transition (1996)	
Imputed Years of Education	0.033*** (0.004)	0.032*** (0.004)	0.066*** (0.006)	0.065*** (0.006)
An Additional Year of Schooling Above any Degree[a]	–	0.020** (0.008)	–	0.034*** (0.012)

Note:
[a] 'Imputed Years' denote the number of years of education imputed from the individual's highest level of educational attainment and the usual number of years it takes to attain that level/degree. 'Additional Years' denote the number of years above the highest level of attainment and which do not lead to a degree. All the regressions also include control dummies for child benefits, taxes and nine industries.

*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

degree have a higher payoff than those that do not result in a degree. To implement the test, we use our information on the total number of reported years of education and the highest degree obtained, together with the knowledge of the usual number of years needed to obtain a given degree. Using this information, we impute the number of years of education used for (a) obtaining the most advanced degree and (b) additional study not resulting in a degree. In Columns 2 and 4 of Table 7, we show the coefficients from a specification that enters these two measures as explanatory variables in the standard regression of Equation (1). In both 1989 and 1996 the coefficients on the additional years of study are significantly different from zero but smaller than the coefficients on the imputed years leading to a degree. The F tests indicate that the difference in the coefficients on imputed vs. additional year is significantly different from zero in 1996 but not in 1989.[32]

Overall, our results point to the presence of a sheepskin effect and the effect is more pronounced at higher educational levels and during the transition than under communism. They also caution that studies that impute years of education from educational attainment and do not control for the drop-out or repeater phenomena overestimate the rate of return on education.[33]

4.4 Returns to a Field of Study

Our data also permit us to estimate the returns to a field of study for a given level of education and assess whether there was a shift in these returns from the communist to the market system. As we show in Table A.5, there is no statistically significant change in the returns to the different fields of study from 1989 to 1996 for men who

32 The F(1,1934) = 1.36, P value = 0.243 for 1989; and F(1,1610) = 5.72, P value = 0.017 for 1996.

33 The actual coefficients reported from other studies in Table 2 are not necessarily higher than ours. As mentioned earlier, Flanagan's (1996) estimates come from data that, by construction of the earnings variable, produce a downward bias. The coefficients from the other studies refer to earlier years in the 1990s when the return on education was still low.

Table 8: Cross-sectional Estimates of Returns to a Year of Labor Market Experience[a]

	Communism (1989)	Transition (1996)			
	All	All	State	Privatized	DeNovo
Experience	0.021*** (0.003)	0.021*** (0.005)	0.015** (0.006)	0.022*** (0.007)	0.030*** (0.004)
Experience^2	-0.0004*** (0.0001)	-0.0004*** (0.0001)	-0.0003*** (0.0001)	-0.0004** (0.0002)	-0.0007*** (0.0001)

Note:
[a] Taken from Table A.3, years of education.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

only attained an apprentice education. For men whose highest level of education was vocational high school, most of the coefficients on the fields of study rose between 15 and 25 percentage points from 1989 to 1996. Men trained in business and trade services gained relatively more over this period, as did men in manufacturing and the electro-technical area. Those trained in law, teaching and "other social branches" saw no change in their returns. For the university educated men all the coefficients basically doubled in size between 1989 and 1996. The high outlier is law where returns rose by a factor of almost three. On the low end, the returns of those trained in health, teaching and "other social branches," financed from the state budget, did not change over time. Our data hence reveal important shifts in the returns to fields of study. As expected, education in business and trade services has become more highly rewarded. Similarly, the higher rate of return for university educated lawyers is consistent with the increase in demand for legal services during the process of privatization and increased reliance on legal institutions.

5. Returns to Experience

We explore the returns to experience in the two regimes with our cross-section and longitudinal data and with the information provided by the wage grids. In Table 8, we present the coefficients and standard errors of the experience and experience squared terms estimated with the 1989 and 1996 cross-sectional data.[34] Focusing on the first two columns for "all workers," we find the coefficients are statistically significant, and within the standard range. We test the differences in these coefficients from 1989 to 1996 and find that the experience-earnings profile did not change from communism to the transition, peaking around 26 years in both years.

34 These results are based on the regression where education is measured as "actual years of schooling" (Table A.3). We also estimated experience coefficients in a regression with education measured as "level of attainment" (Table A.4) and found that there was no statistically significant difference in the experience-earnings profiles estimated with years vs. attainment. The F test statistics are $F(2, 3547) = 0.07$ for the 1989 vs. 1996 comparison based on the specification with years of education and $F(2, 3539) = 0.28$ for the 1989 vs. 1996 comparison based on the specification with levels of education. To save space, we only report one set of experience coefficients.

On the other hand, our estimates by ownership categories (columns 3–5 of Table 8) show marked differences in experience-based wage setting across the three types of ownership. The wage experience profile is flattest in the state sector, more concave in privatized firms and most concave in the *de novo* firms. The coefficients on the experience terms for the *de novo* firms are statistically different from those for the state and close to being statistically different from those of privatized firms in both specifications. Men's wage-experience profiles begin steeper in *de novo* firms than in the state sector, but they are also more concave and have an earlier turning point. *De novo* firms hence pay higher returns on a year of experience to employees with low experience (recent entrants into the labor market) and lower returns to men near retirement age.[35]

The similarity of the estimated wage-experience profile under communism, in the transition and in market economies has led us to collect data on wage grids in a number of periods of the communist regime, as well as transition, and analyze them more systematically. The search was surprisingly laborious, but we were able to obtain various wage grids, from 1954 to 1998. The wage-experience profiles given by these grids are presented for 1954, 1979, 1985–1989, and 1998 in Figure 1 (a)–(d) as the "grid based profiles." We note that we could not find grids pertaining to the same reference group over time, and the grids hence should not be compared longitudinally. For example, the 1954 grid is for agricultural workers, the 1979 grid is for workers in forestry, the 1985–89 grid is for white collar workers and the 1998 grid is for all workers in SOEs, public administration and privatized SOEs. As we noted in Section 1, the method for structuring the grid also changed over time; for example, in the earlier years it had an industrial component and in some years it did not. Nevertheless, the grids permit us to discern that in all years the wage-experience profiles are piece-wise linearly concave and have a flat region in the latter part of the profile. Hence, while ideology led the planners to impose narrow education-related wage differentials and cap the experience-earnings profile, they built into the grid enough wage progression in the early years of experience to generate a Mincerian-type concave profile.

Given the nature of all the grids, we fit the quadratic Mincerian earnings-experience function to the data of the five grids dating from 1954 to 1998. These coefficients

35 In order to check the robustness of these findings, we have also re-estimated the three ownership-specific equations with all coefficients, except those on education, experience and experience squared, being constrained to be equal. The resulting estimates are very similar to those reported in Table 8. We have also estimated spline experience-earnings profiles, where the splines capture three ten-year experience intervals from the start of one's career. Although the spline functions generate similar results to the coefficients on the quadratic experience profiles, in that they are similar in 1989 and 1996 for all workers, they highlight a greater decline in the returns to workers with more than 30 years experience in 1996 than in 1989; it is clear that it is the *de novo* firms that are driving this steeper slope for the 30+ segment. As we noted in the paragraph above, this corresponds to the greater concavity of the wage-experience profile in the *de novo* firms. And as with the quadratic experience estimates described above, the spline profile (at least for men with 30 or fewer years of experience) in *de novo* firms is clearly above that of the privatized firms and state sector, which are very similar. Estimating spline functions at other than ten year intervals did not fundamentally change the results.

Table 9: Parameters from Fitting the Wage-Grid with a Quadratic Wage-Experience Function

	1954[a]	1973[b]	1979[c]	1982[d]	1985–1989[e]	1998[f]
	(Agricul.)	(Industry)	(Forestry)	(Manual Workers)	(White Collar)	(SOEs/Pub Admin.)
Experience	0.016	0.017	0.024	0.032	0.039	0.023
Experience^2	-0.0030	-0.0004	-0.0004	-0.0006	-0.0006	-0.0003

Sources:
[a] Ministry of Agriculture (1952)
[b] Ministry of Industry (1973)
[c] Ministry of Agriculture (1979)
[d] Ministry of Defense (1982)
[e] Ministry of Labor and Social Affairs (1985, 1986)
[f] Ministry of Labor and Social Affairs (1998)

are reported in Table 9 and also plotted in Figure 1(a)–(d). We see in Figure 1 that the quadratic function fits the wage grids fairly well and better in some years (e.g. 1998) than others (e.g., 1985). The goodness of fit is particularly high in the 1998 grid because of its fine gradation of earnings with seniority. The plots and the coefficients also show that the slope and concavity of the wage experience profile in agriculture was fairly flat whereas it was much steeper for all workers in 1998. We note that the coefficients in Table 9 for the 1998 wage grid are very similar to the coefficients from our data for all workers in 1996. It hence appears that the slope of the experience-earnings profile in the grid became steeper over time, but since the grids in the earlier years apply to different types of narrowly defined workers, we cannot formally draw this conclusion. Rather, we turn to our sample to test whether the experience-earnings profile changed over the communist period.

The time-varying estimates of the coefficients on experience (Table 10) permit us to provide the first assessment of the extent to which the concavity of the experience-earnings profiles changes over time within the communist and transition periods. Although the coefficients on experience interacted with time are all positive and those on experience squared interacted with time are all negative, suggesting that the profile is becoming steeper and more concave over time, only the coefficient on experience interacted with time for the communist period in specification based on education levels (panel B) is marginally statistically significant (at 10% test level). In this latter specification, an F test on the joint significance of experience interacted with time and experience squared interacted with time also indicates that at 5% significance test level one cannot reject the hypothesis that the slope of the profile was changing during the 1955–89 period. In contrast, joint F tests performed on the overall estimates in panel A for 1955–90 and panels A and B for 1991–96 suggest that the profile was not changing significantly over time. Moreover, tests of equality of experience-related coefficients between the 1955–90 and 1991–96 periods indicate that one cannot reject the hypothesis of equality of the evolution

Table 10: Time-Varying Estimates of Returns to a Year of Labor Market Experience

	Communism (1955–1989)	Transition (1991–1996)			
	All	All	SOE	Privatized	De Novo
A. Education in years[a]					
Experience	0.0236*** (0.005)	0.0285*** (0.005)	0.0349*** (0.007)	0.0256*** (0.009)	0.0283*** (0.006)
Experience·t	0.0007 (0.0005)	0.0017 (0.0014)	0.0018 (0.003)	0.0012 (0.003)	0.0012 (0.002)
Experience^2	-0.0005*** (0.0002)	-0.0006*** (0.0001)	-0.0008*** (0.0001)	-0.0006** (0.0002)	-0.0007*** (0.0001)
Experience^2·t	-0.000004 (0.00002)	-0.00004 (0.00004)	0.00003 (0.00006)	-0.00002 (0.00007)	0.00000 (0.00004)
B. Education Levels[b]					
Experience	0.0244*** (0.006)	0.0291*** (0.005)	0.0411*** (0.006)	0.0252*** (0.008)	0.0303*** (0.006)
Experience·t	0.0009* (0.0005)	0.0022 (0.0015)	0.0026 (0.003)	0.0033 (0.003)	0.0016 (0.002)
Experience^2	-0.0005*** (0.0002)	-0.0006*** (0.0001)	-0.0009*** (0.0001)	-0.0006*** (0.0002)	-0.0007*** (0.0001)
Experience^2·t	-0.00001 (0.00002)	-0.00005 (0.00004)	0.00006 (0.00006)	-0.00006 (0.00007)	-0.00002 (0.00005)

[a] Taken from Table A.6.
[b] Taken from Table A.7.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

of the experience profile during the two periods.[36] We hence conclude that the experience-earnings profile for all workers under communism approximated the Mincerian human capital earnings function; there is weak evidence that the profile was altered during communism but its evolution was not altered during the first six years of the transition.

The time-varying estimates based on firm ownership (columns 3–5 of Table 10) confirm that during 1991–96 the wage-experience profile is concave in all three types of ownership categories and that it does not change significantly over time. However, unlike in Table 8 (using cross-section data), the ownership-specific estimates in Table 10 suggest that the return to experience is highest in the state, followed by the *de novo* and privatized firms. The difference between the cross-sectional and the longitudinal estimates based on starting wages is brought about almost entirely by a change in the coefficients of the state sector. Unlike in *de novo* and privatized firms, new jobs in the state sector have a steeper and more concave profile than existing (cross-sectional) state jobs. The profile of the new state jobs

36 The relevant F statistic is $F(4, 3266) = 0.29$ for the model based on years of education and 0.28 for the model based on levels of educational attainment.

also peaks earlier (23 years) than that of existing jobs (26 years). We provide one insight into this phenomenon presently, but the asymmetry in compensating new versus existing workers in the state sector during the transition should be explored in more detail in future research.

An intriguing feature of our results is the finding that while state and privatized firms continue to rely on wage grids, the wage structures of these two sectors and of the *de novo* firms do not differ in a major way. This raises important questions of labor market dynamics during the transition, in particular whether *de novo* firms are replicating the structure of the wage grid or whether the wage grids follow the development of the private sector. In order to provide some insight on this issue, we have computed the average wage in ongoing jobs in 1989, starting wages in new jobs in the three sectors at the onset and at later points during the transition, and average wages in ongoing jobs in the three sectors in 1996. We find that at the start of the transition in the early 1990s, starting wages for new jobs in the state and privatized firms were virtually identical to the 1989 average wage in ongoing jobs. On the other hand, in the *de novo* firms the starting wage in the early 1990s (proxying also the average wage since this was a new sector) was about 40% higher. The starting wages in *de novo* firms did not grow much between 1992 and 1996, while they grew substantially in the state and privatized firms.[37] By the end of 1996, the average wages for the ongoing jobs in the three sectors were very similar, with the state and privatized firms trailing the *de novo* firms by only about 10%. Hence, *de novo* firms established themselves in the early transition labor market by paying considerably higher wages, but state and privatized firms gradually adjusted upwards the parameters of their wage grids so that by 1996 they almost caught up with wages in the *de novo* firms.[38] Our calculations in this area provide similar results as those obtained by Jurajda and Terrell (2002)

Our overall results for the transition period are similar to those of Flanagan (1998), but they differ from those of Chase (1998) and Krueger and Pischke (1995), who find a much flatter wage experience profile.[39] Our estimates by ownership categories and an examination of the wage grid over time provide a possible explanation of this discrepancy. As may be seen from Table 8, the wage experience profile is flatter in the state and privatized enterprises than in the *de novo* firms. Since Chase's (1998) and Krueger and Pischke's (1995) estimates relate to an earlier phase of the transition (1991 and 1993, respectively) when *de novo* firms were less prominent,

37 The SOE wages stopped growing after 1994, while wages in privatized firms started growing later and continued until 1996.

38 In the present calculations, we do not address the issue of heterogeneity in worker characteristics across the three sectors.

39 Chase's (1998) coefficients on experience and experience squared are 0.014 and -0.0003, respectively. The corresponding coefficients for Krueger and Pischke (1995) are 0.014 and -0.0002.

the difference in the estimated wage experience profiles is likely to come from the different composition of firm ownership in these studies.[40]

6. Returns to Communist Human Capital in the Transition

Earlier studies have hypothesized that human capital acquired under communism is less appropriate for a market economy and it should hence receive a lower rate of return during the transition period than post-communist human capital. Some labor economists and education specialists have also noted that apprenticeship/vocational education in the communist economies went well beyond what is observed in western market economies and expressed doubt about the value of that particular type of education in post-communist labor markets. To test these hypotheses, we have identified for each man three measures of human capital: the number of years of education, the type of education and the number of years of experience obtained under communism vs. transition. We then test for differences in the returns to pre- and post-communist human capital during the transition period.

Since 14 percent of the men in our 1996 sample concluded their education during the 1990–1996 period, we have a sufficiently large sample to test three specifications. We begin by entering for each man as separate regressors his number of years of communist (old) education and his number of years of post-communist (new) education. The estimated coefficients are 0.058 and 0.031 for old and new, respectively, and at the 5% test level they are significantly different from zero and from each other.[41] The finding that years of post-communist education have a lower return than years of education obtained under communism strongly contradicts the first of the two hypotheses. We have checked whether the result is arising because a large proportion of school leavers in 1990–96 have lower levels of education (junior high school and apprentices) that we know command relatively low returns during transition, but we find that this is not the case. In a related test, we have estimated a model that allows the coefficient on years of education to be different for younger (less than 30 years) and older men, proxying for two vintages of human capital that correlate with the communist and transition periods. The resulting estimates do not allow us to reject the hypothesis that the education of the younger and older men generates the same rate of return, thus again contradicting the first of the above two hypotheses.[42] We have next tested for differences in returns to different levels of education (apprenticeships, vocational, academic high school

40 The various data sets may also have different age compositions of workers. In particular, depending on the number of individuals that a sample contains from different age categories, one's estimates may reflect the concave or flatter parts of the wage-experience profile.

41 The coefficient for "communist education" was 0.058 (S.E.=0.005) and the coefficient for "post-communist education" was 0.031 (S.E.= 0.013). $F(1,1610) = 4.65$, with $\text{Prob} > F = 0.03$.

42 The coefficients on the education coefficient for individuals less than 30 and for those greater than or equal to 30 are 0.063 and 0.059, respectively, in 1996. The F test indicates that the hypothesis of zero difference cannot be rejected.

and university) obtained during vs. after communism. We estimated our 1996 cross-sectional regression using as education regressors both levels of education and levels of education interacted with a dummy variable coded 1.0 for those who graduated after 1991. We find that while communist (pre-1992) education at all levels has positive returns, the interaction terms on post-communist education have statistically significant negative coefficients for apprenticeships as well as vocational high school education (the interaction terms on post communist academic high school and university have insignificant effects). F tests on whether for each level of education the sum of the communist (base) and post-communist (interaction) coefficients exceeds zero is rejected for apprenticeships but not other categories. These tests hence provide support for the second of the two aforementioned hypotheses, namely that obtaining apprenticeship education during the transition does not add value relative to the base educational category of junior high school. They also indicate that the lower return to years of post-communist relative to communist education that we found above is driven by the lower returns to post-communist apprenticeship and vocational high school education. Overall, our results contradict the hypothesis that education acquired under communism is less appropriate for a market economy than education obtained in transition. Rather, the findings are consistent with three other hypotheses: (i) education obtained under communism is (at least) as appropriate for a market economy as education obtained in transition, (ii) newly minted apprentices and vocational high school graduates command lower returns in the transition labor market than those who received this type of education earlier and (iii) market oriented (productivity and earnings enhancing) reforms of the educational system have proceeded slowly during the transition.[43]

We have also tested the hypothesis that experience obtained after 1989 generates higher rates of return in the transitional than experience accumulated under communism. This is a conjecture made by policy makers and several authors, including Krueger and Pischke (1995) and Flanagan (1998). However, the cross-sectional data used in previous studies did not permit a direct test of this hypothesis because they do not have sufficient variation in the values of the post-communist experience variable. We can carry out the test on the 1991-96 job start data and we find that individually and jointly the coefficients on the pre- and post-communist experience and experience squared are not different from one another.[44] Our direct test hence suggests that the communist and transition experience command the same rate of return during the transition.

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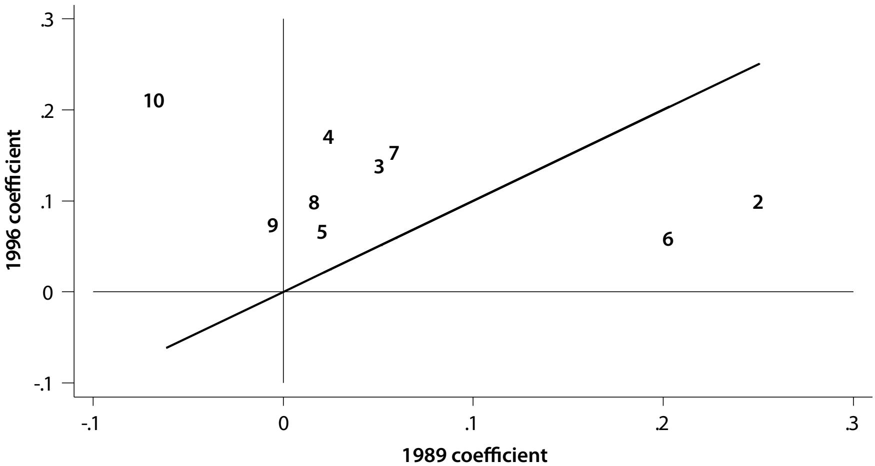
43 The educational system went through a fundamental reform of financing and governance (see Filer and Münich, 2000) and apprenticeship education in particular was in a state of chaos during the first phase of the transition. Under communism, apprenticeship centers were closely affiliated with specific SOEs that ensured the quality of the program and recruited the graduates. This symbiotic relationship disappeared during the privatization process and the apprenticeship centers were transferred first to industrial ministries and later to the Ministry of Education.

44 The F test value on the joint significance is $F(2, 2078) = 1.22$.

Figure 2: Scatter-plot of Estimated Coefficients on Industry-Specific Dummy Variables (1989 vs. 1996)



Legend
1 Agriculture=base (excluded)
2 Mining, Quarrying, Energy Production and Distribution
3 Construction
4 Wholesale, Retail, and Private Services
5 Public Administration, Education, Health, and Army
6 Finance, Insurance, Real Estate
7 Transportation and Telecommunication
8 Manufacturing-machinery
9 Manufacturing-Other
10 Other

7. Shifts in Industry Wage Premiums between 1989 and 1996

Students of the effects of communism on the labor markets have pointed out, that the introduction of central planning altered significantly the wage structure from what it had been under the market system (e.g., Adam, 1984). In order to assess the extent to which the industry wage structure changed with the shift from central planning to the transition, we analyze industry intercepts from the 1989 and 1996 regressions in which we control for years of education and experience. These intercepts are industry wage differentials relative to agriculture, holding constant the composition of workers' human capital characteristics.[45] Analogous to the approach adopted by Krueger and Summers (1987), we plot the industry intercepts (coefficients) for 1989 against those for 1996.[46] As seen in Figure 2, major changes have taken place in the structure of inter-sectoral wage premiums. Rather than fitting along the positively sloped 45 degree line, the coefficients fit more closely to a downward sloping line.[47] Between 1989 and 1996, relative wages in finance and mining and quarrying have decreased, while those in trade, transport and

45 These coefficients are reported in full in Table A.3.

46 The reported pattern is very similar to the one obtained when one does not control for workers' human capital characteristics.

47 The nine-point scatter in fact generates a negative correlation coefficient of -0.41.

Table 11: Changes in Industry Wage Structure from 1989 to 1996[a]

	Communism (1989)	Transition (1996)				
	All	All	Difference[b]	State	Privatized	DeNovo
Mining & Quarrying	0.251*** (0.039)	0.092** (0.044)	-0.159*** (0.007)	0.245** (0.099)	0.063 (0.058)	-0.079 (0.159)
Construction	0.051 (0.035)	0.131*** (0.040)	0.080 (0.134)	0.110 (0.120)	0.082 (0.058)	0.119 (0.091)
Wholesale and Retail Trade	0.025 (0.037)	0.163*** (0.041)	0.139** (0.012)	-0.134 (0.138)	0.060 (0.062)	0.147* (0.087)
Public Admin., Education & Health	0.021 (0.035)	0.059 (0.115)	0.038** (0.389)	0.080 (0.090)	-0.190 (0.219)	0.0850 (0.090)
Finance, Insur. & Real Estate	0.203 (0.139)	0.052 (0.080)	-0.152 (0.345)	0.140 (0.171)	0.054 (0.116)	-0.017 (0.170)
Transport & Telecommunications	0.059 (0.036)	0.146*** (0.040)	0.087* (0.100)	0.096 (0.095)	0.122* (0.062)	0.275*** (0.095)
Manufacturing-Food, Textile	0.017 (0.028)	0.092*** (0.033)	0.075* (0.088)	0.045 (0.104)	0.063 (0.040)	0.118 (0.086)
Manufacturing-Machinery	-0.005 (0.030)	0.066* (0.037)	0.071 (0.134)	0.152 (0.120)	0.036 (0.045)	0.111 (0.093)
Not known	-0.062 (0.079)	0.200*** (0.038)	0.262*** (0.001)	-0.133 (0.137)	-0.021 (0.226)	0.520** (0.170)

Notes: Base = Agriculture.
[a] Source: Table A.3, education in years.
[b] Difference in 1989 and 1996 coefficients. P values from Chi Square test on differences in coefficients are in italics.
*, **, *** Statistically significant at the 10%, 5%, 1% level. Standard errors in parentheses.

telecommunications, light manufacturing, and "other" activities gained. The long-term stability of the inter-industry wage differentials in these countries, documented in the earlier literature, has therefore been disrupted by the transition.

In order to verify the scatter diagram analysis in Figure 2, we report in Table 11 the industry intercepts and tests for the significance of their 1989 vs.1996 differences. An examination of the intercept coefficients indicates that while only miners enjoyed a significant positive wage premium relative to those in agriculture under communism in 1989, by 1996 seven of the nine sectors paid a premium. In analyzing pair-wise 1989-96 differences in the intercepts, we find that five are statistically significant. Men working in mining and quarrying indeed lost much of their former wage premium, with the decline occurring primarily in the privatized and *de novo* firms. Those in trade, transport and telecommunications, light manufacturing, and "other" activities gained significantly, with most of the gain brought about by higher wage premiums in the *de novo* firms and in the case of transport and telecoms also the privatized firm. However, the seemingly large decline in finance, insurance and real estate's wage differentials turns out not to be statistically significant. The interesting question is why we do not find a growing difference in intercepts in this expanding sector that has been hiring employees at very high wages? Our analysis indicates that the high wages of the employees in the finance sector reflect their relatively high levels of human capital and their concentrated location in the high premium city of Prague. Finally, a more detailed analysis of the differentials in Table 11 indicates that agriculture, the base sector whose share in total output and employment shrank dramatically, lost also in terms of its wage differential relative to the rest of the economy. Overall, our findings suggest that the transition process is restoring some of the industry wage differentials that were attenuated or eliminated by central planning.

8. Analysis of Unobserved Effects

Unlike other studies, we observe the same individuals before and after the regime change and can provide a superior analysis of the variation of wages of individual workers over time. In particular, since managers had discretion in awarding wage premiums under the communist wage grid, it is of interest to assess if individuals who had high or low wage premiums (residuals) related to unobservable characteristics such as skills during communism also enjoyed these premiums during the first six years of the transition. Using our regression estimates, we decompose the variance of worker-specific wages into the components due to observable determinants and those due to unobservable determinants in the old vs. the new regime. This gives us an interesting insight into the persistence of unobserved components of worker's wages during the regime change.

8.1 The Model

Let observed logarithms of wages of individual i under communism (t = 1) and during the transition (t = 2) be given by

$$\begin{aligned} w_{1i} &= x_{1i}\beta_1 + \varepsilon_{1i} \\ w_{2i} &= x_{2i}\beta_2 + \varepsilon_{2i}, \end{aligned} \tag{3}$$

where x_{1i} and x_{2i} are vectors of observed characteristics in each regime, β's are vectors of corresponding coefficients and ε's reflect unobserved determinants of wages. The unobserved individual component of a person's wage in the first period, ε_1, may have an effect on the unobserved component in the second period, so that

$$\varepsilon_{2i} = \theta\varepsilon_{1i} + \upsilon_{2i}. \tag{4}$$

The parameter θ captures the persistence of the unobserved individual-specific wage component across regimes, while υ_2 captures the unobserved component of the wage that is introduced by the transition and is orthogonal to ε_{1i}. Hence

$$x_{1i} \perp \varepsilon_{1i}, x_{2i} \perp \varepsilon_{2i} \quad \text{and} \quad \varepsilon_{1i} \perp v_{2i}. \tag{5}$$

Using equations (4) and (5), the relationship between variances in the unobserved wage can be expressed as

$$\begin{aligned} V(\varepsilon_{2i}) &= \theta^2 V(\varepsilon_{1i}) + V(\upsilon_{2i}) \\ COV(\varepsilon_{1i}, \varepsilon_{2i}) &= \theta V(\varepsilon_{1i}). \end{aligned} \tag{6}$$

Note that repeated cross-sectional data do not allow one to inspect the relationships in (6). Our panel data permit us to do so and also to analyze the variance of a worker-specific wage change, $V(w_{2i} - w_{1i})$. Substituting from (4) into (3) and taking into account (6) yields

$$\begin{aligned} V(w_{2i} - w_{1i}) &= V(x_{2i}\beta_2 + \upsilon_{2i} + \theta\varepsilon_{1i} - x_{1i}\beta_1 - \varepsilon_{1i}) = V[(x_{2i}\beta_2 - x_{1i}\beta_1) + \varepsilon_{1i}(\theta - 1) + \upsilon_{2i}] = \\ &= V(\Delta B) + (\theta - 1)^2 V(\varepsilon_{1i}) + V(\upsilon_{2i}) \end{aligned} \tag{7}$$

where $\Delta B \equiv x_{2i}\beta_2 - x_{1i}\beta_1$.

Equation (7) decomposes the variance of a worker-specific wage change into three mutually exclusive components: (i) the variance due to changes in observable worker/job characteristics and coefficients of these characteristics, (ii) the variance due to workers' unobserved characteristics determining the wage in the first period, and (iii) the variance due to unobserved determinants of the wage that are introduced by the transition and are orthogonal to unobserved determinants in the first period.

The first component in (7) reflects changes in individual and job characteristics and the corresponding payoffs. For example, a rise in returns to education contributes positively to $V(\Delta B)$, while the effect of changing labor market experience depends on where the individual is on the concave wage-experience profile. The value of the second component depends on the persistence of the unobserved individual-specific effect. In the case of full persistence, $\theta = 1$, the part played by unobserved characteristics in the unexplained variation of wages remains unchanged across the regimes and regime change does not affect unobserved wage component of a worker's wage (e.g., general ability is rewarded equally under planning through the wage premium and in the wage setting during the transition). With no persistence, $\theta = 0$, the unobserved component under communism does not translate into the unobserved component during the transition (e.g., entrepreneurial skills are rewarded only by the market and did not appear as an unobserved component in communist wages). One can also expect negative sorting, $\theta < 0$, where communist party membership is for instance rewarded by a wage premium during communism but is punished through negative wage discrimination during the transition. The value of the last term in (7) depends on the extent to which new unobserved components of wages, orthogonal to the unobserved wage component during communism, are introduced during the transition.

Applying the decomposition in (6) and (7) to our panel data, we are able to assess the extent to which wage changes experienced by individual workers stem from their observable characteristics versus unobservable time-invariant and regime-specific effects.

8.2 The Estimating Framework

From the estimated coefficients $\hat{\beta}_1$ and $\hat{\beta}_2$, we calculate the residuals for each individual i as

$$\begin{aligned} \hat{\varepsilon}_{1i} &= w_{1i} - x_{1i}\hat{\beta}_1 \\ \hat{\varepsilon}_{2i} &= w_{2i} - x_{2i}\hat{\beta}_2. \end{aligned} \tag{8}$$

The variances in (6) can be consistently estimated as

$$\hat{V}(\varepsilon_{ti}) = V(\hat{\varepsilon}_{ti}) = {}^{1}\!/_{N}\sum_{i=1}^{N}\hat{\varepsilon}_{ti}^{2}, \text{ for } t=1,2 \text{ and } i=1,..,N\ , \tag{9}$$

where N is the number of individuals. The parameter θ can be obtained as an OLS coefficient in (4) or identically as

$$\hat{\theta} = COV(\hat{\varepsilon}_{1i},\hat{\varepsilon}_{2i}) / V(\hat{\varepsilon}_{1i}). \tag{10}$$

The remaining variance in (7) is obtained by substituting estimates from (9) and (10) into (6):

$$\hat{V}(\upsilon_{2i}) = \hat{V}(\varepsilon_{2i}) - \hat{\theta}^2\hat{V}(\varepsilon_{1i}). \tag{11}$$

The variances in (7) contribute to the overall variance in wages as follows:

$$\begin{aligned} V(w_{1i}) &= V(x_{1i}\beta_1) + V(\varepsilon_{1i}) \\ V(w_{2i}) &= V(x_{2i}\beta_2) + V(\varepsilon_{2i}) \end{aligned} \tag{12}$$

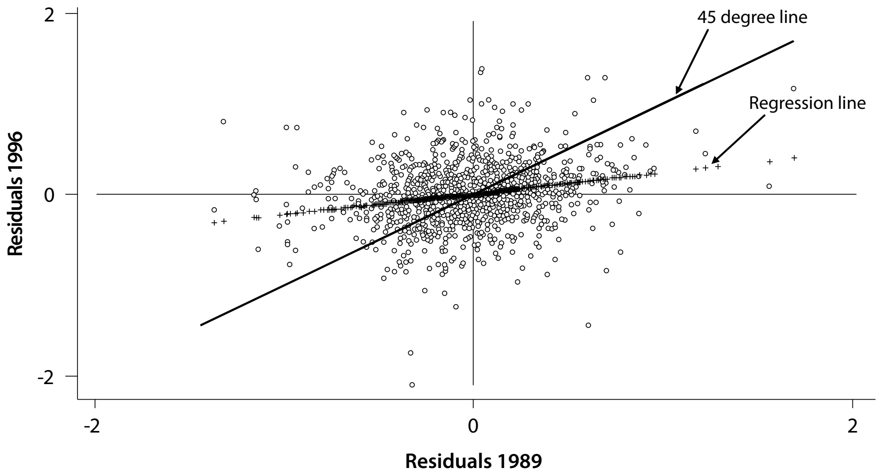
and the variance in the deterministic components in (12) can be estimated as

$$\begin{aligned} \hat{V}(x_{1i}\beta_1) &= V(x_{1i}\hat{\beta}_1) \\ \hat{V}(x_{2i}\beta_2) &= V(x_{2i}\hat{\beta}_2). \end{aligned} \tag{13}$$

Finally,

$$\hat{V}(\Delta B) = V(\Delta\hat{B}). \tag{14}$$

Figure 3: Scatter Plot of Residuals from Equation (8) Estimated with the 1989 vs. 1996 Data



8.3 Empirical Estimates

As may be seen from Figure 3, there is a positive relationship in the scatter plot of the 1989 and 1996 residuals. The point estimate of parameter θ, capturing this relationship in terms of equation (4), is 0.23 with a standard error of 0.027.

The estimates of the variance components of observed wages are presented in Table 12. The individual cells in the table correspond to the components in equations (6) and (7). Rows 1989 and 1996 refer to cross-sectional variances in these years, while the row titled "within" refers to the variance in worker-specific wage changes. Panel A presents actual variances, while panels B and C present variances as a percentage of the overall cross-sectional variance for each year and for 1989, respectively. As may be seen throughout Table 12, the variance in wages due to unobserved effects dominates the variance due to observable determinants. However, the variance due to observed determinants increases both absolutely (from 0.019 to 0.031) and in relative terms (from 13% to 20% of total variance) from communism in 1989 to the transition in 1996. The variation in wage changes experienced by individual workers is greater than the cross-sectional variance in both regimes (0.219 > 0.15 in panel A), implying that individual workers experience relatively substantial wage changes. Furthermore, panel B shows that 34% of the variance in wage changes experienced by individual workers is due to unobserved characteristics determining the wage already in 1989 (hence showing persistence over time), while 54% is due to new transition-specific unobserved determinants of wages that are orthogonal

Table 12: Variance in Wages and its Decomposition

	$V(w_i)$	$V(X_i\beta)$	$V(\varepsilon_i)$	$V(\upsilon_i)$
A: Variance of Wages (Vw_i)				
1989	0.144	0.019	0.126	–
1996	0.156	0.031	0.007	0.118
within	0.219	0.024	0.075	0.118
B: Variance in % of $V(w_i)$				
1989	100	13	88	–
1996	100	20	4	76
within	100	11	34	54
C: Variance in % of $V(w_i)$ in 1989				
1989	100	13	88	–
1996	108	22	5	82
within	152	17	52	82

to those in 1989. Finally, 11% is due to changes in observed characteristics and their associated coefficients.

The fact that our decomposition estimates are by definition based on the sample of workers who worked in both periods raises the issue of whether our results are biased by excluding workers who worked in only one period. We recognize the problem but think that this exclusion does not substantially change our results for two reasons. First, between 1989 and 1996, labor force participation of Czech men has been very high and the unemployment rate extremely low. Second, we have estimated the cross-sectional variances including all workers in each of the two years and found the results to be very similar to those presented in Table 12.

9. Conclusions

We estimate and test for changes in the returns to various kinds of human capital during the communist period and in transition to a market system. In sum, our study finds more changes in the returns to education than in the returns to experience. The transition brought about a major increase in the returns to a year of education and the magnitude of this increase is similar in private *de novo* firms, privatized state-owned enterprises (SOEs), and the state sector (SOEs and public administration). We find that those who have obtained (vocational) high school and university degrees experienced more rapid rates of increase in their returns than individuals with basic education (junior high school or apprentices). The sheepskin effect is prevalent and the effect is especially detectable in transition and for higher levels of education in both regimes. Certain fields of study have experienced tremendous increases in their return (e.g., law), while others have not gained in the new market economy (e.g., health and education). On the other hand, with respect to experience, our estimates indicate that men's wage-experience profile was concave in both regimes and did not change from the communist to the transition period. However, we find that the *de novo* firms have a more concave and steeper profile than the state sector, indicating that *de novo* firms pay a higher return to new entrants than the state. Our results contradict the hypothesis that education acquired under communism is less appropriate for a market economy than education obtained in transition and we in fact find that newly minted apprentices and vocational high school graduates command lower returns in the transition labor market than those who received this type of education earlier. Contrary to earlier conjectures, we also cannot reject the hypothesis that experience obtained under communism is rewarded identically to experience obtained during the transition.

Overall, our study provides two important insights into the functioning of the communist system and the transition economy. First, for decades the communist planners used the wage grid to maintain extremely low education-related wage differentials, but they also generated a significant amount of human capital that is as highly rewarded as post-communist human capital in the nascent market economy. The communist system was hence able to maintain an effective educational system while decoupling it from education-related pecuniary rewards. Moreover, a large part of unobservable, individual-specific wage effects (e.g., skill premiums) has carried over from communism to the market economy. Second, except for the greater concavity of the wage-experience profile in the *de novo* firms, firm ownership during the transition is found to be unrelated to wage differentials based on education and work experience. Hence, factors such as the reduction of state subsidies, opening up of the economy to the world and allowing competition in the labor market are sufficient to generate human capital-related wage differentials that on average do not vary with principal types of firm ownership in the economy. The data indicate that the *de novo* firms established themselves in the early transition by paying considerably higher wages, but state and privatized firms gradually adjusted upwards their wage grids so that by 1996 they almost caught up with wages in the *de novo* firms.

Appendix – Tables

Table A.1: Means and Standard Deviation of Variables in Cross-sectional Data

	1989		1996	
	mean	**st.dev.**	**mean**	**st.dev.**
Log of monthly wage	8.227	(0.394)	8.961	(0.404)
Experience (years)	18.2	(11.458)	20.4	(11.992)
Experience^2	463.3	(490.445)	559.8	(545.452)
Education in years	12.776	(2.519)	12.626	(2.347)
% of Population with Given Education:				
Junior High School (reference group)	0.057	(0.394)	0.047	(0.212)
Apprentices w/2 years	0.048	(0.213)	0.035	(0.184)
Apprentices w/3 years	0.484	(0.500)	0.503	(0.500)
Vocational H.S. w/4 years	0.258	(0.438)	0.274	(0.446)
Academic H.S. w/4 years	0.022	(0.147)	0.023	(0.149)
University	0.131	(0.338)	0.119	(0.323)
Field of highest level of education:				
Apprenticeship:				
Machine control	0.028	(0.164)	0.029	(0.168)
Manuf. Machinery and Metalurgy	0.199	(0.399)	0.200	(0.400)
Electrotechnics, transport, telecom	0.069	(0.254)	0.073	(0.260)
Chemistry, Food processing	0.016	(0.125)	0.018	(0.132)
Textile, Clothing	0.007	(0.084)	0.004	(0.061)
Wood, Shoes manufacturing	0.025	(0.157)	0.031	(0.173)
Construction	0.089	(0.284)	0.089	(0.284)
Agriculture, Forestry	0.040	(0.197)	0.042	(0.202)
Trade, Services	0.029	(0.168)	0.022	(0.145)
Other	0.030	(0.170)	0.031	(0.173)
Academic High School	0.022	(0.147)	0.023	(0.149)
Vocational High School :				
Natural sciences	0.004	(0.060)	0.002	(0.050)
Manufacturing-Machinery	0.091	(0.288)	0.094	(0.292)
Electrotechnics	0.046	(0.209)	0.058	(0.235)
Construction	0.019	(0.136)	0.017	(0.130)
Other technical branches	0.016	(0.127)	0.018	(0.135)
Agriculture	0.023	(0.149)	0.022	(0.147)
Health	0.003	(0.055)	0.006	(0.074)
Business, Trade, Services	0.028	(0.164)	0.027	(0.162)
Law	0.001	(0.032)	0.001	(0.035)
Teaching	0.002	(0.045)	0.002	(0.050)
Other social branches	0.005	(0.071)	0.004	(0.065)
Other	0.021	(0.142)	0.020	(0.141)
University:				
Natural sciences	0.010	(0.098)	0.007	(0.082)
Manufacturing-Machinery	0.023	(0.150)	0.024	(0.153)
Electrotechnics	0.009	(0.096)	0.009	(0.096)

Table A.1: Means and Standard Deviation of Variables in Cross-sectional Data *(continued)*

	1989		1996	
	mean	**st.dev.**	**mean**	**st.dev.**
Construction	0.013	(0.112)	0.012	(0.107)
Other technical branches	0.010	(0.101)	0.008	(0.089)
Agriculture	0.013	(0.115)	0.012	(0.107)
Health	0.008	(0.087)	0.008	(0.089)
Business, Trade, Services	0.012	(0.110)	0.009	(0.096)
Law	0.006	(0.078)	0.005	(0.070)
Teaching	0.016	(0.125)	0.015	(0.123)
Other social branches	0.005	(0.068)	0.004	(0.061)
Other	0.006	(0.078)	0.006	(0.078)
Other variables				
Prague	0.106	(0.307)	0.116	(0.320)
Child benefits included	0.197	(0.398)	0.110	(0.313)
Gross earnings reported	0.247	(0.431)	0.226	(0.418)
Industry:				
Mining & Quarrying	0.088	(0.283)	0.074	(0.261)
Construction	0.116	(0.320)	0.122	(0.327)
Wholesale, Retail,	0.099	(0.299)	0.138	(0.345)
Broad public	0.127	(0.333)	0.136	(0.343)
Finance, Insurance, Renting & Real Estate	0.005	(0.068)	0.015	(0.121)
Transport, Telecommunications	0.082	(0.274)	0.082	(0.274)
Manufacturing-Food, Textile,	0.241	(0.428)	0.252	(0.434)
Manufacturing-Machinery	0.118	(0.323)	0.112	(0.315)
Households + Exteritorial + Not known	0.010	(0.101)	0.009	(0.096)
Firm Size				
1-25 employees			0.258	(0.438)
26-100 employees			0.211	(0.408)
101-500 employees			0.238	(0.426)
>500 employees			0.256	(0.437)
Not known			0.037	(0.214)
Ownership				
Privatized			0.310	(0.445)
SOE & Public Administration			0.236	(0.341)
De Novo Private			0.371	(0.483)
Other & not known			0.083	(0.276)
Employment status				
Employee			0.900	
Employer			0.025	(0.157)
Self-employed			0.067	(0.250)
HH Helper + Not known			0.008	(0.089)
Log of district level enemployment rate			0.035	(0.021)
No. of Obs.	1951		1627	

Table A.2: Means and Standard Deviation of Variables for Start-Date Data

	Communism		Transition	
Log of earnings	8.049	(0.549)	8.509	(0.484)
Experience	7.009	(9.178)	13.442	(12.653)
Exper. x time	-640	(1184.843)	381	(534.646)
Experience ^{2}	135	(302.504)	341	(511.855)
Exper. ^{2} x time	-921	(2053.821)	786	(1598.660)
Years of education	12.843	(2.526)	12.428	(2.261)
Education x time	-151	(126.817)	32	(23.523)
Apprentice (2 years)	0.037	(0.190)	0.036	(0.185)
Apprentice (2) x time			0.088	(0.572)
Apprentice (3 years)	0.475	(0.500)	0.533	(0.499)
Apprentice (3) x time	-5.4	(8.482)	1.4	(1.836)
Vocational H.S.	0.268	(0.443)	0.243	(0.429)
Vocational H.S. x time	-3.3	(7.300)	0.6	(1.442)
Academic H.S.	0.022	(0.146)	0.036	(0.185)
Academic H.S. x time	-0.3	(2.501)	0.1	(0.671)
University	0.143	(0.350)	0.101	(0.302)
University x time	-1.4	(5.016)	0.2	(0.896)
Prague	0.111	(0.314)	0.121	(0.327)
Child ben. incl,	0.136	(0.343)	0.089	(0.284)
Gross earnings	0.258	(0.437)	0.226	(0.418)
Machine Control	0.093	(0.290)	0.049	(0.216)
Electro., trans., tele.m.	0.098	(0.298)	0.175	(0.380)
Chemistry, Food processing	0.096	(0.295)	0.187	(0.390)
Textile, Clothing	0.125	(0.331)	0.112	(0.315)
Wood, Shoes manufac.	0.007	(0.083)	0.012	(0.108)
Construction	0.075	(0.264)	0.062	(0.241)
Agriculture, Forestry	0.244	(0.429)	0.254	(0.435)
Trade, Services	0.134	(0.341)	0.080	(0.272)
Other	0.007	(0.083)	0.008	(0.089)
1-25 employees			0.336	(0.472)
26-100 employees			0.245	(0.430)
101-500 employees			0.209	(0.407)
>500 employees			0.172	(0.377)
Not known			0.038	(0.192)
Privatized			0.196	(0.397)
SOE & Public administration			0.229	(0.420)
De Novo Private			0.495	(0.500)
Other & not known			0.081	(0.272)
Employee			0.911	
Employer			0.018	(0.131)
Self-employed			0.061	(0.240)
HH helper + Not known			0.010	(0.102)
No. of Obs.	1285		2107	

Table A.3: Cross-sectional Earnings Functions, 1989 and 1996 (Education by years)

	Communism		Transition				
	All (1)	All (2)	All (1)	All (2)	State	Privatized	DeNovo
Education	0.026 (0.003)	0.027 (0.004)	0.058 (0.005)	0.058 (0.005)	0.056 (0.009)	0.065 (0.007)	0.061 (0.010)
Experience	0.022 (0.003)	0.021 (0.003)	0.020 (0.005)	0.021 (0.005)	0.015 (0.006)	0.022 (0.007)	0.030 (0.004)
Experience2	-0.0005 (0.0001)	-0.0004 (0.0001)	-0.0004 (0.0001)	-0.0004 (0.0001)	0.000 (0.000)	0.000 (0.000)	-0.001 (0.000)
Prague	–	0.015 (0.027)	–	0.120 (0.032)	0.151 (0.047)	0.088 -(0.064)	0.177 (0.057)
Child benefits included	–	0.061 (0.022)	–	0.064 (0.026)	0.051 -(0.042)	0.112 (0.052)	0.054 -(0.045)
Gross earinings	–	0.122 (0.020)	–	0.069 (0.022)	0.082 (0.041)	0.045 -(0.031)	0.091 (0.040)
Industry:							
Mining & Quarrying	–	0.251 (0.039)	–	0.092 (0.044)	0.245 (0.099)	0.063 (0.058)	-0.079 (0.159)
Construction	–	0.051 (0.035)	–	0.131 (0.040)	0.110 (0.120)	0.082 (0.058)	0.119 (0.091)
Wholesale and Retail Trade	–	0.025 (0.037)	–	0.163 (0.041)	-0.134 (0.138)	0.060 (0.062)	0.147 (0.087)
Public Admin., Education & Health	–	0.021 (0.035)	–	0.059 (0.115)	0.080 (0.090)	-0.190 (0.219)	0.085 (0.090)
Finance, Insur. & Real Estate	–	0.203 (0.139)	–	0.052 (0.080)	0.140 (0.171)	0.054 (0.116)	-0.017 (0.170)
Transport & Telecommunications	–	0.059 (0.036)	–	0.146 (0.040)	0.096 (0.095)	0.122 (0.062)	0.275 (0.095)
Manufacturing-Food, Textile,	–	0.017 (0.028)	–	0.092 (0.033)	0.045 (0.104)	0.063 (0.040)	0.118 (0.086)
Manufacturing-Machinery	–	-0.005 (0.030)	–	0.066 (0.037)	0.152 (0.120)	0.036 (0.045)	0.111 (0.093)
Not known	–	-0.062 (0.079)	–	0.200 (0.038)	-0.133 (0.137)	-0.021 (0.226)	0.520 (0.170)
Constant	7.704 (0.050)	7.620 (0.055)	8.060 (0.063)	7.916 (0.071)	7.919 (0.143)	7.812 (0.099)	7.845 (0.157)
adj.R^2	***0.069***	***0.118***	***0.162***	***0.190***	***0.256***	***0.23***	***0.23***
nobs	***1955***	***1951***	***1639***	***1627***	***384***	***504***	***604***

Base = people working outside Prague, whose earnings are net of tax and child benefits, and who work in agriculture.

Table A.4: Cross-sectional Earnings Functions, 1989 and 1996 (Education by levels)

	Communism		Transition				
	(1)	(2)	(1)	(2)	State	Privatized	DeNovo
Apprentice (2 years)	0.0701 (0.052)	0.0635 (0.051)	0.1128 (0.058)	0.0939 (0.057)	0.1290 (0.121)	0.1143 (0.065)	0.1009 (0.137)
Apprentice (3 years)	0.0923 (0.038)	0.0773 (0.037)	0.1434 (0.049)	0.1122 (0.049)	0.0968 (0.105)	0.1559 (0.058)	0.0652 (0.115)
Vocational H.S.	0.1374 (0.040)	0.1265 (0.040)	0.3228 (0.050)	0.2943 (0.050)	0.3232 (0.105)	0.3266 (0.058)	0.2492 (0.118)
Academic H.S.	0.1525 (0.080)	0.1346 (0.081)	0.3822 (0.102)	0.3508 (0.107)	0.4011 (0.142)	0.2656 (0.164)	0.3425 (0.309)
University	0.2793 (0.044)	0.2826 (0.045)	0.5515 (0.058)	0.5439 (0.059)	0.4758 (0.115)	0.6734 (0.072)	0.5993 (0.133)
Experience	0.022 (0.003)	0.021 (0.003)	0.024 (0.005)	0.024 (0.005)	0.021 (0.006)	0.027 (0.007)	0.033 (0.004)
Experience^2	-0.00047 (0.0001)	-0.00045 (0.0001)	-0.00050 (0.0001)	-0.00051 (0.0001)	-0.00041 (0.0001)	-0.00054 (0.0002)	-0.00076 (0.0001)
Prague	–	0.009 (0.027)	–	0.102 (0.032)	0.142 (0.047)	0.045 (0.061)	0.140 (0.055)
Child benefits included	–	0.065 (0.021)	–	0.076 (0.026)	0.056 (0.042)	0.122 (0.051)	0.076 (0.044)
Gross earnings	–	0.125 (0.020)	–	0.080 (0.021)	0.088 (0.041)	0.050 (0.031)	0.102 (0.038)
Sector:							
Mining & Quarrying	–	0.250 (0.039)	–	0.095 (0.043)	0.271 (0.089)	0.063 (0.058)	-0.045 (0.150)
Construction	–	0.053 (0.035)	–	0.145 (0.040)	0.150 (0.114)	0.096 (0.060)	0.144 (0.091)
Wholesale and Retail Trade	–	0.020 (0.036)	–	0.150 (0.040)	-0.067 (0.120)	0.028 (0.058)	0.136 (0.086)
Public Admin., Education & Health	–	0.012 (0.035)	–	0.034 (0.038)	0.095 (0.080)	-0.039 (0.210)	0.068 (0.102)
Finance, Insur. & Real Estate	–	0.210 (0.131)	–	0.024 (0.076)	0.091 (0.157)	0.046 (0.119)	-0.064 (0.185)
Transport & Telecommunications	–	0.057 (0.036)	–	0.149 (0.039)	0.115 (0.087)	0.144 (0.057)	0.305 (0.094)
Manufacturing-Food, Textile	–	0.018 (0.028)	–	0.092 (0.032)	0.077 (0.097)	0.063 (0.039)	0.135 (0.085)
Manufacturing-Machinery	–	-0.010 (0.030)	–	0.066 (0.036)	0.172 (0.116)	0.026 (0.044)	0.137 (0.091)
Not known	–	-0.064 (0.082)	–	0.180 (0.111)	-0.167 (0.094)	-0.016 (0.223)	0.525 (0.176)
Constant	7.910 (0.043)	7.847 (0.046)	8.516 (0.054)	8.404 (0.059)	8.331 (0.136)	8.324 (0.077)	8.401 (0.143)
R^2	***0.070***	***0.120***	***0.181***	***0.210***	***0.280***	***0.270***	***0.270***
nobs	***1955***	***1951***	***1639***	***1627***	***384***	***504***	***604***

Base= Jr. H.S. graduates working outside Prague in agriculture, whose earnings are net of tax and child benefits.

Table A.5: Cross-sectional Earnings Functions, 1989 and 1996 (Education by levels and field of study)

	1989	1996
Apprenticeship Fields of study:		
Machine control	0.123 (0.053)	0.084 (0.062)
Manuf. Machinery and Metalurgy	0.113 (0.040)	0.139 (0.051)
Electrotechnics, transport, telecom.	0.076 (0.045)	0.122 (0.056)
Chemistry, Food processing	0.122 (0.068)	0.031 (0.085)
Textile, Clothing	-0.056 (0.071)	-0.194 (0.133)
Wood, Shoes manufacturing	0.071 (0.056)	0.073 (0.061)
Construction	0.054 (0.046)	0.154 (0.060)
Agriculture, Forestry	-0.040 (0.053)	-0.007 (0.064)
Trade, Services	0.007 (0.067)	0.161 (0.071)
Other	0.093 (0.061)	0.163 (0.067)
Academic High School	0.138 (0.081)	0.352 (0.106)
Fields within vocational high school:		
Natural sciences	0.185 (0.127)	0.745 (0.303)
Manufacturing-Machinery	0.120 (0.045)	0.289 (0.052)
Electrotechnics	0.120 (0.052)	0.361 (0.058)
Construction	0.138 (0.077)	0.309 (0.079)
Other technical branches	0.238 (0.070)	0.265 (0.073)
Agriculture	0.011 (0.065)	0.163 (0.063)
Health	-0.011 (0.118)	0.084 (0.129)
Business, Trade, Services	0.099 (0.068)	0.280 (0.069)
Law	0.539 (0.348)	0.617 (0.119)
Teaching	0.215 (0.172)	0.223 (0.154)
Other social branches	0.198 (0.101)	0.240 (0.198)
Other	0.210 (0.071)	0.354 (0.082)
Fields within university education:		
Natural sciences	0.135 (0.106)	0.454 (0.157)
Manufacturing-Machinery	0.274 (0.074)	0.571 (0.082)

Table A.5: Cross-sectional Earnings Functions, 1989 and 1996 (Education by levels and field of study) *(continued)*

	1989	1996
Electrotechnics	0.300 (0.069)	0.746 (0.130)
Construction	0.275 (0.076)	0.569 (0.104)
Other technical branches	0.488 (0.079)	0.753 (0.136)
Agriculture	0.305 (0.077)	0.496 (0.080)
Health	0.315 (0.091)	0.246 (0.166)
Business, Trade, Services	0.350 (0.117)	0.643 (0.144)
Law	0.394 (0.112)	1.054 (0.138)
Teaching	0.266 (0.083)	0.314 (0.091)
Other social branches	0.129 (0.087)	0.139 (0.101)
Other	-0.007 (0.129)	0.548 (0.088)
Experience	0.021 (0.003)	0.025 (0.0049)
Experience^2	-(0.00044) (0.00006)	-(0.00052) (0.0001)
Prague	0.008 (0.028)	0.108 (0.031)
Child Benefits	0.063 (0.021)	0.081 (0.026)
Gross Earnings	0.130 (0.020)	0.085 (0.021)
Industry:		
Mining & Quarrying	0.214 (0.040)	0.046 (0.045)
Construction	0.027 (0.039)	0.086 (0.045)
Wholesale and Retail Trade	-0.005 (0.037)	0.098 (0.041)
Finance, Insur. & Real Estate	0.167 (0.132)	-0.014 (0.077)
Transport & Telecommunications	0.019 (0.037)	0.097 (0.042)
Manufacturing-Food, Textile,	-0.021 (0.029)	0.046 (0.034)
Manufacturing-Machinery	-0.051 (0.033)	0.013 (0.039)
Public Admin., Education & Health	-0.015 (0.038)	0.017 (0.041)
Not known	-0.089 (0.082)	0.135 (0.112)
Constant term	7.877 (0.046)	8.431 (0.060)
adj.R^2	***0.129***	***0.240***
nobs	***1951***	***1627***

Base= Jr. H.S. graduates working outside Prague in agriculture, whose earnings net of tax and child benefits.

Table A.6: Earnings Regressions with Time Varying Cofficients for Communism and Transition (Education in years)

	Communism	Transition			
		All	State	Privatized	DeNovo
Education	0.0166 (0.0099)	0.0219 (0.0072)	0.0276 (0.0118)	0.0273 (0.0121)	0.0308 (0.0123)
Education·t	-0.0003 (0.0007)	0.0093 (0.0020)	0.0098 (0.0050)	0.0104 (0.0039)	0.0077 (0.0030)
Experience	0.0236 (0.0053)	0.0285 (0.0053)	0.0349 (0.0066)	0.0256 (0.0086)	0.0283 (0.0060)
Experience·t	0.0007 (0.0005)	0.0017 (0.0014)	0.0018 (0.0030)	0.0012 (0.0026)	0.0012 (0.0018)
Experience^2	-0.0005 (0.0002)	-0.0006 (0.0001)	0.0008 (0.0001)	0.0006 (0.0002)	0.0007 (0.0001)
Experience^2·t	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0001)	0.0000 (0.0001)	0.0000 (0.0000)
Prague	-0.1257 (0.0460)	0.1506 (0.0279)	0.1911 (0.0561)	0.1111 (0.0651)	0.1856 (0.0369)
Child benefits included	0.2282 (0.0403)	0.1194 (0.0296)	0.1817 (0.0616)	0.0512 (0.0653)	0.1136 (0.0392)
Gross Earnings	0.1328 (0.0514)	0.0420 (0.0441)	0.0863 (0.0944)	0.1133 (0.0780)	0.0360 (0.0613)
Gross Earnings·t	0.0899 (0.1601)	0.0176 (0.0131)	0.0628 (0.0326)	0.0302 (0.0259)	0.0216 (0.0176)
Industry:					
Mining & Quarrying	0.2759 (0.0553)	0.0448 (0.0548)	0.1965 (0.1287)	0.0382 (0.0792)	0.2002 (0.1094)
Construction	0.1337 (0.0520)	0.1287 (0.0430)	-0.0241 (0.1255)	0.1627 (0.0707)	0.0249 (0.0578)
Wholesale and Retail Trade	-0.0540 (0.0589)	0.1186 (0.0447)	–	0.1844 (0.0945)	0.0110 (0.0593)
Public Admin., Education & Health	0.0937 (0.0513)	0.0650 (0.0470)	0.1244 (0.1310)	–	–
Finance, Insurance & Real Estate	0.1161 (0.2079)	0.0047 (0.0818)	0.1294 (0.1142)	0.0406 (0.1378)	0.0489 (0.0746)
Transport & Telecommunications	0.0963 (0.0632)	0.1010 (0.0551)	0.2232 (0.1959)	0.0060 (0.1032)	0.1819 (0.1379)
Manufacturing-Food, Textile	-0.0021 (0.0441)	0.0253 (0.0414)	0.1072 (0.1204)	0.1721 (0.1008)	0.0753 (0.0856)
Manufacturing-Machinery	-0.0162 (0.0494)	0.0855 (0.0482)	0.0018 (0.1171)	0.0086 (0.0634)	0.0079 (0.0569)
Not known	0.0639 (0.1303)	0.1963 (0.1032)	0.0351 (0.1379)	0.0778 (0.1119)	0.1842 (0.1578)
Constant	7.9297 (0.1289)	7.7520 (0.0944)	7.5578 (0.1799)	7.6788 (0.1553)	7.8586 (0.1707)
adj.R^2	***0.172***	***0.285***	***0.384***	***0.269***	***0.356***
nobs	***1285***	***2107***	***483***	***1045***	***579***

Base= individuals working outside Prague in agriculture, whose earnings are net of tax and child benefits.

Table A.7: Earnings Regressions with Time Varying Cofficients for Communism and Transition (Education in levels)

	Communism	Transition			
		All	State	Privatized	DeNovo
Apprentice (2 years)	0.0566 (0.1007)	0.0783 (0.1062)	0.1532 (0.1673)	0.1542 (0.1562)	-0.0658 (0.1635)
Apprentice (2 years)·t	n.a. n.a.	n.a n.a.	n.a n.a.	n.a. n.a.	n.a. n.a.
Apprentice (3 years)	0.0690 (0.0745)	0.0489 (0.0691)	0.0950 (0.1117)	0.1185 (0.1032)	0.0865 (0.0775)
Apprentice (3 years)·t	-0.0003 (0.0051)	0.0528 (0.0206)	0.0652 (0.0217)	0.0417 (0.0216)	0.0315 (0.0150)
Vocational H.S.	0.056 (0.082)	0.051 (0.074)	0.0591 (0.1243)	0.2034 (0.1169)	0.1827 (0.0911)
Vocational H.S.·t	-0.0014 (0.0059)	0.0768 (0.022)	0.1022 (0.0323)	0.0474 (0.0217)	0.0322 (0.0191)
Academic H.S.	0.3378 (0.1783)	0.0896 (0.1126)	0.2993 (0.1857)	0.0585 (0.2400)	0.0133 (0.1862)
Academic H.S.·t	0.0104 (0.0106)	0.0335 (0.0338)	0.0367 (0.0560)	0.1037 (0.0559)	0.0315 (0.0535)
University	0.1789 (0.0888)	0.2675 (0.0822)	0.3302 (0.1332)	0.4048 (0.1270)	0.3160 (0.1120)
University·t	-0.0047 (0.0066)	0.0996 (0.0245)	0.1168 (0.0409)	0.0762 (0.0263)	0.0987 (0.0253)
Experience	0.0244 (0.0054)	0.0291 (0.0053)	0.0411 (0.0063)	0.0252 (0.0077)	0.0303 (0.0057)
Experience·t	0.0009 (0.00048)	0.0002 (0.0001)	0.0026 (0.0027)	0.0033 (0.0025)	0.0016 (0.0018)
Experience^2	-0.0006 (0.0002)	-0.0006 (0.0001)	0.0009 (0.0001)	0.0006 (0.0002)	-0.0007 (0.0001)
Experience^2·t	-0.00001 (0.000020)	-0.000004 (0.000003)	0.0001 (0.0001)	0.0001 (0.0001)	0.0000 (0.0000)
Prague	-0.130 (0.046)	0.140 (0.028)	0.1629 (0.0575)	0.0794 (0.0736)	0.1667 (0.0364)
Child benefits included	0.228 (0.040)	0.122 (0.029)	0.2099 (0.0597)	0.0493 (0.0579)	0.1126 (0.0400)
Gross earnings	0.134 (0.051)	0.048 (0.044)	-0.0325 (0.0904)	0.0828 (0.0779)	0.0609 (0.0631)
Gross earnings·t	0.004 (0.004)	0.002 (0.001)	0.0441 (0.0305)	0.0085 (0.0264)	0.0185 (0.0180)
Mining & Quarrying	0.272 (0.055)	0.046 (0.055)	0.202 (0.129)	0.061 (0.078)	-0.206 (0.111)
Construction	0.132 (0.052)	0.130 (0.042)	-0.0001 (0.123)	0.200 (0.071)	-0.001 (0.059)
Wholesale and Retail Trade	-0.054 (0.059)	0.119 (0.044)	–	0.180 (0.097)	-0.014 (0.061)
Public Admin., Education & Health	0.083 (0.053)	0.055 (0.047)	0.129 (0.113)	–	–
Finance, Insur. & Real Estate	0.083 (0.053)	0.095 (0.055)	0.188 (0.167)	0.103 (0.095)	-0.252 (0.137)
Transport & Telecommunications	0.090 (0.063)	0.025 (0.041)	0.118 (0.123)	0.211 (0.098)	0.058 (0.087)
Manufacturing-Food, Textile	-0.002 (0.044)	0.025 (0.041)	0.009 (0.116)	0.026 (0.063)	-0.037 (0.059)
Manufacturing-Machinery	-0.017 (0.049)	0.087 (0.048)	0.128 (0.130)	0.114 (0.071)	0.026 (0.072)
Not known	0.068 (0.131)	0.182 (0.099)	0.030 (0.148)	0.091 (0.130)	0.136 (0.149)
Constant	8.063 (0.084)	7.959 (0.078)	7.719 (0.151)	7.864 (0.138)	(8.148) (0.078)
adj.R^2	***0.172***	***0.296***	***0.344***	***0.339***	***0.27***
nobs	***1285***	***2107***	***483***	***413***	***1045***

Base = Jr. H.S. graduates working outside Prague in agriculture, whose earnings net of tax and child benefits.

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6 | Changing Composition of Human Capital: The Czech Republic, Hungary, and Poland

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1. Introduction

Human capital is not homogeneous: an engineer and an entrepreneur may have the same *level* of human capital but not the same *type*. Suppose that in an economy there are many workers with engineering skills but few with entrepreneurial skills, yet the economy demands many entrepreneurs and few engineers. This situation roughly describes the economies of the Czech Republic, Poland, and, to a lesser extent, Hungary in the early 1990's. A key aspect of their transition toward a market economy has been the reorientation of human capital from the technical to the business-serving types.[1] In this paper, we assess its quantitative significance.

Our strategy is to investigate the reallocation of labor along the educational and occupational dimensions. Based on data analysis, we construct an aggregate model with endogenous occupational mobility and quantify the welfare impact of the initial imbalance and the subsequent adjustment in human capital. We emphasize that the changes in human capital that we study are not about the level but the composition. In 1990, the average number of schooling years was 10.1 in Czechoslovakia, 8.9 in Hungary, and 9.5 in Poland. These numbers are comparable to those for the OECD countries, whose average was 9.0 (Barro and Lee 1996). We also abstract from the changes in the composition of human capital within an occupation or within a type of education: a business worker in the new market economy may have different skills from his counterpart in the old command economy although they share a common occupational code. This is a potentially significant omission. Our only defense is that we chose to study a readily quantifiable aspect of the changes in human capital, and that our results represent a low bound of their quantitative significance.

In Section 2, we present the historical background. In Section 3, we present the evidence for labor reallocation. In the Czech Republic and Poland, there has been a major shift in education from the technical to the business fields since 1990. Also, the business occupations have expanded while the technical occupations have contracted. These changes were a sort of catching up with the other European countries. We do not find the same pattern in Hungary, however, which may be due to the fact that it began its transition to the market economy in the 1980s, earlier than the Czech Republic and Poland. In Section 4, we model the labor reallocation as a response to the changing demand structure. The reallocation has two parts: the exogenous increases in the share of new workers with business education and the endogenous movement of workers with technical education and experience to business occupations. We calibrate the model based on Czech and Polish data, and

1 This aspect of transition is shared by other post-communist countries. The caricature of a former nuclear scientist driving a taxi cab aside, the surplus of scientists and the shortage of managers were the topic of a newspaper report on Russia as late as year 2000: "The biggest problem in Russia is finding good managers. The Soviet Union produced generations of talented scientists and engineers, people in the business community say, but it crushed entrepreneurial instincts" (The New York Times, 2000).

measure the discounted sum of output loss due to the imbalance in human capital. This amounts to 8 to 40 percent of the 1990 GDP.

Our paper can be viewed as a study of mismatch between the existing worker characteristics and those that the market demands. A much-studied mismatch of this nature is the excessive qualification of workers for available jobs, that is, overeducation (see Alba-Ramirez 1993 for example). Another is the insufficient capacity of workers in adopting new technology, that is, skill-biased technological change (see Acemoglu and Zilibotti 2001 among others). These issues are more about the level mismatch than about the composition mismatch, that we focus on. Our paper also relates to other studies of educational changes and labor mobility in transition economies. Sarychev (1999) studies the changes from specialized vocational training to general training during the early period of transition in East Germany. Sorm and Terrell (2000) find a significant movement of labor into the finance, trade, and tourism sectors and out of the agricultural and industrial sectors in the Czech Republic. Similarly, Sabirianova (2002) finds the expansion of service and business occupations in Russia. In comparison, our paper highlights the changes from technical to business-related education/occupation. Also, we assess their quantitative significance based on an aggregate model.

2. The Historical Background

At the beginning of the 1990s, the Czech Republic, Hungary, and Poland embarked on the transition from the planned to the market-based economy.[2] A plethora of reforms, including the dismantling of quotas and fixed prices, the enactment of market-governing laws and regulations, and the privatization of state enterprises, were implemented. There were differences in the initial condition and the reform strategy among the three countries. Hungary and, to a lesser extent, Poland undertook some market-based reforms in the 1980s while Czechoslovakia, of which the Czech Republic was a part, did not; the Czech Republic undertook a fast-pace voucher privatization while Hungary and Poland relied on the direct sale as the main form of privatization. Regardless, all three countries are among the successful transition economies of the 1990s: the reform measures by and large brought about the market-based restructuring of the economy without a prolonged economic downturn in comparison to other transition economies. The restructuring of the economy can be in part summarized by the downsizing of large industrial state firms and the development of small and medium-size service-oriented private firms.

The educational reform went hand in hand with the restructuring of the economy. In the Czech Republic and Poland, schools and districts became more autonomous in decision making (e.g., financing, enrollment, curricula) while in Hungary the

2 Consult the Transition Report by EBRD (1999) among others for a more detailed summary of the transition experiences of the countries.

educational system was already fairly decentralized in the 1980s (Fiszvein, ed. 2001). The contents of education had to adjust to the demands of the market economy. For example, vocational training required for the expanding service sector had to be rationed while the overall demand for vocational training shrank in the Czech Republic and Hungary (Filer and Münich 2003).

Thus enrollments across fields of study adjusted to changing demands but only gradually. In all three countries, private education expanded from virtually none, supported by the state funding. Notably, private schools moved into regions and fields with access demand, indicating market forces at work.

3. Data Analysis

In this section, we analyze educational and occupational data[3] for the Czech Republic, Hungary, and Poland since the early 1990's. The objective is to describe the reallocation of labor from the technical to the business fields. Table 1 presents the distribution of new graduates across fields.[4] We can see a large shift away from the technical field in all three countries. In the Czech Republic and Poland, nearly all the shift was toward the business field with only a slight increase in the share of the other fields. In Hungary, the shift was all toward the other fields with no noticeable change in the business share. Figure 1 plots the ratio of the business share *and* the sum of business and technical shares (i.e. business share/[business share + technical share]), which illuminates the relative shift from the technical to the business fields.

Table 2 presents the distribution of workers across occupations.[5] In the Czech Republic and Poland, over the whole period we can see a shift from technical to business occupations with little change in the other occupations, much like the shift in education. However, the pace of shift is uneven over the years, and even in the opposite direction in some years.[6]

3 See the Appendix for the sources and the processing of the data.

4 We cautiously present the 1999–2001 data for the Czech Republic and the 2001 data for Poland. The large decline and recovery in the total number of graduates in the Czech Republic reflects the lengthening of the duration of the primary school by one year implemented in the middle of the 1990s. We are not sure of the reasons for the large increase in the number of graduates in other fields in Poland. We should not infer a medium-term or long-term trend from these years.

5 The total number of new graduates (Table 1) and the total number of workers (Table 2) seem compatible in each country on the average-over-years basis, considering that not all graduates enter the formal workforce and some workers retire early due to marriage, etc. In order to reconcile the numbers of graduates and workers on a year-by-year and occupation-by-occupation basis, one would need to consider macroeconomic fluctuations, sectoral policy shocks, etc. (see footnote 6). In our quantitative exercise (Section 4), we abstract from these short-term factors since our interests are medium-term to long-term changes in the composition of workers/graduates across occupations/fields.

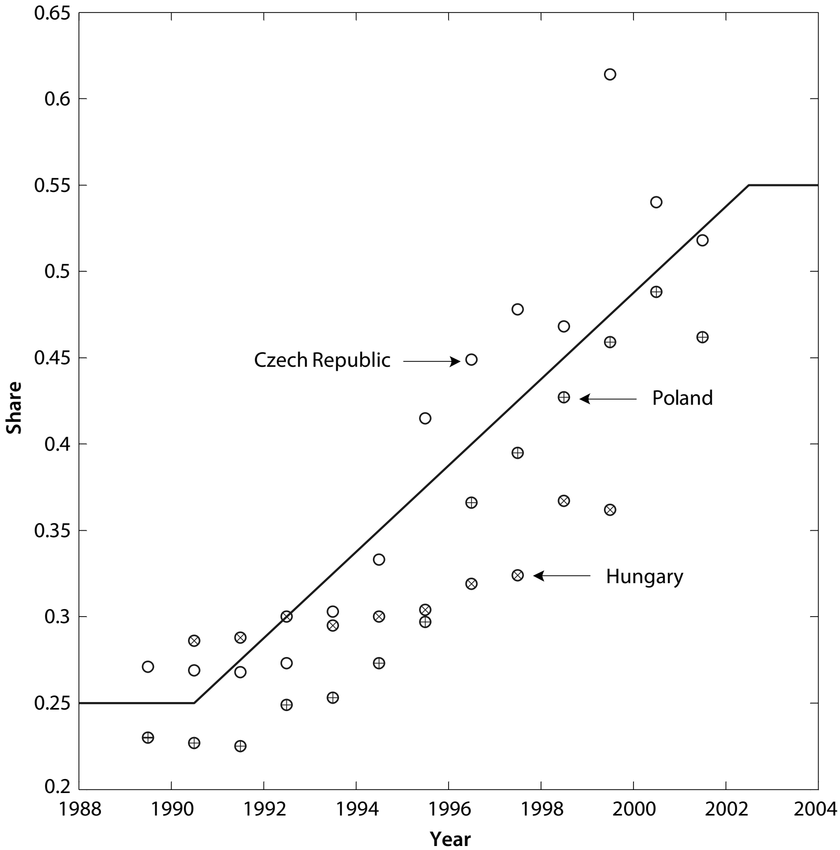
6 Fluctuations in the aggregate number of workers are noticeable too. For example, the large decline in Poland in the late 1990s reflects the severe recession during this period.

Table 1: Distribution of New Graduates across Fields

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Czech Republic:													
Business fields	35514 (0.223)	34572 (0.221)	37091 (0.219)	37053 (0.221)	37016 (0.240)	37228 (0.258)	50831 (0.326)	60228 (0.360)	60932 (0.382)	65109 (0.381)	50712 (0.449)	39547 (0.423)	48981 (0.393)
Technical fields	95306 (0.599)	93952 (0.601)	101438 (0.598)	98765 (0.589)	85261 (0.553)	74560 (0.517)	71656 (0.459)	73933 (0.441)	66600 (0.417)	73929 (0.433)	31840 (0.282)	33631 (0.359)	45538 (0.365)
Other fields	28245 (0.178)	27859 (0.178)	31039 (0.183)	31763 (0.190)	31796 (0.206)	32546 (0.225)	33631 (0.215)	33346 (0.199)	32153 (0.201)	31691 (0.186)	30376 (0.269)	20419 (0.218)	30272 (0.243)
Hungary:													
Business fields	27011 (0.221)	28884 (0.226)	30260 (0.236)	31864 (0.227)	31321 (0.227)	30687 (0.225)	33 606 (0.235)	33681 (0.233)	36796 (0.239)	33576 (0.210)			
Technical fields	67576 (0.552)	71436 (0.558)	70572 (0.549)	76015 (0.542)	73249 (0.532)	70173 (0.515)	71 730 (0.502)	70398 (0.488)	63357 (0.412)	59067 (0.370)			
Other fields	27789 (0.227)	27598 (0.216)	27627 (0.215)	32258 (0.230)	33223 (0.241)	35394 (0.260)	37522 (0.263)	40 298 (0.279)	53518 (0.348)	67193 (0.420)			
Poland:													
Business fields	86613 (0.181)	86884 (0.177)	89427 (0.177)	96875 (0.187)	97104 (0.189)	98947 (0.204)	117228 (0.225)	155630 (0.277)	180166 (0.299)	204795 (0.324)	233469 (0.344)	261104 (0.361)	215504 (0.285)
Technical fields	289203 (0.603)	296288 (0.605)	307383 (0.608)	291451 (0.561)	287027 (0.558)	263519 (0.544)	276991 (0.531)	269833 (0.481)	276230 (0.459)	274646 (0.434)	275105 (0.406)	274266 (0.379)	250856 (0.332)
Other fields	103424 (0.216)	106962 (0.218)	108803 (0.215)	130844 (0.252)	130034 (0.253)	121644 (0.251)	127117 (0.244)	135692 (0.242)	145307 (0.241)	152983 (0.242)	169699 (0.250)	187916 (0.260)	288857 (0.382)

Note: See Appendix for sources.

Figure 1: Business Education Share



In Hungary, we do not see the shift from technical to business occupations. If anything, the shift is from business to other occupations. Figure 2 plots the ratio of the business share and the sum of business and technical shares, illustrating the relative shift from the technical to the business occupations.

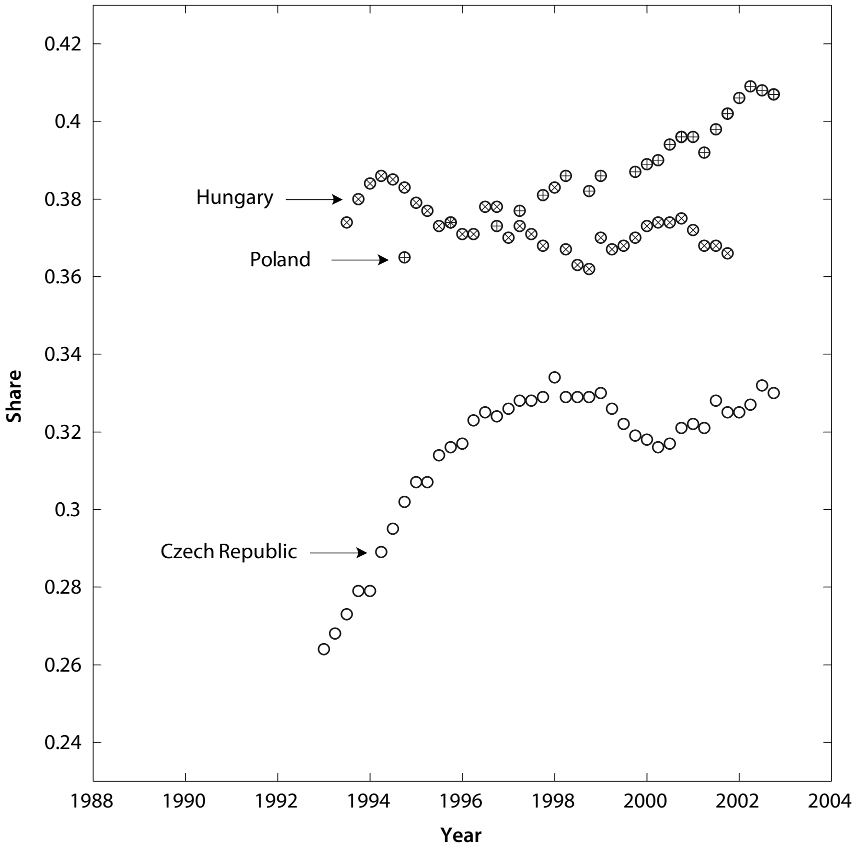
Table 3 presents occupational distribution in three other European countries, Austria, Germany, and Spain, for comparison. Austria and Germany, two of the other Central European countries, are a useful gauge for assessing the economic future of the Czech Republic, Hungary, and Poland. Spain went through its own economic transition after joining the EU in 1986, some twenty years ahead of the three countries of our inquiry, and provides an additional point of comparison. The table shows no pattern of change common to all three countries. In Austria, we can notice a shift from technical to business occupations, as in the Czech Republic and Poland, but on a smaller scale. In Germany, the shift is from technical to other

Table 2: Distribution of Workers across Occupations

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Czech Republic:										
Business occupations	839 (0.170)	931 (0.189)	967 (0.193)	998 (0.200)	999 (0.202)	983 (0.203)	922 (0.194)	926 (0.195)	948 (0.200)	982 (0.204)
Technical occupations	2164 (0.439)	2155 (0.437)	2092 (0.419)	2084 (0.418)	2038 (0.412)	2005 (0.413)	1971 (0.414)	1956 (0.412)	1967 (0.413)	1992 (0.414)
Other occupations	1923 (0.391)	1849 (0.374)	1939 (0.388)	1906 (0.382)	1904 (0.386)	1862 (0.384)	1870 (0.392)	1867 (0.393)	1846 (0.387)	1844 (0.382)
Hungary:										
Business occupations	897 (0.239)	886 (0.239)	840 (0.230)	844 (0.230)	824 (0.224)	823 (0.220)	864 (0.226)	890 (0.229)	862 (0.225)	
Technical occupations	1466 (0.390)	1425 (0.385)	1406 (0.384)	1386 (0.378)	1416 (0.386)	1448 (0.386)	1474 (0.386)	1482 (0.382)	1490 (0.389)	
Other occupations	1391 (0.371)	1393 (0.376)	1413 (0.386)	1440 (0.392)	1431 (0.390)	1475 (0.394)	1484 (0.388)	1506 (0.388)	1482 (0.387)	
Poland:										
Business occupations		2732 (0.186)	2868 (0.195)	2974 (0.198)	3147 (0.206)	3188 (0.209)	3001 (0.207)	3028 (0.209)	2910 (0.208)	2803 (0.205)
Technical occupations		4748 (0.323)	4794 (0.326)	4998 (0.332)	5120 (0.336)	5154 (0.337)	4751 (0.328)	4611 (0.319)	4334 (0.310)	4088 (0.299)
Other occupations		7213 (0.491)	7058 (0.479)	7066 (0.470)	6978 (0.458)	6935 (0.454)	6737 (0.465)	6831 (0.472)	6726 (0.481)	6765 (0.495)

Note: All numbers are in thousands. See Appendix for sources.

Figure 2: Business Occupation Share



occupations.[7] In Spain the main shift is from business to other occupations. Figure 3 plots the ratio of the business share and the sum of business and technical shares. Although the patterns of change are dissimilar among the countries, the relative business share is uniformly higher than in the Czech Republic and Poland in the early years of the period. Thus the shift from business to technical occupations in the Czech Republic and Poland can be viewed as a sort of catching up with the other European countries.

In summary, our analysis shows that in the Czech Republic and Poland, there was a major reallocation of labor from technical to business education/occupation in the last decade. This is not a general pattern along the occupational dimension

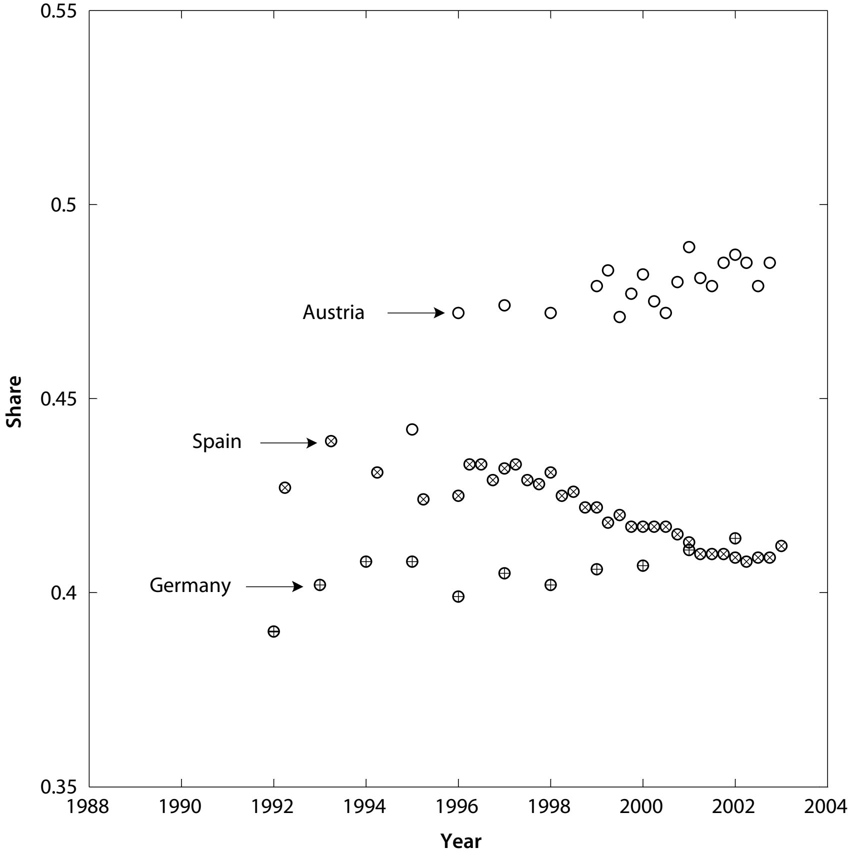
7 The German data cover the entire country. The former East German part alone may have exhibited the same pattern of change as the Czech Republic and Poland.

Table 3: Distribution of Workers across Occupations in Other European Countries

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Austria:											
Business occupations				985 (0.268)	1014 (0.280)	1008 (0.279)	1015 (0.280)	1056 (0.287)	1067 (0.290)	1086 (0.294)	1079 (0.289)
Technical occupations				1243 (0.338)	1133 (0.313)	1120 (0.310)	1134 (0.313)	1148 (0.312)	1145 (0.311)	1134 (0.307)	1138 (0.305)
Other occupations				1447 (0.394)	1470 (0.406)	1481 (0.410)	1477 (0.407)	1474 (0.401)	1472 (0.400)	1477 (0.399)	1517 (0.406)
Germany:											
Business occupations	8318 (0.239)	8424 (0.241)	8450 (0.243)	8435 (0.242)	8242 (0.235)	8205 (0.236)	8139 (0.233)	8320 (0.234)	8354 (0.233)	8436 (0.234)	8356 (0.234)
Technical occupations	12995 (0.373)	12557 (0.359)	12270 (0.353)	12236 (0.351)	12421 (0.353)	12066 (0.347)	12122 (0.346)	12156 (0.341)	12161 (0.339)	12099 (0.336)	11803 (0.330)
Other occupations	13532 (0.388)	13971 (0.400)	14068 (0.404)	14189 (0.407)	14476 (0.412)	14532 (0.418)	14742 (0.421)	15150 (0.425)	15367 (0.428)	15487 (0.430)	15604 (0.436)
Spain:											
Business occupations	3198 (0.248)	3076 (0.250)	2968 (0.244)	2901 (0.232)	3012 (0.236)	3109 (0.236)	3161 (0.230)	3298 (0.227)	3461 (0.226)	3551 (0.224)	3580 (0.220)
Technical occupations	4293 (0.333)	3935 (0.319)	3921 (0.322)	3935 (0.315)	3939 (0.309)	4075 (0.309)	4276 (0.312)	4592 (0.316)	4847 (0.317)	5111 (0.322)	5184 (0.319)
Other occupations	5402 (0.419)	5312 (0.431)	5297 (0.435)	5658 (0.453)	5810 (0.455)	6007 (0.455)	6282 (0.458)	6619 (0.456)	6998 (0.457)	7215 (0.454)	7477 (0.460)

Note: All numbers are in thousands. See Appendix for sources.

Figure 3: Business Occupation Share in Other European Countries



in European countries.[8] Notably, in the Czech Republic and Poland the business share of occupation was lower than in all the other countries including Hungary, in the early 1990s. Based on this, we interpret Czech and Polish labor reallocation as a natural aspect of transition toward a market economy. As mentioned, Hungary began its market-based reform earlier than the Czech Republic and Poland, which probably explains its relatively high business share in the early 1990s.[9,10]

8 For a partial evidence along the educational dimension, see our snapshot analysis of Austrian educational data in Section 4.4 and Appendix.

9 Partial evidence of early Hungarian transition can be found in the data reported in Campos and Zlabkova (2000). Conducting a similar exercise as above, we found that the business share of occupation increased from 32% in 1986 to 37% in 1989 to 44% in 1992; and the technical share decreased from 48% in 1986 to 45% in 1989 to 37% in 1992. The data are not comparable to the 1990's date discussed above. See the Appendix for details.

10 Perhaps for this reason, Hungary received, as a share of GDP, much larger sums of foreign direct investment in the early and the mid-1990s than the Czech Republic and Poland did. To the extent that the foreign

4. Quantitative Exercise

In this section, we conduct an exercise in order to quantitatively assess the significance of the gap between the technically-oriented workforce and the business-oriented labor demand during the transition paths of the Czech Republic and Poland,[11] as documented in Section 3. The transition is modeled as follows. The economy is assumed to be on a balanced growth path for $t \leq 0$. There is an unexpected change in the demand structure (i.e., the parameter of the business/technical occupation share in the production function) starting at $t = 1$. Labor reallocates from the technical to the business occupation following the change in demand structure. The reallocation has two parts. First, the share of new workers with a business education increases exogenously over time. Second, some workers, old and new, choose to work in the high-paying business occupation despite technical education and experience. Based on the calibrated model, we quantify the labor reallocation and the output loss due to the imbalance in human capital.

4.1 The Worker's Decision Problem

A worker receives either a business or a technical education before beginning his work life. Let the type of education be denoted by $s = 1, 2$, where $s = 1$ means business education and $s = 2$ means technical education. The type of education a worker receives is exogenous: he takes it as given in his decision problem.[12] A worker's work life is 10 periods. This implies that the length of a period is 4 years under the assumption that a worker's work life is 40 years.[13] Let the period of a worker's work life be denoted by $j = 1, 2,..., 10$. Let the occupations denoted by $i = 1, 2$, where $i = 1$ means business occupation and $i = 2$ means technical occupation. In any period of his work life, a worker can work in either occupation. Let a worker's experience in an occupation, i.e., the number of periods he spent in the occupation, be denoted by $e = 1, 2,..., 9$.

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investment went to sectors that require few business skills, it would help explain why Hungary took a path dissimilar to the Czech and Polish one. From the late 1990s, the Czech Republic and Poland also received large foreign direct investments which may have influenced their pattern of labor mobility. A more general point is that the long-run composition of human capital may be affected by the initial condition for any country, a counter point to the convergence hypothesis hinted at above.

11 That is, we conduct the exercise based on the Czech and Polish data. However, under the assumption that the Hungarian transition of the 1980s was similar to that of the Czech Republic and Poland in the 1990s, the results may also be relevant to the earlier transition in Hungary.

12 A worker with a technical education is worse off than one with a business education due to the cross-occupational wage differential in equilibrium. Given a choice, a worker would prefer a business education to a technical one. Therefore, the assumption of exogenous educational composition can be interpreted as a rationing of business education given the adjustment costs of educational structure, a seemingly accurate description of the 1990's (see Section 2).

13 Since workers can choose occupation in each period, the length of a period should be interpreted as the time it takes on average for a worker to have a new opportunity to move between technical and business occupations. The four-year length does not seem unreasonable.

The effective labor input of a worker depends on the education he has received, the occupation in which he works, and his experience in that occupation.[14] Let $a(s, i, e)$ denote the effective labor input by a worker who has received type s education, works in occupation i, and has spent e number of periods working in occupation i. We assume:

$$\begin{aligned} &\log a(s, i, e) = \sigma_1 e - \sigma_2 e^2 && \text{for } s = i \text{ and} \\ &a(s, i, e) = \lambda a(s, s, e) && \text{for } s \neq i, \end{aligned} \tag{1}$$

where $\sigma_1, \sigma_2 > 0$ and $0 < \lambda < 1$. The first equation is Mincerian, as commonly used in the labor literature. It captures the increasing and concave wage profile over experience. The parameter λ captures the effective labor input of a worker who works in an occupation for which he is not educated. The wage of a worker is given by

$$w_t(s, i, e) = \tilde{w}_t(i) a(s, i, e), \tag{2}$$

where $\tilde{w}_t(i)$ is the wage rate for one unit of effective labor input in occupation i.

Let $g_t(s, j)$ denote the date t occupation of a worker who has received type s education and is in the jth period of his work life. The career path of a worker who has received type s education and enters the work force in period t is then $\{g_{t+j-1}(s, j)\}_j$. Given $\{g_{t+j-1}(s, j)\}_j$, the worker's experience path $\{e_{t+j-1}(s, j)\}_j$ is given by

$$e_{t+j-1}(s,j) = \sum_{k=1}^{j-1} \eta(g_{t+j-1}(s,j), g_{t+k-1}(s,k)) \tag{3}$$

where η is an indicator function: $\eta(i, i^t)$ is equal to 1 if $i = i^t$, and equal to 0 otherwise. A worker's utility is the discounted linear sum of wages over his work life: the utility of a worker who has received type s education and enters the work force in period t is

$$\sum_{k=1}^{10} \beta^{k-1} \tilde{w}_{t+k-1}(g_{t+k-1}(s,k)) a(s, g_{t+k-1}(s,k), e_{t+k-1}(s,k)) \tag{4}$$

where the discount rate $\beta < 1$. A worker's decision problem is to maximize his utility by choosing his career path, taking as given his education type s and wage rates $\{\tilde{w}_t(i)\}$. The solution to this problem may not be unique: multiple career paths may maximize the worker's utility. Let $G_t(s)$ denote the set of utility-maximizing career paths for a worker entering the work force in period t with education type s:

$$G_t(s) = \{\{g_{t+j}(s,j)\}_j : \{g_{t+j}(s,j)\}_j \text{ maximizes the utility of the worker}\}. \tag{5}$$

This completes the description of the worker's decision problem.

14 Thus we abstract from the general experience premium. Adding this premium to the effective labor input would have little impact on the incentives for switching occupation and thereby on the quantitative results.

4.2 The Labor Supply

We assume no population growth and normalize the mass of workers who enter the work force to be one. Thus at any date there are 10 units of total work force, each unit representing a different age group. Let $m_t(s)$ denote the mass of new workers who begin work life in period t with education type s: $m_t(1) + m_t(2) = 1$. Recall from the previous subsection that multiple career paths may maximize the utility of the worker. Thus in equilibrium workers of the same cohort with the same education may choose different career paths. Let $\mu_t(\{g_{t+j}(s,j)\}_j)$ denote the mass of workers who choose the career $\{g_{t+j}(s,j)\}_j$:

$$\sum_{G_t(s)} \mu_t(\{g_{t+j}(s,j)\}_j) = 1. \tag{6}$$

Let $n_t(i)$ denote the mass of workers in occupation i in period t. Given the wage rates $\{\tilde{w}_t(i)\}$, the labor supply $\{n_t(i)\}$ is determined by the distribution of workers across career paths:

$$n_t(i) = \sum_{\tau=t-9}^{t} \sum_{s} \sum_{G_\tau(s)} \eta(i, g_t(s, t-\tau+1)) \mu_\tau(\{g_{\tau+j}(s,j)\}_j) m_\tau(s). \tag{7}$$

The workers working in an occupation in a period will differ in terms of their effective labor input due to differences in their education and experience. Let $\tilde{n}_t(i)$ denote the total effective labor input in occupation i in period t:

$$\tilde{n}_t(i) = \sum_{\tau=t-9}^{t} \sum_{s} \sum_{G_\tau(s)} \eta(i, g_t(s, t-\tau+1)) a(s, i, e_t(s, t-\tau+1)) \mu_\tau(\{g_{\tau+j}(s,j)\}_j) m_\tau(s) \tag{8}$$

where the experience $e_t(s,t-\tau+1)$ is determined by (3) given the career path $\{g_{\tau+j}(s,j)\}_j$. Again, the labor supply $\{n_t(i)\}$ and the effective labor supply $\{\tilde{n}_t(i)\}$ may not be unique since the utility-maximizing career path of workers of the same cohort and with the same education may not be unique.

4.3 The Aggregate Economy

The aggregate economy is a standard neoclassical one except for the following two features. First, labor input is differentiated by occupation. Second, we abstract from capital accumulation and the firm's profit-maximization problem. We simply assume that there is an aggregate production function and that the wage rates are determined by the marginal products of the labor inputs. The aggregate production function is

$$Y_t = A_t \left(\tilde{n}_t(1)^{\alpha_0} \tilde{n}_t(2)^{1-\alpha_0} \right)^{\theta} \tag{9}$$

for $t \leq 0$,

$$Y_t = A_t \left(\tilde{n}_t(1)^{\alpha_t} \tilde{n}_t(2)^{1-\alpha_t} \right)^{\theta} \tag{10}$$

for $t \geq 1$, and

$$\frac{\alpha_{t+1} - \alpha_t}{\alpha_\infty - \alpha_t} = \rho, \tag{11}$$

where parameters α_0, α_∞, θ, and ρ all take on values between 0 and 1. The parameter α_0 captures the relative demand for the two occupations before transition. The relative demand changes during transition: α_t increases in t. The parameter α_∞ captures the relative demand in the long run and the parameter ρ captures the speed of change in demand, a higher value meaning a faster change. We set $\alpha_0 = m_0(1)$ for all $t \leq 0$, and $\alpha_\infty = m_\infty(1)$. This specification insures that before transition the composition of new workers each period exactly met the old demand structure, and will exactly meet the new demand structure in the long run. The elasticity parameter θ can be interpreted as the labor income that accrues to the two occupations as a share of the aggregate income, with parameter A_t capturing not only the total factor productivity but also the capital input and the labor inputs of the other occupations.[15] We assume the sequence $\{A_t\}$ to have followed some constant growth path for $t \leq 0$. This pre-transition growth rate is not essential for the exercise and does not need to be specified. We assume the sequence to follow a new constant growth path after the transition starts: for $t \geq 1$

$$A_{t+1} = \mathrm{A}_t^{1+\gamma}. \tag{12}$$

The wage rates are given by $\tilde{w}_t(i) = \partial Y_t / \partial \tilde{n}_t(i)$. The equilibrium of the economy is the distribution of career paths $\{\mu(\{g_t(s, j)\}_j)\}$, the labor supply $\{n_t(i)\}$, the effective labor supply $\{\tilde{n}_t(i)\}$, and the wage rates $\{\tilde{w}_t(i)\}$ such that the distribution of career paths is derived from the workers' utility maximization problem given the wage rates; the labor supply and the effective labor supply are derived from the distribution of career paths; and the wage rates are derived from the effective labor supply.

4.4 Calibration

For the exercise, we need to specify the discount rate β, the growth parameter γ, the elasticity parameter θ, the education premium parameter λ, the experience premium parameters σ_1 and σ_2 , the educational distribution of new workers $\{m_t(s)\}$, and the speed of demand change ρ. We set $\beta = .85$. This implies a real annual interest rate of about 4% under constant consumption over periods. We set $\gamma = .082$, which implies an annual growth rate of about 2%. The values of θ do not affect the results except for the aggregate output. Tables 1 and 2 suggest a range of values: on average over the years the business and technical share of labor is about .6 (occupation dimension) to .8 (education dimension) for the Czech Republic, and about .5 to .8

15 That is, $A_t = \tilde{A}_t k_t^{\varphi} \tilde{n}_t(0)^{\vartheta}$, where $\tilde{A}_t$ is the total factor productivity; k_t is the capital input; $n_t(0)$ is the effective labor input in the other occupations; and $\varphi + \vartheta + \theta = 1$.

for Poland. The implied values of θ are these numbers multiplied by the aggregate labor income share, which we assume to be two-third, as commonly used in the literature. Thus we set θ to be in the range of .4 and .53 for the Czech Republic, and in the range of .33 and .53 for Poland. Recall that the parameters σ_1 and σ_2 measure occupation-specific experience premium, while the common measures of premium are of pooled experience, i.e., without regard to the type of experience. Conceptually, the former is smaller than the latter if there is no switching of occupation, but could be greater than the latter if there is much switching. We set σ_1 to be in the range of .05 to .15, and σ_2 in the range of .0033 to .01. At an annual rate, they are equivalent to .012 to .036, and .0002 to .0006, respectively. The low end of the ranges corresponds to the pooled-experience premium values for the transition economies in the early 1990's; the high end corresponds to those for Western European countries.[16]

We set the initial and the long-run business shares of education/occupation (i.e., $m_0(1)$ and $m_\infty(1)$ or, equivalently, α_0 and α_∞) based on Figures 1 and 2. Figure 1 suggests $m_0(1)$ to be about .25 and $m_\infty(1)$ to be somewhere above .50 for both the Czech Republic and Poland. To better guess at $m_\infty(1)$, we calculated the business share of education in the 1990s for Austria in the same way as we did for the Czech Republic, Poland, and Hungary.[17]

We found that the business share was stable at about 57%. Therefore, one reasonable set of values for $m_0(1)$ and $m_\infty(1)$ are .25 and .55, respectively. On the other hand, Figure 2 suggests quite different values. A rough guess based on this figure would set $m_0(1)$ and $m_\infty(1)$ at .20 and .35 for the Czech Republic, and at .30 and .45 for Poland. We conducted the exercise for all three sets of values: $(m_0(1), m_\infty(1))$ equal to (.20,.35) for the Czech Republic, (.30,.45) for Poland, and (.25,.55) for both countries.[18] Given $(m_0(1), m_\infty(1))$, Figure 1 suggests a linear path of adjustment in educational composition for the first three periods: $m_t(1) = t(m_\infty(1) - m_0(1))/3$ for $t = 1, 2$ and $m_t(1) = m_\infty(1)$ for $t \geq 3$. The solid line draws the adjustment path for the case of $(m_0(1), m_\infty(1)) = (.25, .55)$.

The parameters that remain to be chosen are λ and ρ. These parameters are difficult to relate to the data directly. Instead we chose the values of these two parameters so that the endogenous variables under the chosen values match the data along some dimensions. Specifically, we chose to match the size of labor reallocation and the cross-occupational wage differential at date two, which corresponds to year 1998.

16 Bird et al. (1994), Krueger and Pischke (1995), and Chase(1998) document the low experience premium in transition economies in the early 1990s. If workers in transition economies switched occupation, thereby losing the occupation-specific premium, more than workers in Western Europe in the early 1990s, this would account for some of the observed premium differential between them.

17 See the Appendix for the details.

18 That we have rough and diverse ranges is not surprising. We have only limited data for the early 1990s and the long-run business share is difficult to predict. More basically, the way we classified the education types and occupations is inevitably arbitrary. Trying diverse ranges is a sensible strategy given this situation.

From Figure 2, assuming the initial and the long-run business shares of (.20, .35) for the Czech Republic and (.30, .45) for Poland, the size of labor reallocation during the first two periods is about 80% of the total for the former and about 53% of the total for the latter. We chose the model to replicate these percentages of reallocation. As for the wage differential, the Czech Labor Force Survey does not contain information about wages. However, we were able to find that information in the Microsensus conducted in 1992 and 1996. Conducting the same data analysis as for the Labor Force Survey, we found that wages in business occupations grew 4% more than the average and wages in technical occupations grew 9% less than the average.[19] The Polish Labor Force Survey contains wage information, but only from 1995. We found that during the 1995–1999 period, wages in business occupations grew 4% more than the average and wages in technical occupations grew 7% less than the average.[20]

Based on this information, for both countries we chose the model to generate a 25% wage differential between the business and the technical occupations at date 2, starting from zero differential at date 0.

The algorithm for finding the equilibrium under a given set of parameter values is as follows. First, we set the labor supply for $t \geq 1$ to be such that every worker works in the occupation for which he is educated, i.e., workers with a business education work in the business occupation and workers with a technical education work in the technical occupation. Second, we calculate the wage rates for $t \geq 1$ under this labor supply. Third, we solve the career-decision problems of individual workers under these wage rates and derive a new labor supply for $t \geq 1$. Fourth, we update the original labor supply by a small amount so that it is closer to the new labor supply. This marginal update rule avoids the non-converging oscillation of labor supply as the update is repeated. Fifth, we recalculate the wage rates for $t \geq 1$ under this updated labor supply. Sixth, we repeat the third, the fourth, and the fifth steps until the labor supply and the wage rates converge. By construction, the limit of the convergence is the equilibrium.

We calculated equilibria using various values of λ and ρ, and found the pattern that for a higher λ or for a higher ρ, there is more labor reallocation. Intuitively, a higher λ (i.e., a lower occupation-specific experience premium) makes people more willing to move, and a higher ρ (i.e., a higher speed of demand change) creates more of a wage premium for the business occupation, attracting more

19 For 1996, when the Microsensus and the Labor Force Survey data sets can be directly compared, the business share of workers in the Microsensus is two or three percentages higher than in the Labor Force Survey, while the technical share is almost the same. Our overall impression is that the two data sets are comparable and the discrepancy reflects the small sample size for the Microsensus, which was about three thousand for 1992 and about five thousand for 1996.

20 This pattern of wage-growth differential in both countries corroborates our modeling choice for labor mobility: the change in demand structure creates the wage differential, which leads to supply response. We chose not to present the wage data systematically due to their limited coverage.

movers. Thus each value of λ is mapped to a unique value of ρ so that a given size of reallocation is maintained. We also found that as we increase λ, at the same time decreasing ρ according to the mapping, the wage differential decreases. In fact, we can deduce this pattern as a property of the model: given the Cobb-Douglas production function, a lower ρ implies a lower business share of aggregate wage bill, and under a fixed business share of occupations this leads to a lower average wage of the business occupation relative to that of the technical occupation. Thus there is a unique set of values of λ and ρ that generate a given set of the reallocation size and the wage differential at date 2.

4.5 Results

Table 4 summarizes the results. Each row contains a set of parameter values and a description of the model economy under those values. Our interest is the labor reallocation from the technical to the business occupation, which is determined by demand and supply factors in the labor market. The demand factors are the total change in demand, $\alpha_\infty - \alpha_0$, and the speed of its change, ρ. These two factors work as substitutes for each other in determining the change in demand in the early periods. The supply factors are the educational premium, $1/\lambda$, and the occupation-specific experienced premium, σ_1 (and σ_2 which is scaled accordingly). These two factors work as substitutes for each other in determining the supply response, i.e., the movement of workers into the business occupation despite technical education and experience, aside from the exogenous increase in the share of new workers with a business education. For these workers, call them movers, the advantage of high wages in the business occupation outweighs the disadvantages of improper education and lack of experience.[21] The wage differential between the business and the technical occupations reflects the relative strengths of demand and supply factors.[22]

The main difference between the Czech Republic and Poland is the observed speed of labor reallocation (i.e., the date-two completion rates of 80% versus 53%). For the Czech Republic we were barely able to simulate its high speed of reallocation, in some cases reaching the corners in the demand-pull and the supply-push factors (e.g., $\rho = 1$, $\lambda = 1$). For Poland the speed is more moderate and so are the required

21 The movers are concentrated in young age groups. Younger workers have less experience to lose from switching to the business occupation. On the other hand, the loss of experience is permanent while the wage premium of the business occupation is temporary, which matters less to older workers. Under the parameter values chosen for the exercise, the experience factor largely outweighs the temporary-premium factor. This result is consistent with the empirical findings in Sorm and Terrell (2000).

22 The movers enjoy the wage premium in business occupations, but their wage is still lower than that of their fellow workers with business education and experience. Thus labor mobility lowers the average wage rate in the business occupation (i.e., the total wage bill divided by the number of workers in the business occupation), and the average wage differential between the business and the technical occupations is less than the effective wage differential between the two occupations.

Table 4: Simulation Results

	Total Demand Change	Speed of Demand Change	Experience Premium	Education Premium	Date-Two Business Occupation	Date-Two Wage Differential	Maximum Wage Differential	Maximum Movers	Output Loss
Czech Republic	0.20 – 0.35	1.00	0.15	0.00	0.31(72%)	1.23	1.29(date 1)	9%(date 1)	1.8–2.4%
		1.00	0.10	0.00	0.31(72%)	1.21	1.27(date 1)	9%(date 1)	1.4–1.9%
		1.00	0.05	0.05	0.32(80%)	1.14	1.17(date 1)	11%(date 1)	1.9–2.5%
	0.25 – 0.55	1.00	0.15	0.00	0.49(80%)	1.27	1.35(date 1)	22%(date 1)	6.3–8.2%
		0.88	0.10	0.03	0.49(80%)	1.26	1.26(date 2)	21%(date 1)	5.3–6.9%
		1.00	0.05	0.24	0.49(80%)	1.25	1.26(date 1)	23%(date 1)	10.2–13.4%
Poland	0.30 – 0.45	0.71	0.15	0.06	0.38(53%)	1.26	1.26(date 2)	7%(date 2)	1.9–2.9%
		0.71	0.10	0.07	0.38(53%)	1.25	1.25(date 2)	7%(date 1)	1.8–2.9%
		0.67	0.05	0.11	0.38(53%)	1.25	1.25(date 2)	6%(date 1)	1.9–3.0%
	0.25 – 0.55	0.48	0.15	0.09	0.41(53%)	1.26	1.30(date 3)	13%(date 2)	4.5–7.0%
		0.48	0.10	0.09	0.41(53%)	1.25	1.30(date 3)	13%(date 2)	4.1–6.4%
		0.47	0.05	0.20	0.41(53%)	1.25	1.29(date 3)	13%(date 2)	5.3–8.2%

Explanatory notes: Total demand change: the initial and the long-run business share, α_0 and α_∞

Speed of demand change: ρ

Experience premium: $\sigma 1$

Education premium: occupation-specific premium, $1/\lambda$-1

Date-two business occupation: the share of business occupation, n_2, and the reallocation as a percentage of total demand change, $(n_2-n_0)/(\alpha_\infty-\alpha_0)$

Date-two wage differential: the ratio of average wage rates (i.e., the wage bill divided by the number of workers) in the business and the technical occupations

Maximum wage differential: the maximum and the date

Maximum movers: the maximum percentage of workers working in the business occupation with a technical education and the date

Output loss: the discounted sum of gaps between the actual output and the output under no mismatch problem, as a percentage of date 0 output; the first number is when $\theta = .4$ for the Czech Republic and $\theta = .33$ for Poland; the second number is when $\theta = .53$ for both countries.

demand and supply factors.[23] For both countries, there is a sizeable movement from the technical to the business occupation, all concentrated in the first period or two. The share of movers among all workers is on the order of 10 to 20 percent in the early periods. The business occupation continues to expand as a larger share of new workers is educated in business than in the past. By the logic of the life cycle, it takes about one generation for the economy to complete the labor reallocation and reach a balanced growth path.

We can quantify the welfare effect of the imbalance in human capital as follows. We can calculate the aggregate output path given a set of model parameter values. Call this the actual path. We can also calculate a hypothetical output path under the same values except that at each date and for each age group, the business-technical composition of workers' education and experience is assumed to (magically) match the business-technical composition of demand. By construction, the actual path lies below the hypothetical path during the period of adjustment. We can calculate the discounted sum of output gap between the actual and the hypothetical paths. For both countries, this sum is on the order of 2 to 10 percent of date zero output, largely depending on the total size of demand change and the elasticity parameter θ. Since the length of a period is four years, this is equivalent to 8 to 40 percent of the 1990 GDP.[24]

5. Conclusion

In this paper, we studied the changing composition of human capital in the Czech Republic, Hungary, and Poland since 1990. For the Czech Republic and Poland, we documented the reallocation of labor from technical to business education/occupations, starting from a low business share in comparison to Western European countries. We interpret this change as an adjustment necessary for their transition to a market economy. We did not find the same pattern in Hungary, which seems to reflect that it started its transition in the 1980s, earlier than the other two countries. We constructed a model where labor reallocates as a response to the changing demand structure. When calibrated for the Czech Republic and Poland, the model

23 The unemployment rate was modest in the Czech Republic in the 1990's while the Polish rate was in double-digit, which suggests that a part of the difference in the observed speed of labor reallocation could have been due to the difference in labor market performance, i.e., the effectiveness with which the labor market reallocates labor holding the other factors (see Münich, Švejnar, and Terrell 1999 for further evidence). If an unemployment period is added to the model, it would reduce the incentive for switching occupation. In calibrating the model, however, the education premium would need to be downwardly adjusted in order to match the observed speed of reallocation (and the cross-occupational wage differential). Given the difference in the observed unemployment period, the adjustment would be greater in Poland, making the calibrated education premium more similar between the two countries. The welfare implication is ambiguous: the unemployment duration directly raises the welfare cost of human capital mismatch, but reduced education premium lowers it.

24 To put this range in perspective, consider that Lucas (1987) estimated the welfare effect of business cycles in the US to be equivalent to perpetually losing about one half percent of consumption, which translates to less than 15% of a single year's GDP.

generates a large movement of workers with technical education and experience into business occupations in the early 1990s, and a more gradual inflow of new workers with a business education. The discounted sum of output loss due to the imbalance in human capital amounts to 8 to 40 percent of the 1990 GDP.

We note some shortcomings of our exercise. First, by focusing on labor reallocation we have abstracted from the compositional changes of human capital within an education type or within an occupation. As mentioned, our exercise is about a readily quantifiable portion of the changes, so it understates their quantitative significance. Second, we have little to say about what determine the changes in the demand structure except for the notion of their necessity in the transition to a market economy. One can conjecture that the technically skewed stock of human capital may induce a degree of specialization in technically-oriented production in the Czech Republic and Poland vis-a-vis European countries (see footnote 10). Third, we have not addressed the issues of optimal policy. We can only note the dramatic changes in the educational system in all three countries, which indicates that educational policy has been responsive to changes in the demand structure.

Appendix

A. Construction of Table 1 and Figure 1 (and the Exercise for Austria)

To construct Table 1, we consulted the Statistical Yearbooks of the Czech Republic, Hungary, and Poland. In the Yearbooks, new graduates are classified by the types of school and by the fields within each type of school. The types of school can be broadly reclassified into vocational school, grammar school, and university. We excluded new graduates of grammar school, who mostly advance to the university, since our exercise is about new entrants to the labor market. We pooled new graduates across school types and fields into business fields, technical fields, and other fields. For calibration of the model, we conducted the same exercise for Austria for years 1993 and 1998. We consulted the Austrian Statistics on Universities in addition to the Austrian Statistical Yearbook for these two years. The details of the pooling are as follows:

Czech Republic

Business fields in vocational schools: business and services. Business fields in universities: economics and business. Technical fields in vocational schools: machine control and operation + mechanical engineering and metallurgy + electrical engineering, transport and communications + chemistry and food industry + construction + fashion and clothing + textile and garment industry + wood processing and shoe industry. Technical fields in universities: mining + metallurgy + mechanical engineering + electrical engineering + industrial chemistry + food + architecture + construction + footwear industry + wood and paper production + transport. Other fields in vocational schools: agriculture and forestry + veterinary medicine + arts and handicraft + librarians and journalists + arts + philosophy and theology + health services + physical training and sports + public and legal administration + environmental protection + pedagogy. Other fields in universities: agriculture, forestry, and veterinary medicine + philosophy + politics + history + journalism + philology + psychology + sciences of arts + medicine and pharmacy + physical training + law + physics and mathematics + geology + geography + chemistry + biology + ecology and environmental protection + pedagogy + teacher training.

Hungary

Business fields in vocational schools: economics + commerce + trade + catering + miscellaneous service industries. Business fields in universities: economics and business. Technical fields in vocational schools: mining + metallurgy + other iron and metal industry + engineering + electrical engineering and energy industry + precision engineering + chemical industry + paper industry + food processing industry + building material industry + construction + transport, post, telecommunications + textile industry + leather, fur and shoe industry + clothing industry + wood industry + printing industry. Technical fields in universities: engineering. Other fields in vocational schools: plant cultivation + animal husbandry + art + sanitary education + kindergarten teachers. Other fields in universities: agricultural + veterinary + liberal arts + fine arts + theology + medical science + sanitary + physical education + law and state administration + natural science + teacher training (higher grade) + teacher training (higher grade) for disabled children + teacher training (lower grade) + kindergarten teacher.

Poland

Business fields in vocational schools: commerce and business + services. Business fields in universities: commercial and business administration + services. Technical fields in vocational schools: trade, craft, and industrial programs + transport and communications. Technical fields in universities: engineering + architecture and town planning + transport and communications. Other fields in vocational schools: agriculture, forestry and fishery + fine and applied arts + health-related auxiliaries + teacher training. Other fields in universities: agriculture, forestry and fishery + fine and applied arts + humanities + religion and theology + social and behavioral science + home economics + mass communication and documentation + medical science + law + natural science + mathematics and computer science + education science and teacher training.

Austria

Business fields in vocational schools: commerce + office and administrative work + data processing + hotel management, catering and tourism. Business fields in universities: social, economic, and business studies excluding sociology. Technical fields in vocational schools: industry and trade + fashion and clothing. Technical fields in universities: technical sciences + metallurgy. Other fields in vocational schools: agriculture and forestry + animal nursing + domestic science + social work + arts + craft + nursing + medical service + teaching. Other fields in universities: agriculture + veterinary + social sciences + theology + arts + social work + medicine + medical service + law + military + natural sciences + teaching.

B. Construction of Table 2, Figure 2, Table 3, and Figure 3

To construct Tables 2 and 3, we consulted the Labor Force Surveys of the respective countries. For the Czech Republic, Hungary, and Poland, we obtained the data directly from the respective national statistical offices. For Austria, Germany, and Spain, we obtained the data from Eurostat, the statistical office of the European Union. The Czech Republic and Poland have conducted their Labor Force Surveys based on the ISCO-88 (International Standard Classification of Occupations) since 1993 and 1994, respectively. Hungary has conducted the Labor Force Surveys based on its own classification system titled HSCO-93 (Hungarian Standard Classification of Occupations) since 1993, but the Statistical Office provides instruction on how to convert HSCO-93 to ISCO-88. We grouped the two-digit ISCO-88 occupation codes into business occupations, technical occupations, and other occupations. The tables present the results for the fourth quarter of each year for the Czech Republic, Hungary, and Poland; the first quarter for Austria; and the second quarter for Germany and Spain. The figures present the results for all quarters for which we could obtain data. The details of the grouping of occupation codes are as follows:

Business Occupations: corporate managers (12) + managers of small enterprises (13) + office clerks (41) + customer service clerks (42) + models, salespersons, and demonstrators (52). Technical Occupations: physical, mathematical and engineering science professionals (21) + physical and engineering science associate professionals (31) + extraction and building trade workers (71) + metal, machinery, and related trade workers (72) + precision, handicraft, craft printing, and related trade workers (73) + other craft and related trade workers (74) + stationary-plant and related operators (81) + machine operators and assemblers (82) + drivers and mobile plant operators (83). Other Occupations: legislators, senior officials, and managers (11) + life science and health professionals (22) + teaching professionals (23) + other professionals (24) + life science and health associate professionals (32) + teaching associate professionals (33) + other associate professionals (34) + personal and protective services workers (51) + skilled agricultural and fishery workers (61) + subsistence agricultural and fishery workers (62) + sales and service elementary occupations (91) + agricultural, fishery and related laborers (92) + laborers in mining, construction, manufacturing and transport (93).

C. Calculations of the Hungarian Occupational Shares Reported in Footnote 9

Campos and Zlabkova (2000) report on the occupational distribution in Hungary in 1986, 1989, 1992, 1995, and 1998, based on the Wages and Earnings Survey, which is an enterprise survey dataset. In the survey dataset, the old occupational codes, called FEOR, are used for the first three years while the new HSCO-93 (FEOR-93) codes are used for the last two years. The authors present all data according to the two-digit HSCO-93 codes after mapping the old codes to the new ones. The mapping is unavoidably arbitrary and the pre-1993 data and the post-1993 data are not comparable. Nonetheless, we conducted the grouping exercise on the 1986, 1989, and 1992 data, without converting them once again to ISCO-88. The details of the grouping of occupation codes are as follows:

Business Occupations: managers of business and budgetary institutions (13) + general managers of small enterprises and budgetary institutions(14) + business, legal and social science professionals (25) + business and financial intermediary clerks (36) + office clerks (41) + management (consumer services) clerks (42) + wholesale and retail trade, hotels and restaurants workers (51) + non-material service workers (53). Technical Occupations: engineering and natural science professionals (21) + technicians and related associate professionals (31) + extraction workers (71) + food processing and related trades workers (72) + light industry workers (73) + steel and metal trades workers (74) + handicraft, miscellaneous industry and warehouse workers, laboratory assistants (75) + construction workers (76) + manufacturing machine operators (81) + other stationary-plant operators (82) + mobile-plant operators (83). Other Occupations: legislators, senior government officials, senior officials of nation-wide special-interest organizations (11) + senior officials of regional and local self-government, public administration, jurisdiction and special-interest organizations (12) + health professionals (22) + welfare, labour service professionals (23) + teaching professionals (24) + cultural, sport, artistic professionals (26) + professionals n.e.c. (29) + health associate professionals (32) + welfare and labour market services occupations (33) + teaching associate professionals (34) + legal, life and property protection services associate professionals (35) + cultural, sport, artistic and religious associate professionals (37) + clerks n.e.c. (39) + transport, postal and communications workers (52) + skilled agricultural workers (61) + skilled forestry and farming workers (62) + skilled fishery workers (63) + plant protection, plant health protection and soil conservation workers (64) + elementary services occupations (91) + agricultural and forestry labourers (92).

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7 | Unemployment and the Social Safety Net during Transitions to a Market Economy: Evidence from the Czech and Slovak Republics

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The Central and East European (CEE) countries are completing the first decade of a dramatic transition from a centrally planned economy to a market system. Although economic outcomes have been diverse, all CEE countries (except for the Czech Republic) have experienced rapidly rising and persistently high unemployment rates, which have been accompanied by long spells of unemployment. By contrast, in the Czech Republic the unemployment rate has remained low and unemployment spells have been short.

The unemployment crisis in the CEE countries has contributed to a political backlash as disenchanted voters often ousted the first reform governments after a few years.[1] This experience underscores the importance of two *separate* questions: (1) Why has the unemployment problem associated with the transition to market economies been much less severe in the Czech Republic?; and (2) How can economies in transition strike a balance between (i) reducing government intervention and introducing market incentives, and (ii) providing an adequate social safety net that ensures public support for the transition? In addition to being of academic interest, answers to these two questions are essential for policy makers in the CEE countries, in Western governments, and at international institutions such as the World Bank and the International Monetary Fund.

When addressing the first question, and comparing the Czech experience to that of the other CEE countries, policy makers and researchers are hampered by the difficulty in accounting for differences in relevant laws and institutions, and in the definitions of economic and demographic variables. To minimize this difficulty, we collected parallel micro data sets from the Czech and Slovak Republics. The Slovak Republic (SR) is a natural "comparison" country for the Czech Republic (CR) for addressing this question because the two republics were one country from 1918 until January 1993 (except during World War II). As a result, the republics shared the same laws and regulations, institutions, currency, and government programs.

Despite this common history, the two republics' labor markets have performed substantially differently since the "Velvet Revolution" that overthrew the communist government in November 1989. In January 1990, the unemployment rates in both the Czech and Slovak regions of Czechoslovakia stood at 0.1 percent. However, as may be seen from Table 1, in 1991 the average unemployment rate was 11.8 percent in the SR and by 1996 it had increased to 12.8 percent of the labor force. By contrast, in the CR, the unemployment rate rose to 3.7 percent in 1991, and by 1996 it had decreased to 3.2 percent of the labor force.[2]

As may also be seen from Table 1, all the CEE economies experienced similar declines in GDP in the early 1990's. (Note that Poland's transition, and hence its

1 See Olivier J. Blanchard (1997) for a theoretical model of the effect of worsening economic conditions on worker opposition to enterprise restructuring.

2 See Ham et al. (1995) for a detailed discussion of the Czech and Slovak labor markets during the early part of the transition.

Table 1: Macroeconomic Statistics for Selected Central and East European Countries

	Unemployment rate	GDP growth	Inflation rate (CPI)	Inflow rate	Outflow rate
Bulgaria					
1990	1.5	-9.1	70[b]	–	–
1991	11.5	-11.7	339	–	7.0
1992	15.6	-7.3	79	1.7	9.2
1993	16.4	-2.4	64	1.4	6.8
1994	12.8	1.8	122	1.5	10.2
1995	10.5	2.1	33	1.5	11.6
1996	12.5	-9.0	123[c]	1.7	11.3
Czech Republic					
1990	0.8	-1.2	10[d]	–	–
1991	4.1	-11.5	52	0.9	17.1
1992	2.6	-3.3	13	0.9	26.6
1993	3.5	0.6	18	0.7	22.0
1994	3.2	2.7	10	0.6	21.3
1995	2.9	5.9	8	0.6	21.3
1996	3.3	4.2	9	0.6	19.3
Hungary					
1990	1.9	-3.5	29[c]	–	–
1991	7.5	-11.9	32	–	–
1992	12.3	-3.1	22	0.9	6.6
1993	12.1	-0.6	21	1.3	7.7
1994	10.4	2.9	21	1.1	9.1
1995	10.4	1.5	28	1.0	7.9
1996	10.5	1.0	24	1.3	9.4
Poland					
1990	6.1[a]	-11.6	585[f]	–	–
1991	11.8[a]	-7.0	60	–	–
1992	13.6[a]	2.6	44	0.9	4.3
1993	15.7[a]	3.8	38	1.1	4.8
1994	16.0[a]	5.2	29	1.2	6.2
1995	14.9[a]	7.0	22	1.3	8.0
1996	13.6[a]	5.5	20	1.2	8.2
Slovak Republic					
1990	1.5	-2.5	10	–	–
1991	11.8	-14.6	58	1.3	4.8
1992	10.3	-6.5	9	1.1	10.2
1993	14.4	-3.7	25	1.5	7.8
1994	14.8	4.9	12	1.3	7.4
1995	13.1	6.8	7	1.4	9.5
1996	12.8	7.0	6	1.4	10.0

Notes: Inflow rates are average annual rates of the number flowing into unemployment in a month divided by the number employed in a month, multiplied by 100; outflow rates are average annual rates of the number flowing out of unemployment in a month divided by the number unemployed in a month, multiplied by 100.

Sources: Columns 1,4, and 5: OECD-CET Labour Market Data Base; columns 2 and 3: European Bank for Reconstruction
Transition Report 1997, except where noted below.

[a] European Bank for Reconstruction Transition Report 1997 and *Transition Report Update*, April 1997.

[b] Retail trade price. Economist Intelligence Unit, *Bulgaria Country Report* (1st Quarter, 1992 p. 5).

[c] Economist Intelligence Unit, *Bulgaria Country Report* (4th Quarter, 1997 p. 9). Percent change in average consumer prices.

[d] Economist Intelligence Unit, Czechoslovakia Country Report (1st Quarter, 1992 p. 3).

[e] Economist Intelligence Unit, Hungary Country Report (1st Quarter, 1992 p. 3).

[f] Economist Intelligence Unit, Poland Country Report (1st Quarter, 1992 p. 3).

decline in GDP and rise in unemployment, started one year earlier than in the other CEEs.) The statistics in Table 1 also show that while the CR had a lower inflow rate to unemployment than the other CEEs, the most important reason for the CR's lower unemployment rates was its considerably higher rate of outflow from unemployment.[3] Hence, the Czech economy was undergoing similar restructuring as the other CEE countries in terms of GDP decline, but it was able to reemploy its unemployed at a faster rate than others. On the other hand, Slovakia's unemployment rates and its rates of inflow to, and outflow from, unemployment were quite similar to the other CEE countries. An analysis of the different transition rates from unemployment in the Czech and Slovak Republics is therefore key to understanding the unemployment problem in the CEE region in general. From a longer-term perspective, this analysis is also useful vis-a-vis Russia and other newly independent states. These countries launched their transitions much later than the CEE countries, but in recent years they encountered similar problems of high unemployment rates coupled with relatively low rates of outflow from unemployment.

In order to provide an understanding of the differences in labor market performance between the CR and SR (i.e., to answer the first question), we estimate the relative effects of various variables, including demographic characteristics, local labor demand conditions, and features of the unemployment compensation system (UCS), on the probability that an individual leaves unemployment (the hazard function) in each republic. We derive and implement an Oaxaca-type decomposition of the difference in the (nonlinear) expected unemployment durations between the CR and SR in order to determine which factors account for the differences between the two countries. Finally, we discuss additional factors that may underlie the decomposition and thus may be important for explaining the Czech and Slovak differences in unemployment.

To answer the second question above and assess the disincentive effects of the UCS, we use estimates of the hazard function for UCS recipients to calculate the effect of marginal changes in the UCS. Within each republic, we also compare the experience of recipients and nonrecipients of unemployment benefits to obtain an alternative (inframarginal) measure of the impact of the UCS on the duration of unemployment in each country.[4] The average unemployment spell lasts three to

3 During the period of our study, 1991–1993, the average CR and SR inflow rates were 0.8 and 1.3, respectively, while the corresponding outflow rates were 21.3 and 7.6. Note that it is during this period that the unemployment rates diverged between the Czech Republic on one hand and Slovakia and the other CEE countries on the other hand.

4 We propose a new identifications trategyt hatp rovides relatively precise estimates of the effects of the UCS on the recipients in the two republics. Since the compensation schemes are similar across the CEE countries (see Section 3), our approach should be of general interest to those studying the UCS in the other CEE countries. For examples of studies that examine the unemployment duration effects of the UCSs in CEE countries, see John Micklewright and Gyula Nagy (1994), Jennifer Hunt (1995), Patrick Puhani (1996), and Joachim Wolfe (1997).

four times longer in Slovakia than in the Czech lands. Our first principal finding, based on an Oaxaca-type decomposition, is that for recipients nearly one-half of this difference is explained by different values of the explanatory variables in the two republics. The remaining one-half is accounted for by the different behavior of firms, individuals, and institutions in the labor market, as reflected by differences in the coefficients of the hazard functions. For nonrecipients, nearly 40 percent of the difference in expected duration between the two republics is due to differences in explanatory variables, and the remaining 60 percent is due to differences in coefficients. An important finding in this context is that the CR, unlike the SR and perhaps other CEE economies, was able to absorb the low-skilled unemployed into employment at a rate similar to the rate it absorbed the skilled unemployed. Below we argue that the principal factors underlying the different coefficients of the hazard function are the faster growth of the service sector, more rapid privatization, greater inflow of foreign investment, lesser impact of the decline in military production, and stricter enforcement of labor regulations in the CR than in the SR. Further, differences are also likely due to the ages and locations of factories in the two republics, and the greater opportunities for the Czechs than the Slovaks to work in neighboring Western economies. We find that among the recipients of unemployment benefits, the contribution of the explanatory variables comes almost entirely from differences in demand conditions between the two republics; relatively little of the difference in expected unemployment duration comes from differences in the demographic variables. However, for nonrecipients slightly more than one-half of the contribution of the explanatory variables arises from differences in demographic characteristics of this group between the two republics.

With respect to our second question, we find that in both republics the unemployment compensation system has only a moderately negative effect in terms of lengthening an unemployment spell.[5] Thus policy makers in both the low and high unemployment transition economies have considerable latitude in providing an adequate social safety net without jeopardizing efficiency. This finding is important because the negative sociopolitical backlash to the transition measures has been significant and an adequate social safety net may be a prerequisite for rallying sufficient popular support to complete the transition.

The paper is organized as follows. In Section 1 we describe our data, while in Section 2 we outline the principal features of the UCS in the CEE countries, and in the CR and SR in particular. In Section 3 we present our estimation strategy. In Section 4 we first discuss the determinants of the probability of leaving unemployment in each republic, focusing on the effects of the UCS, demographic characteristics, and demand conditions. We then compare the expected durations

5 Note that although the republics share the same UCS, individuals may respond differently to the system in the two republics. We find that the response to a change in unemployment benefits is lower in the SR than in the CR, while the effect of an increase in entitlement is similar across the two republics.

of recipients to nonrecipients to obtain an alternative estimate of the effects of the UCS. In Section 5 we decompose the difference in the expected duration of unemployment spells between the CR and SR for both recipients and for nonrecipients. Since the econometric results point to differences in individual, firm and institutional behavior, we then discuss the ctors underlying these differences. We conclude the paper in Section 6.

1. The Data

For this study, we collected data on a stratified random sample of 3,000 Czech and 3,000 Slovak men and women who registered at their district labor offices as unemployed between October 1, 1991, and March 31, 1992.[6] We followed these individuals from the time of their registration to the end of their unemployment spell or the end of July 1993, whichever came first. Since the labor market experience of men and women is likely to differ, in this paper we focus on men's experience. Moreover, we selected individuals who were not in retraining, did not suffer a prolonged illness, and had no missing values.[7] This yielded data on 780 men in the CR and 1,063 men in the SR who received unemployment benefits (recipients), and 482 men in the CR and 229 men in the SR who did not receive benefits (nonrecipients).

The basic sample statistics for each group are given in Table B1 in Appendix B. As may be seen from the table, in the CR a recipient had a 0.052 average probability of leaving unemployment for a job in a given week, while the average transition rate for a nonrecipient was 0.063. In the SR the weekly transition rates from unemployment to employment for recipients (0.020) and for nonrecipients (0.019) were much lower than those in the CR. The differences in the two labor markets are also illustrated by the fact that in the CR only 11.3 percent of the recipients, and 16.1 percent of the nonrecipients, did not exit for a job during our sample period, while in the SR the corresponding figures were 34.2 percent and 38.2 percent, respectively.[8] Moreover, a much smaller proportion of recipients exhausted their benefits in the CR (0.135) than in the SR (0.455). Finally, it should be noted that the mean previous wages and unemployment benefits differ only slightly, reflecting the institutional similarities across the CR and SR. (We discuss the remaining explanatory variables in the second half of the table in Section 3, when we describe the econometric model.)

6 During this period there were 78 districts in the Czech Republic and 38 districts in the Slovak Republic. We first randomly selected 20 districts in each of the two republics and then randomly selected 150 individuals in each district labor office.

7 Within our sample, 42 individuals in the CR and 43 individuals in the SR entered training. This group is too different from the rest of the sample to justify inclusion and too small to warrant separate estimation.

8 Note that the probability of leaving unemployment refers to a given week, while the percentage of recipients that did not exit for a job refers to the sample period, which could be as long as 1.75 years.

2. Characteristics of the Unemployment Compensation System

With the advent of unemployment at the start of the transition, all CEE countries designed and implemented unemployment compensation systems. As they struggled to strike a balance between providing an adequate social safety net and reducing government intervention while controlling their budget deficits, these governments decided within one or two years to reduce the level of protection in unemployment. In this section we first show that the principal features of the UCSs in the CEE countries have been quite similar, and then we describe in more detail the UCS systems in the Czech and Slovak Republics. The material in this section is important for understanding and modeling the disincentive effects of the UCS and for assessing the applicability of our methodology and findings to other CEE countries.

2.1 The Unemployment Compensation Systems in CEE Countries

By the end of 1991, UCSs had been established in all CEE countries. We briefly highlight the principal features of these systems from late 1991 to 1993, the period of our study.[9] In terms of who was eligible to collect unemployment compensation, all the CEE countries required a minimum period of previous employment that ranged from six months during the preceding year (Bulgaria, Poland, and Romania) to one year in the preceding three years (CR, SR, and Hungary). The minimum working period was waived for new graduates. A second similarity is that the length of time over which unemployment compensation could be collected did not vary across workers. This was true in the CR and SR, as well as in Albania, Poland, and Romania.[10] Third, in all of the CEE countries except Albania, the levels of unemployment benefits were based on fixed replacement rates of previous wages that did not vary with worker characteristics. Fourth, except for Bulgaria and Poland, these replacement rates fell over the entitlement period for all workers. Fifth, all the CEE countries (except Poland) imposed a similarly low maximum level of benefits (between 1.4 and 2.0 times the minimum wage). Finally, there was no indexation of benefits for inflation in any of the CEEs.

2.2 The Czech and Slovak Unemployment Compensation System

In January 1990, Czechoslovakia introduced UCS that was liberal when compared to the UCS in the United States, but not when compared to West European systems. As in the other CEEs, the government soon began to reduce benefits and tighten entitlement provisions. In this section we focus our discussion on the three main features of the system eligibility, entitlement, and benefits during the period covered by our study. Except for one feature noted below, the system was

9 See Organization for Economic Cooperation and Development (OECD) (1995) for further details.

10 Since then, Poland has had two entitlement periods, with a higher one for those employed for 25–30 years or in certain regions of the country.

essentially identical in the CR and SR through the end of 1993 (i.e., even after the "Velvet Divorce" between the two republics in January 1993).

Eligibility. Anyone who worked for at least 12 months in the preceding three years was immediately eligible for unemployment benefits, unless the person was fired for cause or quit repeatedly.[11] Students at the time of their graduation from high school or university were also eligible. Until January 1992, individuals out of the labor force were eligible if they had cared for a young child or a sick/disabled relative, or if they were in the military or imprisoned, for 12 months in the previous three years. After January 1992, individuals who were out of the labor force and not taking care of children were no longer eligible.

Entitlement. In 1991, all eligible unemployed individuals were entitled to 12 months of benefits. On January 1, 1992, entitlement was reduced to six months. Since there was no "grandfather clause," those who became unemployed after July 1, 1991, received a maximum of only six months of benefits.

Benefits. For most of those who worked before entering unemployment, the level of benefits was set in 1991 at 60 percent of the person's previous net wage for the first six months of unemployment. However, individuals who were laid off because of major organizational changes (redundancy) had benefits set at 65 percent of their previous wage.[12] For both groups, the replacement rate fell to 50 percent in the second six months of the entitlement period. On January 1, 1992, the replacement rate in the first half of the entitlement period became 60 percent for workers laid off for redundancy.[13] Throughout the period, those who had never worked before received benefits equal to 60 percent of the minimum wage in the first half of the entitlement period and 50 percent in the second half of this period.

In 1991, a minimum benefit level was set at 60 percent of the minimum wage but there was no maximum level. In January 1992, a maximum level equal to 150 percent of the minimum wage was imposed. Throughout the period, a family could receive social assistance (welfare) in addition to unemployment compensation if the sum of the unemployment benefits and the income of other household members was less than the household minimum living standard (MLS).[14] Once benefits expired,

11 Individuals who were fired for cause or quit repeatedly were eligible for unemployment benefits after a six-month waiting period.

12 Those dismissed for redundancy also received severance pay. In principle, severance pay was treated differently in the two republics until January 1992. In the CR an individual was not eligible for unemployment benefits while collecting severance pay. From January 1990 to January 1992, the Slovak authorities allowed the unemployed to receive severance pay concurrently with unemployment benefits. However, most Slovaks who received severance pay did not collect unemployment benefits until they had exhausted their severance pay.

13 Throughout 1991–1993, anyone undertaking training received a benefit of 70 percent of his/her previous wage during the training period.

14 The MLS is equivalent to the household poverty line in the United States. See Terrell and Daniel Münich (1996) for a detailed description of the MLS in the CR, and Terrell et al. (1996) for an equivalent description for the SR.

the unemployed were eligible for social assistance if their household income was below the MLS. All single individuals were eligible for welfare benefits, while a married person was only eligible if the combined income of the other household members was below the household MLS.

Registered Unemployed Who Are Ineligible for Benefits. A significant number of individuals who were ineligible for unemployment benefits registered as unemployed. Some registered in order to obtain the assistance of the district labor office in finding a job. Registration was also a prerequisite for receiving welfare. As noted above, those who did not have the necessary work experience in the previous three years (or its equivalent) were ineligible, as were those who were fired for cause or quit repeatedly. Further, if a graduating student started a job and lost it before acquiring 12 months of experience, he was not eligible for benefits.[15]

As will be seen below, we have taken these principal UCS features into account when developing an econometric approach for estimating the effects of changes in the UCS characteristics on unemployment duration.

3. The Estimation Strategy

3.1 Econometric Model

We analyze the durations of Czech and Slovak unemployment spells, and their differences, using a duration model. This model is preferable to a regression model because factors such as demand conditions and unemployment benefits change over an individual's unemployment spell and this nonstationarity cannot be captured in a regression framework."[16] For each country we denote the hazard function (the probability of leaving unemployment to employment) in week r of an unemployment spell as[17]

$$\lambda(r\,|\,\theta) = (1 + \exp(-y(r\,|\,\theta)))^{-1} \tag{1}$$

where

$$y(r\,|\,\theta) = \mathbf{Z}(r)\boldsymbol{\gamma} + \alpha_o B(r) + \alpha_1 W + g(E(r)) + h(r) + \theta. \tag{2}$$

15 For a discussion of those covered and not covered by unemployment compensation in the United States, see Rebecca M. Blank and David E. Card (1991).

16 See e.g., Christopher Flinn and James J. Heckman (1982), Heckman and Burton Singer (1984a), Nicholas M. Kiefer (1988), and Tony Lancaster (1990). See also Theresa J. Devine and Kiefer (1991) for a comprehensive survey of previous empirical studies.

17 All variables in equations (1) and (2) are individual specific. We have omitted the individual subscript for expositional ease. In an earlier version of the paper, we also considered a multiple exit version of the model since a substantial number of individuals in the CR (but not the SR) leave unemployment for self-employment instead of for a new job. We estimated a separate transition rate for finding a new job and for becoming self-employed. However, the data were not rich enough to estimate these transition rates separately. Thus we treat exits to self-employment as exits to employment in calculating the above hazard.

In equation (2), the term $\mathbf{Z}(r)$ contains variables measuring demographic characteristics and demand conditions in week r, while the vector $\boldsymbol{\gamma}$ contains the corresponding set of parameters. Differences in both the variables and coefficients will determine the differences in the probability of leaving unemployment in the two republics. The means of these variables are given in Appendix Table B1. Except for age, the demographic variables are in a dummy variable form; the only ones requiring explanation are the "recent graduate" and the education variables. The recent graduate variable is coded 1 if an individual graduated within the last year from a university or high school.[18] We use three dummy variables for educational achievement: (i) graduates of a vocational high school or an apprenticeship, (ii) graduates of an academic high school, and (iii) those with some post-high-school (university) education. The control group consists of those with only a junior-high-school education, the minimum level of education required by law.

We use three variables to account for differences in demand conditions. The first two – quarterly data on district unemployment rates and district vacancy rates for the individual's education group – take on values that change quarterly over the duration of a spell and across individuals.[19] The third variable is the real value of per capita industrial production in the district in a given year.[20] This variable takes on different values across calendar years and across districts. In addition, for each district we use the ratio of the 1991 employment in agriculture to employment in industry to capture the differences in the economic structure across districts at the beginning of the transition.[21]

As may be seen from Appendix Table B1, there are substantial differences in the average values of the demand variables between the two republics. In contrast, there are only small differences in the demographic characteristics between (1) the Czech and Slovak recipients, and (2) the Czech recipients and nonrecipients.[22] However, there appear to be more substantial differences between recipients and nonrecipients in Slovakia, as well as between the nonrecipients in the two republics (see e.g., education, marital status, and living in the capital city). In equation (2),

18 Since by definition previous wages do not exist for new graduates, we set their wages to 0. Thus the new graduate coefficient also picks up the wage effect. This is equivalent to imputing a common real wage for these individuals.

19 The denominator in both of these rates is the relevant population group, rather than labor force group, since the number employed by education group and district are not available for this period. We were concerned that the district-level data might be too noisy, particularly in the SR where regional differences are smaller than in the CR. To address this issue more aggregate measures were constructed: the unemployment and vacancy rates by education in the individual's district plus the congruent districts. Since the use of these more aggregate measures did not affect the results, we focus on the results for the district variables.

20 The industrial production variable is available only at an annual frequency. It is a price-weighted composite of total per capita industrial production in the district in 1991 prices.

21 We would also like to control for differences in employment in services across and within the two republics. Unfortunately, data on employment in services are not available at the district level for our sample period.

22 The main exception is the proportion of Romany (gypsies), which is higher for nonrecipients than recipients in both countries and higher in Slovakia than in the Czech Republic.

$B(r)$ denotes unemployment benefits in week r, W is the individual's previous weekly wage, and $g(\cdot)$ is a function of remaining entitlement $E(r)$ in week r. For each republic, we parameterize $g(\cdot)$ as a linear function of: (i) remaining weeks of entitlement, (ii) a dummy for the last week of entitlement before benefits have been exhausted, and (iii) an exhaustion dummy equal to 1 for all weeks after entitlement has been exhausted. We allow for separate coefficients on these last three entitlement variables for married and single men, since single men will most likely be eligible for welfare after exhaustion of benefits and this is not necessarily true for the married men.[23]

The term $h(r)$ represents the effect of duration dependence on the hazard and θ denotes an unobserved heterogeneity component. In the case of time-constant explanatory variables, it is well known that ignoring unobserved heterogeneity or duration dependence biases the coefficients of the explanatory variables. In our case, both benefits and remaining entitlement are linked to duration, and we would expect the potential bias from ignoring heterogeneity or duration dependence to be more serious than in the case when they are not linked.[24] As a result, we use a polynomial in log duration to measure duration dependence and we account for unobserved heterogeneity using the nonparametric approach developed by Heckman and Singer (1984b).[25] We estimate the model by maximum likelihood (see part 1 of Appendix A). Since it is difficult to interpret the parameter estimates of the hazard function, we use these estimates to calculate the effect of changing any given explanatory variable on the expected duration of unemployment.

3.2 Identification of the Czech and Slovak Unemployment Compensation Parameters

When estimating the impact of unemployment benefits on unemployment durations, it is necessary that the benefit levels vary independently from other determinants of the duration of recipients' spells, particularly previous wages. We use five sources of independent variation in benefit levels. First, in 1991 those who were laid off for redundancy had a replacement ratio of 65 percent of their previous

23 We do not have sufficient information to impute welfare benefits for single or married men; therefore we set the value of benefits to zero once an individual exhausts his unemployment compensation. Thus the exhaust dummy (interacted with marital status) implicitly picks up the level of welfare benefits after exhaustion.

24 For example, assume that there is no duration dependence but that there is unobserved heterogeneity. Consider measuring the effect of lowering benefits at 13 weeks, which we would expect to raise the hazard. However, the measured hazard in week one could be higher than the average hazard at 13 weeks because the unobserved characteristics of workers who stay unemployed make them less likely to leave unemployment. If we ignore unobserved heterogeneity, the benefits coefficient will be biased upwards. Alternatively, assume we have negative duration dependence but no unobserved heterogeneity, and consider estimating the effect of changes in entitlement. Since entitlement generally falls as duration increases, ignoring duration dependence also will bias the estimated entitlement coefficient upwards.

25 Following the results of Michael Baker and Angelo Melino (1997), we are conservative in choosing the degree of the polynomial and the number of support points of the heterogeneity distribution. (See part 1 of Appendix A for more detail.)

wage in the first 13 weeks, while the replacement ratio was 60 percent for other workers. Second, the replacement ratio dropped to 50 percent from the thirteenth to twenty-sixth week of compensated unemployment for all individuals. Third, a maximum benefit level was imposed in 1992. Fourth, a number of individuals had their benefits raised to the minimum level of benefits. Fifth, unemployment benefits were not indexed to inflation and hence we discount benefits by monthly movements in the consumer price index in order to capture the erosion of the real value of benefits over time. On the other hand, we assume that the appropriate proxy for the mean of the worker's wage offer distribution is his real wage (in October 1991 prices) at the time he began his spell. Prices and nominal wages rose by approximately 30 percent from the last quarter of 1991 to the second quarter of 1993, the period covered by our data (Karel Dyba and Švejnar, 1995).

Similarly, when estimating the impact of the length of remaining entitlement on unemployment durations, it is also necessary that the weeks of remaining unemployment compensation to which a recipient is entitled be independent of other determinants of the hazard function, particularly current duration.[26] In our empirical work, the principal source of this variation in remaining entitlement comes from the significant number of individuals who do not register for unemployment benefits at the time of their job loss. For such individuals, remaining entitlement is not a simple linear function of current duration and initial weeks of entitlement (which is constant across the sample).[27] One reason that individuals register late for unemployment benefits is that they usually exhaust their severance pay before collecting benefits. Other individuals simply wait to collect benefits; this phenomenon is similar to the phenomenon of less than full take-up of unemployment benefits in the United States (see e.g., Patricia M. Anderson and Bruce D. Meyer, 1997).

It is worth noting that the variation in benefit levels and remaining entitlement is larger in magnitude than the variation used in studies of unemployment durations in Canada and West European countries. It is probably not as large as the variation found among unemployment insurance recipients in the United States. In our empirical work we find that we have sufficient variation in benefit levels and entitlement to estimate precisely the impact of benefits and entitlement on the duration of unemployment spells.

26 We cannot exploit the fact that individuals in 1991 received a year of entitlement while individuals in 1992 received only six months of entitlement. The change in the system was known as early as October 1991 and, as noted above, individuals beginning a spell in 1991 were not grandfathered. Because the CR and SR systems were being computerized in 1991, we were unable to obtain micro data on unemployment spells prior to October 1991.

27 Using late registrants does complicate the econometric framework. See part 2 of Appendix A for a discussion of the relevant issues and the results of our addressing these complications in our empirical work.

3.3 An Alternative Measure of the Differential Impact of the Unemployment Compensation System in the CR and the SR

When addressing the second question raised in the introduction, we can use the estimated hazard function for recipients to calculate the effect of marginal changes in the UCS on average unemployment duration, e.g., the effect of a one-week increase in entitlement. We can also address this question from a different angle by exploiting data on recipients and nonrecipients to obtain an estimate of the impact of an inframarginal change in the UCS.[28] First, consider the hypothetical scenario where we make a recipient ineligible for unemployment compensation. Note that a simple comparison of the expected durations of recipients and nonrecipients does not yield the correct magnitude since it does not control for differences in the characteristics of the recipients and nonrecipients. Instead, for each republic we calculate the effect on unemployment duration of letting recipients keep the values of their explanatory variables but assigning them coefficient values of the nonrecipients.[29] Since the variables relating to unemployment compensation are not available for the nonrecipients, we use a smaller set of explanatory (demographic and demand) variables, $\mathbf{X}^*_{nr}$, to estimate the hazard rate for the nonrecipients. Denote the same smaller set of variables for recipients as $\mathbf{X}^*_r$, and the corresponding parameter estimates for nonrecipients and recipients as $\boldsymbol{\beta}^*_{nr}$ and $\boldsymbol{\beta}^*_r$ respectively. Formally, we calculate

$$\text{(3)} \qquad \text{Diff } 1 = ED(\boldsymbol{\beta}^*_{nr}, \mathbf{X}^*_r) - ED(\boldsymbol{\beta}^*_r, \mathbf{X}^*_r),$$

where $ED(\boldsymbol{\beta}\ , \mathbf{X}\ )$ denotes the expected duration of unemployment at the mean values of the $\mathbf{X}$s.[30] (In order to streamline notation, in what follows we simply use $\mathbf{X}$ to denote mean values in the expected duration calculations.) We call this "moving someone from being a recipient of unemployment insurance to being a nonrecipient."

We also calculate the effect of moving someone from the nonrecipient category to the recipient category. To do this we let nonrecipients keep their mean values of the explanatory variables but take on the recipients' parameter values. Formally we calculate

$$\text{(4)} \qquad \text{Diff } 2 = ED(\boldsymbol{\beta}^*_r, \mathbf{X}^*_{nr}) - ED(\boldsymbol{\beta}^*_{nr}, \mathbf{X}^*_{nr}).$$

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28 See also Steven Marston (1975) and Bruce C. Fallick (1991) for a comparison of recipients and nonrecipients. Phillip B. Levine (1993) allows increases in unemployment benefits to affect the duration of nonrecipients' spells because they may increase recipients' spells. We do not have enough data to implement his approach.

29 Ideally we would like to control for unobserved differences between the recipients and nonrecipients. To do this we would need to estimate a duration model with sample selection (see Ham and Robert J. LaLonde, 1996). To identify and estimate such a model, we need a variable that determines whether someone was a recipient or not, but does not affect their unemployment duration. We could not find a credible exclusion restriction with which to identify the selection model.

30 See part 3 of Appendix A.

3.4 Decomposing the Difference in Czech and Slovak Expected Unemployment Duration

To address our first research question, regarding the factors determining the differences in the expected durations of unemployment in the two republics, we derive and use a nonlinear Oaxaca-type decomposition. Let $\boldsymbol{\beta}_j$ denote the entire vector of parameter estimates from equation (2) for republic j and $\mathbf{X}_j$ denote the vector of mean values of the explanatory variables in republic j, where $j = c$ represents the CR and $j = s$ represents the SR. The difference in the expected durations between the Slovak and Czech Republics is given by

(5) $$ED_s - ED_c = ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c).$$

In part 3 of Appendix A, we show how we calculate the extent to which the difference in the expected durations is due to: (i) differences in the average characteristics of the Czechs and Slovaks ($\mathbf{X}_c$ and $\mathbf{X}_s$), and (ii) differences in the coefficients ($\boldsymbol{\beta}_s$ and $\boldsymbol{\beta}_c$). Moreover, we can decompose the contribution of the explanatory variables into the contribution of: (i) demand variables, and (ii) other variables, including the demographic ones. It is not possible to carry out a similar decomposition of the coefficients. (See e.g., Ronald Oaxaca and Michael R. Ransom, 1995.) We carry out the decompositions for both recipients and nonrecipients in the two republics.

Since the CR and SR have the same UCS, we would not expect the UCS variables to affect the contribution of the differences in the explanatory variables (especially given the similarity of mean previous wages across the republics). However, different responses to the UCS in the two republics will affect the contribution of the coefficients. Further, by examining the impact of the UCS in each republic, we are able to ascertain the direction of this effect, even if we cannot obtain a quantitative estimate because of the Oaxaca-Ransom result.

4. Factors Affecting the Probability of Leaving Unemployment in the CR and the SR

4.1 The Duration Effects of the Unemployment Compensation Variables

The estimated effects of changes in the UCS on the probability that an individual will leave unemployment in the CR versus SR are presented in Table 2. In Panel A of the table we present the estimates of the hazard coefficients for selected variables for the two republics.[31] (A negative coefficient indicates that an increase in the variable reduces the exit rate.) In Panel B we use the estimated coefficients of the Czech and Slovak hazard functions to calculate the effect of a given change in each UCS variable on the expected duration of unemployment (in weeks) in each

31 The estimated effects of all variables are reported in Appendix Tables B2 and B3. Ham et al. (1993) provide estimates of the empirical hazard functions.

Table 2: Effects of the Unemployment Compensation System

	Czech Republic	Slovak Republic
A. Coefficients of the hazard function		
Weekly unemployment benefits	-13.622 (6.914)	-7.766 (6.370)
Previous weekly wage	0.241 (3.036)	6.609 (2.882)
Weeks of remaining entitlement*married	-0.383 (0.140)	-1.095 (0.163)
Weeks of remaining entitlement*single	-0.391 (0.134)	-0.744 (0.348)
Last week of entitlement*married	1.253 (0.363)	0.626 (0.317)
Last week of entitlement*single	-0.869 (0.762)	0.744 (0.348)
Benefits exhausted*married	-0.722 (0.349)	-0.618 (0.302)
Benefits exhausted*single	-1.686 (0.398)	-0.515 (0.346)
B. Expected duration effects (in weeks):		
Base expected duration	17.75	60.71
Benefits raised by 10 percent	0.61	0.39
Previous wage raised by 10 percent	-0.02	-1.49
Entitlement raised by 1 week	0.30	0.93
Entitlement raised by 1 week – single men	0.24	0.83
Entitlement raised by 1 week – married men	0.34	1.00
C. Elasticity of expected duration with respect to:		
Increase in benefits	0.34	0.06
Increase in entitlement	0.44	0.41
Increase in previous wage	-0.01	-0.25

Note: Standard errors in parentheses.

Source: Columns 1 and 4 of Appendix Tables B2 and B3.

republic.[32] Finally, in Panel C we report the elasticity values implied by the expected duration effects of a change in benefits, entitlement, or the previous wage in each republic.

Starting with the results for the CR in column 1 of Table 2, we find that the level of unemployment benefits has a statistically significant coefficient and that a 10 percent increase in the level of benefits causes the expected duration of an unemployment spell to rise by 0.61 of a week. Since the average expected duration of recipients is estimated at approximately 17.75 weeks, our results imply a moderate elasticity of unemployment duration with respect to benefits of 0.34. The estimated

32 Since we do not have a long time series, we calculate a truncated expected duration (at four years). See part 3 of Appendix A.

coefficients for the remaining weeks of entitlement for single and married men are both significantly negative and almost identical. However, the coefficient for the last week of entitlement is significantly positive for married men while it is negative and insignificant for single men. The difference in these coefficients may reflect the fact that single men will qualify for welfare when they exhaust their benefits while many married men will not. The exhaustion dummy is significantly negative for both single and married men.[33] The entitlement coefficients imply that an additional week of entitlement results in 0.30 of a week increase in expected duration for all men. (The respective figures for single and married men are quite similar and thus we focus on the overall effect.) The estimated elasticity of expected duration with respect to entitlement is 0.44. The coefficient on the previous wage (which proxies the opportunity cost of staying unemployed) is not significantly different from zero at standard confidence levels.

For Slovakia, the relevant results are contained in column 2 of Table 2.[34] The benefit coefficient is negative as expected and implies an elasticity of only 0.06. This coefficient is not significantly different from zero, but it is informative because the 95 percent confidence interval is relatively small. We can obtain an upper-bound estimate of the elasticity of expected duration with respect to benefits by using the lower bound of the confidence interval for the benefits' coefficient (which will have the greatest disincentive effect).[35] The resulting estimated upper bound for this elasticity equals 0.13, indicating that the disincentive effect of increasing benefits is quite small in the SR.[36] The coefficients on remaining entitlement for both single and married men are both negative and significant. The coefficients for the last week of entitlement for single and married men are positive, statistically significant, and quite similar. Hence, in contrast to the CR, there is a spike in the probability of exiting unemployment in the last week of entitlement for both married and single men. The coefficients on the benefits' exhausted variables are statistically significant, have the expected negative sign, and again are nearly identical for married and single individuals. Raising entitlement by one week increases the expected duration of unemployment by 0.93 of a week. (Again, the effects for single and married men are similar.) The estimated elasticity of expected duration with respect to raising entitlement is 0.41, which again represents a moderate disincentive effect. The previous wage has a positive coefficient and is statistically significant. A 10 percent increase in the previous weekly wage leads to a 1.49-week decrease in expected

33 Recall that this dummy also picks up the effect of welfare benefits.

34 The SR hazard coefficients are statistically different from the Czech coefficients using a likelihood ratio test.

35 The lower bound of the confidence interval is –7.77 – (1.96 x 6.37) = –20.26.

36 The effect of raising benefits by 10 percent using the lower-bound estimate of the benefits' coefficient is to increase duration by 0.772 weeks. Thus the absolute magnitude of the changes of raising benefits is similar in the two republics. However, because the base duration is so much larger in Slovakia, the estimated benefits' elasticity is much smaller in the SR.

duration, implying an elasticity of about –0.25. Thus in the SR, those with a higher opportunity cost of time leave unemployment earlier.

A comparison of our benefit and entitlement elasticities for the CR and SR with those from different hazard function studies for the United States and Canada – as summarized by Devine and Kiefer (1991 Table 5.2) – indicates that our benefit elasticities are on the lower end while our entitlement elasticities are close to the average values reported by Devine and Kiefer. Hence, there is little about the behavioral responses to the UCS system that looks different from what we have seen in the United States and Canada. Czechs and Slovaks respond to the incentives created by the UCS system in a similar way to their Western counterparts and not too dissimilar from each other. Indeed, since the relevant elasticities are lower in the SR than in the CR, tightening of the UCS would not reduce the (proportionate) difference in unemployment durations between the two republics. We must therefore turn to differences in other factors for possible explanations of the Czech-Slovak difference.

4.2 The Duration Effects of the Demographic and Demand Variables in Each Republic

The full set of coefficient estimates for recipients and nonrecipients in the CR and the SR are contained in Appendix B, Table B2, while the corresponding expected duration calculations are reported in Table B3. In these tables the estimates for Czech and Slovak recipients using the full model are contained in columns 1 and 4, respectively. We report in columns 2 and 5 of the tables the results from the smaller model for recipients in the CR and SR, respectively. Finally, columns 3 and 6 report the results (from the smaller model) for nonrecipients in each republic.[37]

Our estimation yields a number of interesting results for the demographic and demand variables. Education has a strikingly different effect in the two republics, raising the exit rates from unemployment in Slovakia but not much in the Czech Republic. Our results indicate that at least among recipients, the CR was able to absorb the displaced low-skilled workers (those without high school or higher education) into employment at about the same rate as the more educated ones, but that the SR was unable to do so. This result suggests that men with little education are a natural group to target in the SR and other CEEs. We also find that unemployment duration increases with age at a similar rate in both the CR and

37 The likelihood functions for the nonrecipients were poorly behaved, indicating that the smaller model is still too rich for the relatively small number of individuals in these groups. After eliminating the vacancy rate from the specification, the problem with the likelihood function disappeared in the SR. In the CR we obtained two optima for the nonrecipients. The optima were quite close in terms of the value of the likelihood function, and the problem remained when we changed the specification. To err on the side of being conservative, here we report the results for the optimum with the largest discentive effects of nonmarginal changes in the UCS. (The other optimum showed no disincentive effect.) This choice of optimum did not affect the CR-SR comparisons.

Table 3: An Alternative Measure of the Impact of the UCS: Recipients v. Nonrecipients (Using the Smaller Model)

	Czech Republic	Slovak Republic
Expected durations (in weeks) of:		
1. Recipient $\boldsymbol{\beta}$'s and $\mathbf{X}$'s	18.6	55.5
2. Nonrecipient $\boldsymbol{\beta}$'s and $\mathbf{X}$'s	15.6	54.8
3. Recipient $\boldsymbol{\beta}$'s, nonrecipient $\mathbf{X}$'s	17.3	65.7
4. Nonrecipient $\boldsymbol{\beta}$'s, recipient $\mathbf{X}$'s	13.7	46.3
Differences in expected durations:		
5. Recipient to nonrecipient (row 4–row 1)	-4.9	-9.2
6. Nonrecipient to recipient (row 3–row 2)	1.7	10.9

Sources: Rows 1 and 2 are taken from columns 2, 3, 5, and 6 of Tables B3.
The calculations in rows 3 and 4 are based on the coefficients in columns 2, 3, 5, and 6 of Table B2.

the SR. Single and handicapped rnen are also similarly disadvantaged (relative to base duration) in the two republics. Interestingly, Romanies are at a proportionate disadvantage in the CR, although they have very long durations in both republics. The demand variables have the expected signs, although only the unemployment rate is generally statistically significant. Differences in the agricultural industry structure across districts do not play much of a role in determining the probability of leaving unemployment in either republic.

4.3 Unemployment Duration of Recipients v. Nonrecipients

In this section we report the effect on the expected duration of unemployment of moving an individual: (i) from the recipient category to the nonrecipient category, and (ii) from the nonrecipient to the recipient category. These calculations, presented in Table 3, provide estimates of the effects of inframarginal changes in the UCS.[38] For the CR we see that the base expected duration of an unemployment spell for recipients (using the smaller model) is 18.6 weeks (row 1) and for nonrecipients it is 15.6 weeks (row 2). This implies that if we ignore the differences in characteristics between the recipients and nonrecipients in the CR, we find that moving a recipient to the nonrecipient category would reduce his average spell by 16.1 percent. In contrast, when we allow for the recipients to behave like nonrecipients using equation (3), we find (in row 5) that moving an individual from the recipient to the nonrecipient category reduces his unemployment duration by 4.9 weeks or 26.3 percent. Alternatively, when we use equation (4) we find (in row 6) that moving someone from the nonrecipient to the recipient category increases his unemployment duration by 1.7 weeks or 10.9 percent.

38 The calculations are based on the smaller model for recipients and nonrecipients (columns 2, 3, 5, and 6 of Appendix Tables B2 and B3).

In the case of the SR, a comparison of the top two rows of Table 3 indicates that the base expected duration for nonrecipients is 0.7 weeks (1.3 percent) shorter than that for recipients. However, controlling for differences in characteristics using equation (3), one finds that moving a recipient to the nonrecipient category decreases unemployment duration by 9.2 weeks or 16.6 percent (row 5). Alternatively, using equation (4) we estimate in row 6 that moving a nonrecipient to the recipient category increases unemployment duration by 10.9 weeks or 19.9 percent.[39]

Since these experiments correspond to drastic changes in public policy, we consider these effects to be moderate.[40] A related, and from our standpoint the most important, finding in Table 3 is that the difference in expected durations between the CR and SR is much greater than the difference between recipients and nonrecipients within either republic. As noted above, our comparisons of recipients and nonrecipients in Table 3 suggest that if one were to eliminate the UCS benefits, one could expect to reduce unemployment duration (averaging the two effects) by similar amounts of about 18 percent in each republic. In contrast, the results in Table 3 also indicate that if one could transplant an unemployed Slovak into the Czech system, one would reduce his expected unemployment duration by 67 percent for a recipient and 71 percent for a nonrecipient.[41] Hence, our analytical comparisons of recipients and nonrecipients indicate that eliminating the UCS in Slovakia would have a visible effect on unemployment duration, but that this radical policy change would not go very far in lowering unemployment duration in the SR relative to the CR.

5. Explaining the Difference Between the Average Czech and Slovak Unemployment Durations

5.1 Oaxaca-Type Decompositions

A primary goal of this paper is to investigate the differences in unemployment durations in the CR and SR using the Oaxaca-type decompositions. From Table 4

39 As noted above, we dropped vacancies from the specification for the SR nonrecipients. We calculated equations (3) and (4) with and without vacancies dropped from the specification for SR recipients. This change had no effect on the estimated differences. We also calculated the decomposition in equation (5) with and without vacancies in the CR nonrecipient specification, and again there was no difference in the estimates.

40 An alternative approach to this question would be to calculate the expected duration of unemployment using the estimates of the recipient hazard with entitlement and benefits set equal to zero. One could compare this measure with the base expected duration for recipients in Appendix Table B3, acknowledging that this is extrapolating well beyond the experience of recipients in the sample. One problem in this approach is how to handle the benefits exhausted variable, since this will pick up: (i) the difference in unemployment compensation and social assistance, and (ii) duration dependence. To avoid this problem, we set the benefits exhausted dummy equal to zero and set benefits equal to social assistance (but keep entitlement equal to zero) when making this calculation. Using this approach, we find that moving someone from the recipient to nonrecipient category reduces unemployment duration by 45.7 percent in the CR and by 40.6 percent in the SR.

41 This ignores differences in mean characteristics. We address this issue in Section 5, subsection 5.1.

Table 4: Decomposing the Difference in Expected Duration Between the Czech and Slovak Republics

	Recipients		Nonrecipients	
	Number	Percent	Number	Percent
$ED_s - ED_c$ (weeks)	43.0	100.0	39.2	100.0
Differences due to:				
Coefficients	22.7	52.9	24.1	61.5
Explanatory variables	20.2	47.1	15.1	38.5
Differences from explanatory variables due to:				
Demographics	(-1.2)	(-2.8)	(8.7)	(22.1)
Demand conditions	(21.4)	(49.9)	(6.4)	(16.3)

Sources: Row 1 is obtained from the base expected durations in first row, columns 1, 3, 4, and 6 of Appendix Table B3. The decomposition in rows 2 and 3 use the estimations presented in the same columns of Appendix Table B2.

we see that during the period of our study, the average recipient in Slovakia was unemployed 43.0 weeks longer than the typical recipient in the Czech Republic. The decomposition for recipients in Table 4 indicates that 20.2 weeks (47 percent) of the difference in expected duration between the two republics is due to differences in the explanatory variables, and 22.7 weeks (53 percent) is accounted for by differences in the estimated coefficients. Interestingly, virtually none of the contribution of the explanatory variables is driven by differences in the values of the demographic variables between the two republics. Instead, this contribution comes almost entirely from the demand and industry structure variables. The finding that over onehalf of the difference in unemployment duration between the two republics comes from differences in the coefficients suggests that the functioning of labor market institutions and the behavior of firms and agents in the labor market is very different in the two republics. For example, the difference in the coefficients reflects in part the fact that the CR can place most marginal workers into employment much faster than the SR can. We address this issue presently.

From column 3 of Table 4 we see that the average Slovak nonrecipient was unemployed 39.2 weeks longer than the typical Czech nonrecipient. Of this difference, 15.1 weeks (or 38.5 percent) is accounted for by differences in the explanatory variables and 29.1 weeks (61.5 percent) is accounted for by differences in the estimated coefficients. About three-fifths of the contribution of the difference in the explanatory variables is coming from the difference in demographic variables. Thus, unlike the case of recipients, among nonrecipients the differences in demographic variables play a role in explaining the difference in the expected durations between the CR and SR. As pointed out in Section 3, subsection 3.1, there are important differences in the demographic compositions of the nonrecipients in the two republics in terms of the proportions of junior high-school education, Romany, marital status, and living in the capital city. However, again the large portion explained by the differences in the estimated coefficients suggests that there are important differences in the functioning of labor market institutions, firms and individuals in the two republics.

5.2 Factors Underlying the Differences in Estimated Coefficients in the Two Republics

The differences in the estimated coefficients presumably reflect factors such as additional observed and unobserved differences in the structure of the two economies and different responses of firms, individuals, and institutions in the labor market. On the basis of interviews that we carried out with policy makers in the two countries, as well as our reading of other studies, we have identified several factors that may be important in accounting for the role played by the differences in coefficients in the decompositions:[42]

1. In the early 1990's the growth of the service sector was much faster in the CR than the SR, as was the growth of small firms.[43] This growth could not be accurately measured (at any level of aggregation) since official statistics were only gathered systematically for firms with 25 or more employees.

2. Privatization was carried out more quickly in the CR. By 1993, 53.5 percent of all workers were in private firms in CR, compared to only 32.0 percent in the SR. This phenomenon is impossible to measure at the district level, but it is important because much of the new hiring is likely to have been done by private firms.[44]

3. The age and location of factories differs across the two republics. The CR has factories that tend to be older than those in the SR, but their location was chosen by market forces before communism. Slovakia was industrialized after the communist takeover and planners determined the location of Slovak factories with little regard to the proximity of raw materials or market transportation costs. It is possible that the location factor dominated the capital vintage effect and resulted in lower reemployment probabilities in the SR.

4. The CR attracted over ten times as much foreign direct investment as the SR in the early to mid-1990's.[45]

5. Slovakia was much harder hit than the CR by the decline in military production.[46] Interestingly, much of the relative decline occurred before, rather than during, the

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42 Some of these factors may also explain the difference in observed local demand conditions.

43 See e.g., Anton Vavro (1992) and Milan Horalek (1993).

44 *Czech Statistical Yearbook* (Czech Statistical Office, 1994) and *Slovak Statistical Yearbook* (Slovak Statistical Office, 1994).

45 European Bank for Reconstruction and Development *Transition Reports* 1996 and 1997.

46 In the late 1980's, the Visegrad countries were the fifth largest arms exporters in the world. In 1989, their exports equaled $600 million (Marko Milivojevic, 1995).

transition. However, the artificially maintained full employment under central planning meant that this labor redundancy manifested itself when market forces started to operate in the early 1990's. Indeed, the peak in Czechoslovak military production occurred in 1987, when military production is estimated to have accounted for 3 percent of total industrial production and generated 73,000 direct jobs and 50,000 to 70,000 indirect jobs. At this time, the value of Slovakia's military production was 50 percent above that of the Czech Republic.[47] In 1988 military production started to decline in both republics, but the decline was much greater in Slovakia. In the 1988–1990 period, the value of military production (in constant prices) dropped by 48 percent in the SR and 35 percent in the CR. The real value of military production fell by an additional two thirds between 1990 and 1992, and the rate of decline may have been slightly faster in the SR than in the CR (Ladislav Ivanek, 1994)[48]

6. It has been easier for the Czechs than for the Slovaks to work in neighboring Western countries. The CR has a border with (former West) Germany, whereas the SR does not, and Germany pursued lenient policies toward guest workers from the former Czechoslovakia.[49] Moreover, the CR has a longer border with Austria than the SR.

7. Finally, from discussions with policy makers and district labor officers in both republics, it appears that in these early years the Czech officials were stricter in enforcing the eligibility and entitlement requirements of the UCS than the Slovak officials. This result is consistent with the larger ratio of nonrecipients to recipients in the CR sample as compared to the SR sample.[50]

6. Concluding Remarks

One of the most important issues encountered in CEE economies as they abandoned central planning has been the emergence of a low (3–5 percent) unemployment rate in the Czech Republic, together with a high (double-digit) unemployment rate in Slovakia and all the other CEE countries. Since the differential rise in unemployment in the early phases of the transition was brought about primarily

47 Since the Slovak labor force is almost exactly one half of the Czech labor force, the extent of military production relative to the size of the economy was clearly much larger in Slovakia than in the Czech Republic.

48 An offsetting factor was the fact that the Czechoslovak federal government contributed significantly to the conversion efforts of the military producers – about $50 million in 1991 and $35 million in 1992. These subsidies tended to mitigate the relative unemployment levels in the two republics, as three-fourths of the subsidy in each year went to producers in Slovakia.

49 In the southern German State of Bavaria, workers from the former Czechoslovakia were even allowed to work without a work permit.

50 Note that the difference in enforcement cannot be the only factor determining the difference in expected durations between the two republics, given the large difference in the expected durations of nonrecipients between the CR and SR.

by much higher rates of exit from unemployment to employment in the CR than in Slovakia and other CEE economies, a principal goal of this paper was to investigate the nature and causes of the difference between these exit rates. Since the Czech and Slovak Republics shared many institutional and legal features, we focused our analysis on these two economies, noting that the similarities in the outcomes in Slovakia and the other CEEs gave our findings relatively wide applicability.

Our first principal finding comes from the decomposition of the determinants of the expected durations of unemployment in the Czech and Slovak Republics. We find that about one-half (more than one-third) of this difference for recipients (nonrecipients) is explained by differences in the values of the explanatory variables. For those who receive unemployment benefits (recipients), we find that almost all of the contribution of the difference in the explanatory variables arises from differences in the levels of local demand variables and a variable measuring structural differences at the district level. However, among nonrecipients, differences in demographic characteristics play a somewhat more important role than differences in demand factors between the CR and SR.

The remaining difference in the durations of the unemployment spells in the two republics is explained by differences in the estimated coefficients of the hazard function for leaving unemployment. In this context, an important difference between the two republics lies in the relative inability of the Slovak Republic, and probably also the other CEE countries, to absorb low-skilled unemployed workers. Likely explanations for the differences in the estimated coefficients include the more rapid growth of the small-scale, private firm (mainly in the service sector) in the CR as compared to the SR, the relatively stronger impact of the decline in military production in the SR than in the CR, the differences in the response of the manufacturing sector to market forces (arising in part from differences in the age and location of factories between the two republics), and the much higher level of foreign investment in the CR than the SR. Differences in the enforcement of the unemployment compensation system in the two republics also are likely to have contributed to differences in the hazard coefficients between the CR and SR.

Our second principal finding concerns the effect of the unemployment compensation scheme, which was identical in the Czech and Slovak Republics. Using two different methods, we estimate that this system has moderate effects on the duration of unemployment spells in each of these republics, compared with the estimated effects in other studies in the United States, Canada, and Europe. This result suggests that policy makers in governments and international agencies have considerable latitude in providing a safety net without endangering efficiency. In view of the similarity between Slovakia and the other Central and East European countries in their unemployment situations and the features of their UCSs, this result is also relevant for policy in other transition economies.

Appendix A

1. *Standard Contribution to the Likelihood Function for Complete and Censored Spells.* Here we show the contribution to the likelihood for those who register at the district labor office immediately upon becoming unemployed. The survivor function $S(r)$ – the probability of a spell lasting longer than r weeks – is given by

$$S(r|\theta)=\prod_{v=1}^{r}(1-\lambda(v|\theta)\,. \tag{A1}$$

The contribution of a spell that ends in week t is given by

$$f(t|\theta) = \lambda(t|\theta)\,S(t-1|\theta). \tag{A2}$$

Let $\phi(\theta)$ represent the density function for the unobserved heterogeneity. The unconditional contribution to the likelihood for the spell that ends in week t is given by

$$L(t)=\int \lambda(t|\theta)S(t-1|\theta)\phi(\theta)\,d\theta\,. \tag{A3}$$

The contribution of a censored spell is calculated in an analogous manner. We follow Heckman and Singer (1984b) and assume that θ is drawn from a discrete distribution with J support points $\theta_1, \dots, \theta_{J-1}, \theta_J$ and associated probabilities $P_1, \dots, P_{J-1}$. The number of points of support J is determined by the data.[51] Recent Monte Carlo evidence by Baker and Melino (1997) suggests that care must be taken in choosing the number of support points. They find that parameter estimates can become unstable when one estimates too many support points, which suggests that we should be relatively conservative in selecting the number of support points.[52] Given their results, we use the Schwartz criterion to choose the number of points, since it will lead to a more parsimonious specification than would a likelihood ratio test.[53] In a previous specification (very similar to the one adopted here),[54] this always led us to two points of support, and we use two points of support in our current specification. Following Ham and Samuel A. Rea, Jr. (1987), we choose the degree of the log duration dependence polynomial from the noheterogeneity specification. We again use the Schwartz criterion, assuming that the maximum degree of the polynomial is five.

51 We ignore any complications in the asymptotic distribution theory arising from the fact that J is also estimated.

52 Note that we follow the literature and ignore the fact that choosing the number of support points involves a nonstandard testing problem since some parameters will be unidentified under the null hypothesis.

53 See, e.g., George G. Judge et al. (1980 pp. 425–26). Note that allowing for even two mass points involves estimating more parameters than would be the case if we assumed a normal distribution for the heterogeneity.

54 The earlier specification in Ham et al. (1996) did not use the ratio of employment in agricultural to that in industry in 1991 as an explanatory variable. With this previous specification, we found that the likelihood ratio test led us to a three-point distribution in the SR and the entitlement elasticity rose substantially. However, as noted above, the Schwartz criterion led us to two points of support.

2. *Contribution to the Likelihood for Late Registrants.* Consider an individual who registers after T weeks of uncompensated unemployment and experiences t additional weeks of unemployment. The conditional contribution to the likelihood of the t weeks of unemployment after registering is

$$L(t|\theta)=\lambda(t+T|\theta)\times\prod_{v=1}^{t-1}\left(1-\lambda(T+v|\theta)\right). \tag{A4}$$

As noted above, these spells eliminate the collinearity between remaining entitlement and duration. They also break the identity between the drop in benefits and duration at 13 weeks and thus help us to identify the benefit effect. However, using these spells raises an econometric issue. Workers who register late are drawn from a different heterogeneity distribution than those who register immediately. Here we discuss two possible solutions to this problem. As noted by Heckman and Singer (1984a), we should integrate (A4) against the distribution of θ among those who have unemployment spells longer than T, $\phi(\theta\,|\,t>T)$. In our empirical work we consider two approximate solutions to this problem. First, we allow for a separate heterogeneity distribution for those who register late. Second, we separately allow for a different heterogeneity distribution for those who register for unemployment compensation at least three months after they became unemployed. Neither of these approaches affected the results.

These are only approximate solutions to the problem since they ignore the fact that the heterogeneity distribution for those who register late depends both on T and on the lagged values of the explanatory variables. In future work we intend to investigate the following approach for addressing these issues.[55] After explicitly conditioning on the vector of explanatory variables over the entire unemployment spell prior to registration $\mathbf{X}_{ai}$, we have

$$\begin{aligned}\phi(\theta|t>T,\mathbf{X}_{ai})\\ &=\frac{\Pr(t>T,\theta|\mathbf{X}_{ai})}{\Pr(t>T|\mathbf{X}_{ai})}\\ &=\frac{\Pr(t>T,\theta|\mathbf{X}_{ai})\phi(\theta)}{\Pr(t>T|\mathbf{X}_{ai})}\\ &=\left[\frac{S(T|\theta,\mathbf{X}_{ai})}{\int_r S(T|r,\mathbf{X}_{ai})\phi(r)dr}\right]\phi(\theta)\\ &=g_i(T|\theta,\mathbf{X}_{ai})\phi(\theta)\end{aligned} \tag{A5}$$

Thus we should weight $\phi(\theta)$ the for those who register late by $g_i(\cdot)$. Now

55 This approach originated from a comment by George Jakubson.

(A6) $$S\left(t\,|\,\theta,\mathbf{X}_{ai}\right)=\prod_{v=1}^{T}\left(1-\lambda_w(v\,|\,\theta,\mathbf{X}_i(r))\right),$$

where λ_w is the hazard out of unemployment for someone who waits to register (and thus is not receiving benefits) and $\mathbf{X}'_{ai} = (\mathbf{X}'_i(1), \ldots, \mathbf{X}'_i(T))$. We cannot estimate λ_w because we only see those who survive among those who wait to register; we do not see those who wait to register and leave unemployment before registering at the labor office for benefits. To use this approach and calculate the weights, we need to approximate λ_w. We are currently exploring an approximation where we use the nonrecipient hazard to proxy λ_w.

3. *Expected Duration Calculations and Oaxaca Decompositions*. Write the expected duration of unemployment in each republic as

(A7) $$ED_j = ED(\boldsymbol{\beta}_j, \mathbf{X}_j), \qquad j = c, s,$$

where $\boldsymbol{\beta}_j$ is the vector of parameter estimates for republic j and $\mathbf{X}_j$ is the vector of the mean values of the explanatory variables in republic j.[56] Since we do not have a long time series, we calculate a truncated expected duration (at four years)[57]

(A8) $$\left[\sum_{t=1}^{K} tf(t)+\left(1-\Pr(\mathrm{t}<4\mathrm{yrs})\right)*4\mathrm{yrs}\right], \text{ where } K = 4 \text{ yrs} - 1 \text{ week}.$$

In calculating this expectation, we freeze the hazard after 52 weeks at its value at 52 weeks, since we do not have much data on spells longer than this.

The difference in the expected durations between the republics is given by

(A9) $$ED_s - ED_c = ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c).$$

We can decompose this difference into a contribution due to the difference in the coefficients and a contribution due to a difference in the explanatory variables

(A10) $$ED_s - ED_c = (\, ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_s)\,) + (\, ED(\boldsymbol{\beta}_c, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c)\,)\,.$$

Of course, we could use the alternative decomposition

(A11) $$ED_s - ED_c = (\, ED(\boldsymbol{\beta}_s, \mathbf{X}_c) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c)\,) + (\, ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_s, \mathbf{X}_c)\,)\,.$$

Within this framework, an average measure of the contribution of the difference in the coefficients is

(A12) $$\mathrm{Diff}\,(\boldsymbol{\beta}) = (\,(\, ED(\boldsymbol{\beta}_s, \mathbf{X}_c) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c)\,) + (\, ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_s)\,)\,)\,/\,2\,.$$

56 We have dropped the bar on the **X**'s to simplify the notation. One can calculate the expected duration at the mean values or calculate it for each individual and then take the mean, see e.g., Ham and LaLonde (1996). However, the only way we can carry out the decomposition below (when we measure the contributions of the subsets of explanatory variables) is to calculate the expected durations using the mean values, and thus we adopt this approach when calculating all expected durations.

57 We experimented with three- and five-year horizons and there was no qualitative difference in the results.

By the same token, we measure the contribution of the difference in the explanatory variables as[58]

(A13) $\text{Diff}\,(\mathbf{X}) = \big(\,(\,ED(\boldsymbol{\beta}_s, \mathbf{X}_s) - ED(\boldsymbol{\beta}_s, \mathbf{X}_c)\,) + (\,ED(\boldsymbol{\beta}_c, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c)\,)\,\big) / 2\,.$

We can also decompose the overall effect of the difference in the mean explanatory variables into the respective contributions of different subsets of the explanatory variables. For example, divide the explanatory variables in the CR into two groups, i.e., $\mathbf{X}_c = (\mathbf{X}_{c1}, \mathbf{X}_{c2})$

and do the same for the SR. Then it is possible to decompose the contribution of the difference in the X variables (conditional on the Czech parameter estimates) using

(A14) $$\begin{aligned} ED(\boldsymbol{\beta}_c, \mathbf{X}_s) - ED(\boldsymbol{\beta}_c, \mathbf{X}_c) = {} & (\,ED(\boldsymbol{\beta}_c, \mathbf{X}_{s1}, \mathbf{X}_{s2}) - ED(\boldsymbol{\beta}_c, \mathbf{X}_{c1}, \mathbf{X}_{s2})\,) \\ & + (\,ED(\boldsymbol{\beta}_c, \mathbf{X}_{c1}, \mathbf{X}_{s2}) - ED(\boldsymbol{\beta}_c, \mathbf{X}_{c1}, \mathbf{X}_{c2})\,)\,. \end{aligned}$$

The first term on the right-hand side of (A14) represents the contribution of the differences in the $\mathbf{X}_1$ variables across the republics and the second term represents the contribution of the differences in the $\mathbf{X}_2$ variables.[59]

58 Unobserved differences are captured in (A12).

59 The decomposition is nonlinear and therefore can be sensitive to the order in which one switches the variables. To address this problem we calculate all possible permutations and average the estimates.

Appendix B

Table B1: Mean Values of Variables at First Week of Registered Unemployment

	Czech Republic		Slovak Republic	
	Recipients	Nonrecipients	Recipients	Nonrecipients
Total number of men	780	482	1063	229
Average weekly exit rate to jobs over sample period	0.052	0.063	0.020	0.018
Proportion that do not exit to jobs in sample period	0.113	0.161	0.342	0.382
Proportion of men who exhaust benefits in sample period	0.135		0.455	
Weekly benefits (in Kcs)[a] in 1991 prices*10^{-4}	0.044		0.046	
Previous weekly wage (in Kcs)[a] in 1991 prices*10^{-4}	0.059		0.062	
Demographic variables:				
Age*10^{-1}	3.321	3.148	3.135	3.061
Vocational high school	0.573	0.579	0.509	0.467
Academic high school	0.179	0.137	0.232	0.162
Post high school	0.059	0.056	0.055	0.035
Romany	0.030	0.064	0.053	0.140
Handicapped	0.104	0.071	0.061	0.087
Married	0.506	0.556	0.527	0.489
Recent graduate	0.141	0.145	0.130	0.153
Lives in Prague/Bratislava	0.090	0.089	0.058	0.009
District demand variables:				
Quarterly unemployment rate by education group	3.093	2.65	9.777	9.39
Quarterly vacancy rate by education group	0.745	0.786	0.344	0.227
Annual per capita industrial production in 1991 prices*10^{-6}	0.075	0.068	0.093	0.088
Agricultural/industrial employment ratio in 1991	0.370	0.376	0.572	0.607

[a] The exchange rate during this period was about 29 Kcs (Czechoslovak crowns)/$US1.

Table B2: Estimated Coefficients from the Hazard Model

	Czech Republic			Slovak Republic		
	Recipients	**Recipients**	**Nonrecipients**	**Recipients**	**Recipients**	**Nonrecipients**
Weekly benefits	-13.622 (6.914)			-7.766 (6.370)		
Weeks of remaining entitlement*married	-0.383 (0.140)			-1.095 (0.163)		
Weeks of remaining entitlement*single	-0.391 (0.134)			-0.754 (0.152)		
Last week of entitlement*married	1.253 (0.363)			0.626 (0.317)		
Last week of entitlement*single	-0.869 (0.762)			0.744 (0.348)		
Previous weekly wage	0.241 (3.036)			6.609 (2.882)		
Benefits exhausted*married	-0.722 (-0.349)			-0.618 (0.302)		
Benefits exhausted*single	-1.686 (0.398)			-0.515 (0.346)		
Age*10^{-1}	0.564 (0.317)	-0.232 (0.046)	-0.163 (0.092)	0.125 (0.436)	-0.067 (0.054)	-0.359 (0.126)
Age squared*10^{-1}	-11.128 (4.274)			-3.737 (5.754)		
Vocational high school	0.308 (0.160)	0.356 (0.145)	0.511 (0.252)	1.298 (0.224)	0.816 (0.170)	1.453 (0.345)
Academic high school	0.013 (0.168)	0.104 (0.161)	0.590 (0.292)	1.263 (0.216)	0.701 (0.159)	0.820 (0.346)
Post high school	0.021 (0.236)	0.038 (0.232)	0.803 (0.465)	1.144 (0.293)	0.818 (0.242)	1.372 (0.849)
Romany	-1.492 (0.330)	-1.484 (0.296)	-2.708 (0.448)	-1.931 (0.337)	-1.486 (0.310)	-1.016 (0.460)
Handicapped	-0.562 (0.156)	-0.523 (0.141)	-0.837 (0.344)	-1.059 (0.304)	-0.644 (0.217)	0.154 (0.509)
Married	0.124 (0.263)	0.322 (0.100)	0.636 (0.181)	1.042 (0.307)	0.55 (0.115)	0.790 (0.250)
Recent graduate	0.320 (0.230)	0.213 (0.141)	0.108 (0.251)	0.070 (0.285)	-0.260 (0.155)	-1.432 (0.454)
Lives in Prague/ Bratislava	0.379 (0.231)	0.172 (0.213)	1.242 (0.437)	-1.154 (0.315)	-0.906 (0.241)	1.572 (2.110)
District unemployment rate by education group	-0.138 (0.045)	-0.170 (0.044)	-0.019 (0.072)	-0.076 (0.023)	-0.039 (0.018)	-0.099 (0.049)
District vacancy rate by education group	0.086 (0.115)	0.080 (0.107)	0.312 (0.196)	0.080 (0.080)	0.102 (0.069)	
Industrial production*10^{-6}	0.634 (1.786)	1.210 (1.767)	13.356 (2.116)	1.021 (1.328)	0.739 (1.050)	-2.077 (2.723)
Agricultural/industrial employment ratio	-0.338 (0.241)	-0.171 (0.233)	0.912 (0.479)	-0.049 (0.170)	-0.155 (0.139)	-0.395 (0.322)
Log duration	6.536 (1.515)	0.827 (0.225)	-3.099 (0.748)	0.192 (0.244)	3.680 (1.495)	-0.269 (0.084)
(Log duration)^2	-4.131 (1.013)	-0.154 (0.040)	4.155 (0.772)	-0.098 (0.045)	-5.157 (1.791)	
(Log duration)^3*10^{-1}	10.449 (2.769)		-14.777 (2.595)		27.726 (8.904)	
(Log duration)^4*10^{-2}	-9.295 (2.640)		15.729 (2.783)		-62.169 (19.428)	
(Log duration)^5*10^{-3}					48.809 (15.451)	
Log-likelihood	-2492.1	-2531.0	-1261.5	-3241.7	-3268.9	-590.8

Notes: Standard errors in parentheses. All equations include a constant (not reported).

Table B3: Expected Duration Experiments[a]

	Czech Republic			Slovak Republic		
	Recipients	Recipients	Nonrecipients	Recipients	Recipients	Nonrecipients
Base expected duration (weeks)	17.75	18.58	15.61	60.71	55.53	54.78
Benefits raised by 10 percent	0.61			0.39		
Wage raised by 10 percent	-0.02			-1.49		
Entitlement raised by 1 week	0.30			0.93		
Entitlement raised by 1 week, single man	0.24			0.83		
Entitlement raised by 1 week married man	0.34			1.00		
Aged 25 years v. 35 years	-1.32	-3.28	-2.93	-3.57	-2.76	-11.00
Aged 45 years v. 35 years	5.06	4.09	3.58	6.31	2.87	14.39
Aged 55 years v. 35 years	17.78	9.23	7.82	15.26	5.85	31.93
Vocational high school v. junior high school	-5.73	-6.71	-16.75	-48.20	-40.68	-51.04
Academic high school v. junior high school	-0.16	-1.82	-13.65	-44.37	-32.89	-35.07
Post high school v. junior high school	-1.07	-1.41	-18.46	-41.66	-39.24	-49.39
Recent graduate v. nonrecent graduate	-4.24	-3.00	-1.91	-2.53	11.40	61.54
Romany v. non-Romany	43.37	46.40	84.32	66.36	76.95	41.24
Handicapped v. nonhandicapped	10.21	9.76	22.70	37.23	30.83	-4.56
Prague (Bratislava) v. other	-4.86	-2.44	-12.38	40.36	45.15	-30.93
Married v. single	-6.30	-4.91	-12.46	-30.23	-23.21	-24.70
Unemployment rate increased by 10 percent	0.64	0.81	0.09	2.70	1.60	2.99
Vacancy rate increased by 10 percent	-0.09	-0.09	-0.45	-0.10	-0.15	
Industrial production increased by 10 percent	-0.07	-0.14	-1.59	-0.35	-0.29	0.57
Agriculture/industrial ratio raised by 10 percent	0.19	0.10	-0.62	0.10	0.37	0.75

[a] Based on estimates in Table B2.

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8 | Job Reallocation in Two Cases of Massive Adjustment in Eastern Europe

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1. Introduction

Less-developed countries frequently experience massive shocks that require major adjustments in their economies and also appear to establish turning points, differentiating between multiple growth equilibria (Pritchett, 2000). What is significant about these restructuring episodes is extensive labor movement (across industries as well as within), as firms are restructuring or closing in low-productivity sectors and firms are growing or being created in high-productivity sectors. Among the causes of such adjustment episodes are brisk trade liberalizations, external shocks (e.g., oil), financial crises and the collapse of soviet regimes.[1]

Unfortunately, reallocation frictions can thwart or even disable the transition process so that the times of adjustment are often times of employment crises. When it is clear which sectors need to be scrapped and which ones need to be built up, governments can take an active role in affecting the speed of both processes. Governments can also attempt to limit the extent of frictions. In this paper, we contrast two cases of massive reallocation, where governments clearly followed different policies, in terms of both affecting frictions and directly setting the speed of the reallocation process. We compare the experiences of Estonia and the Czech Republic after the collapse of communism and asses their performance in light of macroeconomic reallocation theories.

There are two classes of two-sector models that deal with the policy issue of adjustment in the productive structure. Importantly, they differ in their policy prescription. First, a strand of models that is referred to as the Optimal Speed of Transition (OST) theory studies the reallocation of labor from the inefficient old (state-owned) sector to the efficient new (private) sector (e.g., Aghion and Blanchard, 1994; Castanheira and Roland, 2000).[2] The shared essence of the various OST models is the macroeconomic mechanism that makes the pace of job creation in the efficient sector depend on the speed of job destruction in the inefficient sector. The prediction is that both too much and too little destruction slows down creation; hence, a gradual phasing out of the inefficient sector (as opposed to a "shock" therapy) is advocated as optimal for maximizing the speed of job creation, overall reallocation and the net present value of output.

Caballero and Hammour (1996) – henceforth CH – devise the second type of two-sector model of the reallocation process. They follow the "creative destruction"

1 To give examples consider (i) the abandoning of import substitution policies and the adoption of trade liberalization and other market-oriented policies (including considerable privatization) in South Asia in the 1970s and in Latin America in the 1980s, (ii) the oil shocks to the Middle East, (iii) financial crises in Latin America in the 1980s that led to structural adjustment, including downsizing of the state sector, and (iv) the collapse of the soviet rule in Europe and Central Asia in the early 1990s. The adjustment periods in the post-soviet countries, coined as "transition," are different in that they are characterized by the simultaneous adjustments in both economic and political institutions.

2 Other examples include Burda (1993), Katz and Owen (1993), Chadha and Coricelli (1997), Atkeson and Kehoe (1996), Ruggerone (1996), Brixiova (1997), and Boeri (1999). For a survey, see Roland (2000).

literature and explore the effects of incomplete contracting in labor and capital markets on the labor reallocation process. In their model, contracting frictions (such as the hold-up problem) impose a cost on job creation and account for the adjustment crises of less-developed countries. The upshot of their analysis is that to attain efficient reallocation governments should not only actively slow down the destruction process when it is extreme (similar to the OST prescription) but also boost job creation. Hence, the distinction between the two theoretical literatures is important for evaluating *gradualism*, traditionally defined as slowing down the scrapping of the inefficient old sector, as an effective way of avoiding high unemployment when there is a major shock to the economy. As Caballero and Hammour (1996) note: *"The real test is whether gradualism can close the wedge between creation and destruction to help redress the transitional employment problem."*

Unfortunately, only limited empirical evidence is available on job reallocation in developing and transition economies undergoing major structural reallocation to substantiate the extensive theoretical literature (Davis and Haltiwanger, 1999). This is in contrast to the vast research documenting job reallocation (and its cyclicality) in the U.S. where empirical stylized facts are available for motivating and evaluating business cycle theories (e.g., Davis, Haltiwanger, and Schuh, 1996). Analysis of economy-wide job flows in periods of radical adjustment is needed to refine theories of structural reallocation and develop the appropriate policy responses. Here, the experience of transition economies provides a fruitful opportunity because it represents an unusually extensive experiment of restructuring. First, there are countries experiencing a similar reallocation process under different policies. Second, drastic job reallocation is not constrained to a particular industry, e.g. steel, or region, but is truly economy-wide, offering a striking case for the evaluation of macro models of aggregate reallocation mechanisms. Third, comprehensive micro data on job and/or worker flows are available in some of these countries.

In this paper we analyze the *dynamics of economy-wide job reallocation* that followed the collapse of communism in Estonia and in the Czech Republic at the end of 1989. We study the first five years of the transition experience (up to 1996) when massive adjustment was required and when the old- vs. new-sector distinction is clearly defined.

These two economies provide a useful comparative case to study. They are both small open economies that applied rapid reforms during early years of the transition in the policy areas of price, wage, and foreign-trade liberalization. However, they operated under markedly different job destruction policies. While the Czech approach to the destruction of the communist economy was gradual, Estonia's early transition was characterized by a rapid scrapping of old state firms. Correspondingly, the Czech unemployment rate remained close to three percent during the first seven years of pro-market reforms while the Estonian unemployment rate reached double digits by

1996.[3] The provision of unemployment insurance and the use of job creation support were also markedly different in these countries. The early-reform policy choices of these two countries thus correspond to some of the policy trade-offs described in the theoretical literature. Furthermore, the two unemployment trajectories differed markedly during late transition as well. While Estonian unemployment remained largely stable, Czech unemployment rose to almost nine percent by 1999, which has been interpreted as being due to delayed transition reallocation.

We compare the dynamics of job reallocation in these two countries through the lenses of the OST and CH theories. Although our analysis hardly constitutes a rigorous test, it can shed useful light on the impact of policy choices on the reallocation process and the level of unemployment. Specifically, in Estonia, we ask whether its high unemployment resulted from the process predicted by the OST models: Was job creation slowed down by the dramatic spike in job destruction? The Czech experience, on the other hand, speaks to the feasibility of engineering an optimal gradual adjustment. We therefore ask whether the Czech slow pace of job destruction and low level of unemployment corresponded to a lower level of job reallocation compared to the Estonian high-unemployment transition scenario. We also use both theories to consider the importance of the strong job-creation support provided by the Czech government and the low level of unemployment insurance offered by the Estonian authorities.

This exercise also helps in assessing the relevance of the two types of macroeconomic reallocation models for the post-soviet transition experience. Studying only two countries, which is dictated by data scarcity, clearly prevents us from testing the theories in a cross-country regression framework; instead, we ask whether the observed patterns of job reallocation are consistent with the theories, given what we know about the policy parameters.[4] At the end of the paper, we complement the analysis of the Czech and Estonian reallocation paths and policy choices with a brief overview of the experience of other transition countries, using existing measures of job reallocation and evidence on some of the key policy variables.

The plan of this article is as follows: We begin, in Section 2, by briefly describing the two classes of job reallocation theories. Section 3 outlines the reform policies of

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3 The Czech unemployment puzzle has been examined from a number of angles (see, e.g., Boeri and Burda, 1996; Ham, Švejnar and Terrell, 1998). However, this literature has not been fully successful in identifying the main cause for the dramatic divergence between the unemployment rates of the Czech Republic and those of the Central and East European transition economies during 1991 and 1992. This is likely due to the severe paucity of comprehensive micro-level data covering the first years of transition.

4 The dynamic nature of the reallocation models does not easily translate to regression-based tests. Recently, Godoy and Stiglitz (2006) return to the big-bang versus gradualism debate and use updated cross-country data to suggest that high initial speed of privatization in post-soviet economies was not conductive to their long-run economic growth. However, the economic mechanism behind this finding remains unclear. In contrast, our case-study approach can be framed in terms of Topel's (1999) suggestion that a fruitful way to learn about macroeconomic theory is to conduct "detailed empirical studies of the operation of labor markets and the impact of policies and institutions within individual countries."

the Czech Republic and Estonia, with focus on the key variables of the theoretical models. Our data are described in Section 4, followed by the estimation strategy. In Section 5 we present and discuss our findings. Section 6 provides perspective on our findings by discussing the existing empirical job reallocation literature from other transition economies. Section 7 concludes with policy implications and suggestions for future research.

2. Theoretical Background

2.1 Creative destruction with frictions

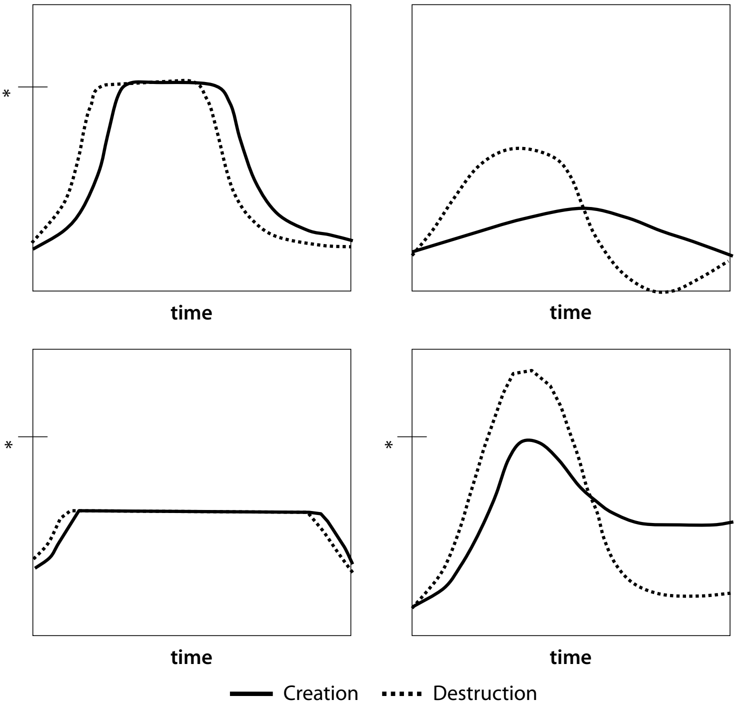
CH (Caballero and Hammour, 1996) model the implications of contracting difficulties in the formation of production units on the efficiency of reallocation during massive adjustment episodes. They note that when investment specificity gives rise to quasi rents, these can be appropriated by one of the contracting parties (i.e., business partners, employees or governments). For example, in the absence of complete enforceable contracts entrepreneurs may invest less than they would otherwise because some of their sunken investment could be appropriated by the contracting parties. This effective cost to job creation affects both the level and timing of reallocation.

CH study a two-sector reallocation model where – in the absence of "appropriability" problems – the onset of reallocation is characterized by a tightly synchronized increase in job destruction (*JD*) and job creation (*JC*). As the reallocation from the unproductive to the productive sector is nearing completion, *JC* and *JD* fall, again synchronously. Such a reallocation pattern, presented in the upper left graph of Figure 1, avoids the waste of resources and political economy problems through excessive unemployment. In contrast, contracting inefficiencies can "decouple" *JD* and *JC* and result in an inefficient reallocation, where more unemployment is created with less reallocation.[5]

In particular, if *JC* is thwarted by the cost brought about by transactional difficulties, then the onset of reforms can be characterized by low *JC*. If the government decides to slow down *JD* to tame unemployment, this will not increase *JC*, as shown in the upper right graph of Figure 1. In fact, subsidizing existing employment in the declining sector can increase the opportunity cost of labor and therefore further slow down *JC*. This core feature of their model leads them to reject gradualism as a sufficient optimal policy, where gradualism is traditionally defined as government support for the collapsing economic sector in order to slow down its demise. Instead, they advocate a policy consisting of a combination of *JC* incentives in the expanding sector and a gradual phasing out of the inefficient production units.

5 The integral between *JD* and *JC* in Figure 1 where *JD* > *JC* (*JD* < *JC*) represents the amount of accumulated ("decumulated") unemployment.

Figure 1: Stylized job reallocation in OST and CH theory



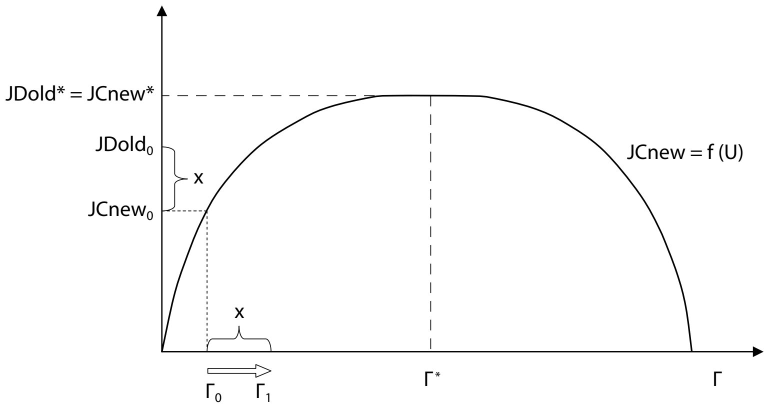
2.2 Optimal speed of transition

The OST models emulate the post-soviet economies and study the reallocation from the old, less efficient state sector to the new, more efficient private sector.[6] The shared essence of the various OST models is that the pace of *JD* in the old sector affects the speed of *JC* in the new sector. Although the CH and OST models both support the traditional notion of gradualism, their policy implications differ: OST prescribes that managing *JD* is a sufficient condition for optimal reallocation whereas CH also advocates incentivizing *JC*.

The backbone of the OST literature is the model by Aghion and Blanchard (1994), where the objective is to maximize the net present value of output. Aghion and Blanchard assume an efficiency wage setting mechanism where high levels of unemployment lower wages. Market forces determine increases in employment in

6 Both the OST and CH models study a movement from a two-sector economy to a one-sector economy, similar to traditional economic development models concerned with transition from a modern and traditional sector to a single modern sector (Lewis, 1955) or more recent trade liberalization models that consider import-competing and export-oriented sectors (see Edwards and van Wijnbergen, 1986, for a review).

Figure 2: Unemployment and job reallocation in OST theory



the new private sector; hence, if the cost of labor is high because of high wages and/or taxes, fewer workers are demanded. On the other hand, the government engineers the downsizing of the state sector through the reduction of subsidies (push) and the creation of generous unemployment benefits (pull). The government must select the rate at which it will reduce the old sector knowing that if it goes too slowly, there will be a low unemployment rate, which will put upward pressure on wages and hence slow down the growth of the new efficient sector. On the other hand, if it downsizes the old sector too rapidly, it will create high unemployment, which will reduce net wage increases. As the model suggests, an excessive rate of closures tends to reduce the tax base, out of which unemployment benefits are financed. The government will then have to raise taxes in order to finance unemployment benefits, hence wage costs increase, dampening the demand for labor in the private sector.[7]

The model postulates an inverted "U" relationship between the speed of job creation in the new sector and the level of unemployment. The dynamics of the economy depend on the initial unemployment level (which determines the level of wages and hence private job creation) and on the speed of labor shedding from the old sector. See Figure 2 for an illustration: Suppose that the economy starts from a low level of unemployment U_0, which determines the initial level of job creation in the new productive sector to be JCnew_0. Suppose further that the government initially sets job destruction in the old inefficient sector to be JDold_0. The gap between JDold_0 and JDnew_0 (denoted as x in the graph) leads to an equal increase in unemployment (from U_0 to U_1) which again leads to a rise of JCnew for the next period. As long as the government continues to set JDold above JCnew, unemployment will rise and

7 Similarly, if workers leave the labor force instead of becoming unemployed, pensions and other social benefits are also government financed.

feed back into the system and slowing down the speed of job creation in the new sector. The economy converges to a stable level of unemployment, which remains in place until the inefficient sector disappears. Clearly, a job destruction rate of JDold* will maximize the speed of reallocation.

Three of the graphs in Figure 1 plot the evolution of JCnew and JDold predicted from Figure 2 under three scenarios, which all share the assumption of a low initial level of unemployment. The upper left graph follows job reallocation where the government increases JDold up to JDold*. Here, gradualism synchronizes creation and destruction and the *JD–JC* pattern is the same as for the CH model, when there are no contracting frictions. The bottom left panel illustrates the too-slow-JDold scenario, where JCnew catches up with JDold, but reallocation proceeds at a sub-optimally slow pace. Finally, the bottom right panel plots the evolution of our hypothetical economy where the government raises JDold above the maximum JCnew* level. This leads to a decline in JCnew and an increase in unemployment (the area between JDold and JCnew). In plotting this scenario, we further assume that the government responds to such a rise in unemployment by quickly slowing down JDold. Again, reallocation takes too long and unemployment is too high.

The OST literature is extensive (see Boeri, 1999 and Roland, 2000 for reviews). For example, Castanheira and Roland (2000) use a different mechanism to establish a *JD → JC* feedback link: investment and the growth of the new sector are restrained by a depression of savings when unemployment is high. In their model, an overly slow speed of closure need not lead to negative *JC* effects as long as wages in the old sector are kept low. Old-sector firms will then see their workers leaving for the new sector (quitting) even if the rate of scrapping of the old sector (layoffs) is too low. [8]

3. Reform Experiences and Theoretical Predictions

Estonia and the Czech Republic are two small open economies that were widely recognized as being among the most market-oriented economies in their regions. The timing of reforms of these two countries were similar in many respects:[9] (i) the price liberalization and wage decentralization process was brisk and started during 1991–1992, (ii) initial inflation was soon dampened, thanks to tight fiscal policy, (iii) the small-enterprise privatization was completed by 1993, when large-firm privatization was started. Despite the similarity in policies, the macroeconomic

8 Allowing for quits is important in light of the Boeri (1999) critique of the OST models, which typically treat labor supply as fixed. Boeri discusses voluntary labor reallocation as well as the discouraged worker effect from generous unemployment insurance – a popular "pull" factor in the OST literature. In a related line of research Brixiova (1997) shows that the optimal rate of destruction of the old sector can be slower when allowing for on-the-job search, unlike Aghion and Blanchard (1994).

9 For more details on the Czech transition, see Dyba and Švejnar (1995) or Kotrba and Švejnar (1994); for the Estonian experience see Eamets (2001) or Haltiwanger and Vodopivec (2002). While the timing and sequence of reforms was similar, in Estonia they began in 1992, one year later than in the Czech Republic.

Table 1: Macroeconomic statistics for the Czech Republic and Estonia

	1990	1991	1992	1993	1994	1995	1996
Real GDP growth rate[a]							
Czech Republic	-1.2	-11.6	-0.5	0.1	2.2	5.9	4.8
Estonia	-6.5	-13.6	-14.2	-8.8	-2.0	4.6	4.0
Inflation[b]							
Czech Republic	9.7	52	11.1	20.8	10	9.1	8.8
Estonia	23.1	211.0	1076.0	89.8	47.7	29	23.1
Real wages index[c]							
Czech Republic	123	91	100	104	112	121	132
Estonia	227	151	100	102	113	119	122
Unemployment rate							
Czech Republic[d]	0.7	4.1	2.6	3.5	3.2	2.9	3.5
Estonia[e]	0.5	0.9	2.1	5.8	7.6	9.7	10.0
Savings as % of GDP[f]							
Czech Republic	31.7	29.0	31.6	27.9	29.9	29.3	
Estonia	36.5	32.7	22.1	16.3	18.7	16.3	
Lending rate[g]							
Czech Republic	14.1	13.1	12.8	12.5			
Estonia	33.7	24.7	19.0	14.9			
Private credit as % of GDP[g]							
Czech Republic	71.9	76.6	70.8	68.9			
Estonia	7.5	10.6	13.3	14.1	18.1		
Tax revenue as % of GDP[h]							
Czech Republic	42.3	41.9	40.3				
Estonia	35.4	36.1	38.8				
Budget subsidies to enterprises (% of GDP)[h]							
Czech Republic	6.4	7.1	8.3	8.0			
Estonia	1.5	1.4	1.9	0.9			

[a] EBRD Transition Report Update, April 2001 p. 15.
[b] EBRD Transition Report, 2000 p. 67.
[c] Unicef, (1999) CEE/CIS/Baltics Regional Monitoring Report, 1999. Unicef, Florence. p. 141.
[d] Czech Republic: EBRD Transition Report 2000 and Business Central Europe Database.
[e] Estonian Labor Force Survey 1995 (incl. retrospective) and 1997 (Vodopivec, 2000).
[f] World Development Indicators.
[g] International Financial Statistics, IMF, Washington.
[h] EBRD Transition Report, November 2001, p. 63, 136, 140.

outcomes differed substantially. Estonia experienced a deeper and longer recession than the Czech Republic, as documented in Table 1. Estonia also faced higher levels of inflation, especially in early 1992, before the introduction of the new Estonian currency (Crown/Kroon). Unemployment – a key variable for our analysis – also followed a very different path in the two economies. During the period under study, the Czech unemployment rate peaked at 4.1 in 1991 and then stabilized at around 3 percent until 1996; the unemployment rate in Estonia continued to rise the entire period, reaching almost 10 percent in 1996.

3.1 OST variables

What was the evolution of the parameters of the reallocation theories described above? The OST theory emphasized that government policies will engineer job destruction in old inefficient firms through "push" and "pull" policies. On the "push" side, there was a crucial difference in the implementation of the privatization policies: Estonian privatization included the elimination of subsidies and removal of exit barriers for state enterprises as early as in 1993 (Cornelius, 1995). In contrast, bankruptcy laws were effectively not in place until 1996 in the Czech Republic (Lízal, 2001). Furthermore, Czech banks remained under control of the government and many of the old Czech firms continued to receive subsidies hidden as commercial loans. According to the EBRD, the Czech government subsidized enterprises much more heavily, allocating around 7.4 percent of GDP during 1993–1996, compared to 1.5 percent in Estonia over this period (see Table 1).[10] Certainly, the Czech government was slowing down job destruction in the inherited old sector.

On the "pull" side of the OST policies, the two countries also differed substantially as the Czechs had a more generous non-employment benefit scheme than the Estonians. In 1991, the Czechs were entitled to twelve months of unemployment benefits. As the transition proceeded they tightened the unemployment benefit system, reducing the entitlement period to six months while keeping the replacement rate between 50 and 60 percent of the previous wage. The Estonian unemployed started with a six-month entitlement period and the effective replacement rate was only 7–10 percent.[11] At the end of entitlement for unemployment benefit, all poor Czech households were able to receive welfare indefinitely whereas only Estonian families with three or more children could receive welfare assistance and only for up to three months.

The OST model also stresses that job creation is directly affected by changes in the wage level. The real wage declined more in Estonia than in the Czech Republic during the years of price liberalization and hyperinflation, but followed a similar pattern once the new Estonian currency was introduced in 1992 (see Table 1).[12] Finally, taxation and savings were suggested as possible channels of the OST feedback mechanism from *JD* to *JC*. Given the high initial inflation, there was a steep decline in Estonian savings in the early years of transition, while Czech savings as a share of GDP remained stable throughout transition. Comparing the tax environment,

10 Much of this subsidy support was hidden. The largest four semi-state banks had long-standing creditor relationships with the large privatized enterprises and also made equity investment in these firms through their voucher-privatization investment funds (Cull, Matesova and Shirley, 2002). Lízal and Švejnar (2002) offer firm-level evidence implying that large old Czech firms operated under soft budget constraints.

11 The level of unemployment benefits was set to 60% of the minimum wage level in 1992 and it was kept at the same nominal level until 1996 despite inflation. In 1995, it amounted to below 10% of the average wage. See Haltiwanger and Vodopivec (2002) for further details.

12 Since we cannot take into account the degree of suppressed inflation prior to 1990, it is difficult to compare the decline in real wages prior to 1992.

Estonia appears somewhat friendlier. As shown in Table 1, tax revenues as a share of GDP were higher in the Czech Republic than in Estonia in early transition.[13]

3.2 CH variables

What do we know about these two countries' contracting difficulties and the JC policies the CH theory emphasizes? First, with respect to protection of property rights, the Czech environment was apparently very problematic. The Czech Republic's early transition is infamous for its weak legal structure, impotent judicial system, asset stripping ("tunneling" or "looting," see, e.g., Cull, Matesova and Shirley, 2002), weak collateral rules, financial markets that lack transparency, and poor investment protection.[14] Hence, it would appear that at least in the Czech Republic, contracting frictions were important. Less is known about the Estonian legal environment, which may have been more transparent in early transition. For example, a number of laws governing the business environment were enacted very early in Estonia's transition (Bankruptcy Law, 1992; Law on Competition, 1993).

Fortunately, there is comparable evidence from firm responses in the Business Environment and Enterprise Performance Survey (BEEPS), first undertaken in 1999 by European Bank for Reconstruction and Development (EBRD) and the World Bank Group in 26 former communist countries. Firms were asked to what degree they agreed with the following statement: "I am confident that the legal system will uphold my contract and property rights in business disputes;" their responses were coded: 1=Fully Agree… 6=Strongly Disagree. The mean answers for Estonia and the Czech Republic were 2.7 and 3.7, respectively, pointing to a lower confidence in contract enforcement in the Czech Republic.

Second, in light of the CH theory, it is also important to know whether the destruction of the communist economy was complemented with vigorous assistance for job creation. This is especially important for the Czech Republic, given the prevalent contracting difficulties there. Official statistics indicate that there was more much credit available (at lower lending rates) to support firm restructuring and growth in the Czech Republic than in Estonia.[15] As discussed

13 The corporate income tax (CIT) and the tax burden on labor were both lower in Estonia, where the CIT was lowered from a flat rate of 35% in 1992 to a flat rate of 26% in 1995; the Czech CIT was also gradually lowered from 45% in 1993 to 39% in 1996. The total tax burden on labor constituted 80% (62%) of labor costs in the Czech Republic (Estonia) at the end of the 1990s (Riboud et al., 2001).

14 As late as 1996 creditors in the Czech Republic had to obtain the permission of the debtor in order to seize the collateral for loans in default. A prime example of Czech contracting problems is the case of a highly profitable commercial TV channel (TV Nova), which was built with funds and know-how provided by a U.S. investor, but later appropriated by a local partner. In 2003, the Czech Republic lost an international arbitrage case for poor investment protection and had to pay over USD 350 million to the U.S. investor.

15 Our calculations from official statistics indicate that new credit was about 10–12 percent of GDP in the Czech Republic (in 1993–94) whereas it was only 2 percent in Estonia (1994–95). These calculations are corroborated by credit-stock statistics shown in Table 1. Equally importantly, lending rates were substantially lower in the Czech Republic compared to Estonia as attested by Table 1.

above, a substantial part of credit in the Czech Republic took the form of soft loans for privatized companies. However, much of the new credit also served as JC support as state-owned banks were instructed to provide plentiful credit to both old and starting firms. Survey evidence from Central European countries suggests that credit for newly established firms was particularly abundant in the Czech Republic (Bratkowski, Grosfeld and Rostowski, 2000; World Bank, 1992). We also know that the relative share of GDP allocated to active labor market policies, another source of financing for startup firms, was far lower in Estonia than in the Czech Republic (0.19 percent vs. 0.08 percent during the 1990s, see Riboud *et al.*, 2001).

In sum, it appears that contracting frictions were a major feature of early transition in the Czech Republic and, to a lesser extent, in Estonia. We also find job creation in the Czech Republic received substantial support during early reforms, certainly much higher than that provided by the Estonian government.

4. Data and Measurement Issues

Our measurements of job reallocation are based on worker-level data sets whereas most of the research on job destruction and job creation is based on firm-level data. We have several reasons for using worker-level data. First, official firm-level census data are sketchy in the early part of transition and do not cover well the newly established private sector we are interested in. After the collapse of central planning firms no longer felt they had to report to the central statistical agencies. Moreover, the statistical offices were not interested in firms with fewer than 20 workers and they were not able to locate most of the newly established firms with more than 20 employees. Second, the existing firm-level surveys were only collected in the mid 1990s and therefore suffer from "survival bias" – they miss any firms, old or newly started, that exited in the first few years of transition. Third, these firm-level data sets typically cover only the manufacturing sector. This is a key issue from the perspective of applying macroeconomic theories of reallocation: the existing literature on transition does not provide a time-consistent coverage of the whole economy (with the exception of Haltiwanger and Vodopivec, 2002).

We therefore turned to data on workers, but unfortunately, the collection of household labor force surveys started only in the mid-1990s, leaving the first crucial years of transition uncovered. Fortunately, we have located two data sets, one collected in Estonia and the other in the Czech Republic, that have a very similar design and provide *retrospective* information on a representative sample of individuals' jobs since the beginning of the transition that allow one to measure job destruction and creation. We describe these data in Section 4.1, discuss our definition of old and new sector in Section 4.2 and show how one can use individual-level data to construct measures of job creation and job destruction in Section 4.3.

4.1 Data

Our analysis uses data from two similar retrospective surveys covering the early period of the transition. The Czech survey, described in detail in Münich, Švejnar and Terrell (1997), was administered in December 1996 to 3,157 randomly selected Czech households using the sample frame of the official Labor Force Survey. Individuals who were employed for at least two weeks during the 1991–1996 period were asked questions about their employment histories; yielding usable data on 4,786 working individuals who experience 7,926 main jobs. The Estonian survey, described in Eamets (2001), was administered in the first quarter of 1995 to one percent of the adult population randomly selected from the 1989 Population Census. In Estonia, we have usable data on 7,928 individuals with at least one spell of employment; in total they experience 14,465 main jobs. The average number of jobs per person is low at 1.82 in Estonia and 1.65 in the Czech Republic.

The two questionnaires elicited information on employment and wages up to six years before the time of the interview. The Czech survey traces the characteristics of the respondents' jobs and non-employment spells between January 1991 and December 1996 whereas the Estonian survey asks about employment histories from 1989 to the first quarter of 1995. For each spell of employment there is information on the industry of employment and a number of employer attributes. We observe the reason for separation for those that exited their jobs. Whereas in both countries there is information on the respondents' wage at the beginning and end of each job, in Estonia respondents were also asked to report their earnings in October of each year.[16]

Using data that relies on recollection of labor activities up to six years before the time of the interview raises questions of "recall bias." However, Noorkoiv *et al.* (1997) suggest that rare changes in labor market status (at 1.7 to 1.8 jobs per person during six years) are likely to have been particularly memorable in an economy transiting from a system with many years of steady employment.

4.2 Sector definition

An important question arises regarding the classification of firms into the old and new sectors. First, we set aside jobs in the public service sector (education, health, and public administration). Second, given the focus of the reallocation theories on the (investment in) newly created firms and jobs, our approach to capturing reallocation in early transition is to define reallocation as the transfer of jobs from the inherited (old, post-soviet) firms to the newly-established (start-up, *de novo*) private firms. Privatized firms are thus kept in the old sector with the state-owned enterprises. This is in accord with both the evidence on the lack of restructuring

16 To form monthly labor market histories, we interpolate wages from the available information for both countries. However, wage information in Estonia from the hyperinflation years of 1990–1991 is not usable.

of Czech privatized enterprises, and empirical studies on firm productivity (e.g., World Bank, 2002).

An important advantage of the Czech data therefore lies in their unique ability among worker-level data sets to distinguish privatized firms from *de novo* private enterprises.[17] However, in the Estonian questionnaire firm ownership is categorized as state, private, or cooperative/collective. Employment spells starting in state-owned firms belong to the old sector. We learn when privatization occurs in such spells and keep privatized spells in the old sector. Similarly, spells starting in a private firm before privatization began in Estonia belong to the new sector. However, for employment spells starting in private firms after 1992, the data do not distinguish jobs in *de novo* private firms from those starting in privatized enterprises. We categorize such spells as being in the new or old sector depending on the size of the firm in which hiring occurs. This choice is guided by evidence available in our Czech data, where 90 percent of all new-firm employment is in firms of less than 100 employees (see Jurajda and Terrell, 2003). Therefore, we categorize Estonian employment spells starting in small firms as being in the new sector and assign those employment spells starting in large firms to the old sector. This is the best approximation available to us. Nevertheless, there are two, potentially offsetting sources of measurement error: (i) some of the large private firms that hire workers in Estonia may be newly created private firms, and (ii) some of the hiring in small private firms occurs in privatized firms.

Using this approximation in Estonia and a direct indicator in the Czech Republic, we therefore distinguish between three main sectors: the *old sector* (state-owned enterprises, cooperatives, and privatized firms), the *new sector* (*de novo* private firms and the self-employed), and the *public sector* (public administration, health and education). Note that the observed growth of the new sector is not due to reclassification of ongoing jobs. Our firm categorization reflects both the reallocation theory and the facts on productivity differences from the transition economies. It also maximizes comparability across the two data sets and allows us to focus on the under-researched employment growth in startup enterprises.

The ability to differentiate between privatized (i.e., inherited) and *de novo* private jobs is indeed a unique feature of early-transition data. The existing worker level data sets from late transition, including the subsequent waves of the Estonian survey used in this paper, no longer provide this distinction and separate only private and state-owned firms.

17 Respondents are asked about the ownership type of their employer at the end of their employment spell. The choices for private employer are, "newly established private firm," "firm after privatization," "firm in privatization." It is unclear how the respondents consider spin-offs from privatized or state-owned firms. However, the number of workers employed in spun-off enterprises is unlikely to be large. Lízal, Singer and Švejnar (2001) analyze the process of breakup of old firms in Czech manufacturing and suggest that employment in spin-offs amounts to approximately five percent of all employment.

4.3 Measurement of job and worker reallocation rates

Job reallocation is typically measured with firm-level data using the following definition (Davis and Haltiwanger, 2000, pp. 2716–7), "Gross job creation in sector k at time $t(JC_{kt})$ equals employment gains summed over all business units in sector k that expand or start up between $t - 1$ and t. Gross job destruction in sector k at time $t(JD_{kt})$ equals employment losses summed over all business units in sector k that contract or shut down between $t - 1$ and t." However, job destruction and job creation can also be measured from worker flow data using information on type of employment separation as pointed out by Blanchard and Diamond (1990) and recently implemented by Haltiwanger and Vodopivec (2002). With this type of data, job creation can be defined as hires less quits that are replaced, while job destruction consists of layoffs and quits without replacement.

In the Czech (Estonian) questionnaire, we have 13 (21) answers for how someone separated from their job (see the Appendix Tables A.1 and A.2). We define job destruction (*JD*) as any separations where: 1) the firm was closed down and 2) the separation was part of a mass layoff.[18] The *JD* rate is the total number of job destructions at a given time t, divided by the number of jobs in t – 1.[19] It is likely the case that some other separations correspond to job destruction as well; hence, our JD measure is likely to be a lower bound estimate.

To measure job creation, we follow the existing literature and use the identity that

$$\begin{aligned} \Delta E_{tk} &= JC_{tk} - JD_{tk} = H_{tk} - S_{tk} \\ &= H_{tk} - (Q_{tk} + L_{tk}). \end{aligned} \tag{1}$$

Here, ΔE_{tk} denotes the time change in employment in sector k, JC_{tk} and JD_{tk} are job creation and job destruction counts in sector k in time t respectively, H_{tk} and S_{tk} stand for hiring and separation, and Q_{tk} and L_{tk} are quits and layoffs. The simple identity (1), namely that net employment growth (ΔE) is the difference between job creation and job destruction implies that $JC_{tk} = \Delta E_{tk} + JD_{tk}$. Again, this may be considered a lower bound estimate for *JC* because *JD* may be underestimated. In particular, when $Q_{tk} > H_{tk}$, the estimated JC_{tk} measure is negative, informing us that the minimum number of quits not replaced is $-JC_{tk}$. Hence, whenever the initial JC_{tk} estimate based on layoffs without replacement is negative we add the negative of JC_{tk} to our JD_{tk} measure and set JC_{tk} at zero. The correction for $JC < 0$ turns out to affect only *JD* in the old sector, which comes as no surprise. Underestimation of *JD* is especially likely in the old firms, where labor shedding is more extensive and

18 We also included early retirements in *JD*, as these are likely to correspond to restructuring layoffs, but the effect on the *JD* measure was negligible as only 10 percent of Czech separations to retirement correspond to early retirement (i.e., about 1 percent of all separations). Early retirement is even less important in Estonia.

19 Unlike Haltiwanger and Vodopivec (2002) who use January-to-January snapshots in their analysis of the Estonian data, we base our results on all observed worker moves within a given time period.

where quits may be used as a welcome opportunity to decrease the firm's workforce without the social and political costs of (mass) layoffs.

The use of worker-level data to examine a firm-level phenomenon results in a measure of gross job flows that is not identical to that of the firm-level studies. Yet, our worker-level data also offer important advantages. Most importantly, unlike firm data sets used in the literature on job reallocation in early transition, our two samples cover all economic activities and all firm sizes in the economy and provide a continuous coverage of the adjustment period without any survival bias. Our measure of job reallocation also captures within-firm restructuring, which is not discernible with firm level data that contain only changes in total firm employment. If firms in a given sector maintain constant employment, but layoff and hire an equal number of workers (in different positions), such restructuring would be ignored in a firm-level data set, but is captured in our data.

5. Results

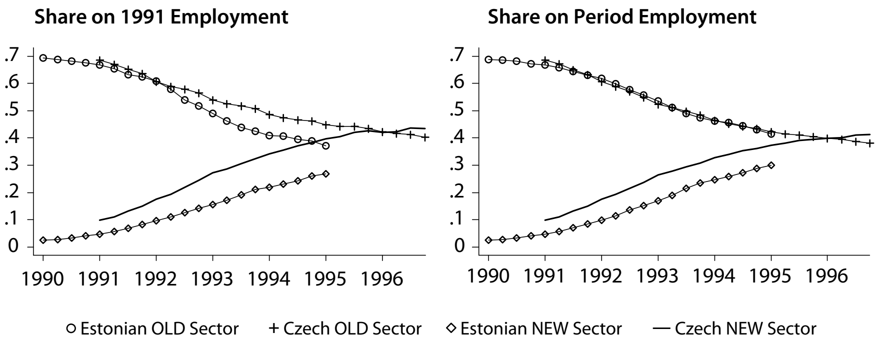
The reallocation theories described in Section 2 provide an anchor for our analysis in that we first empirically describe the variables of this literature: job creation, job destruction and the amount, speed and efficiency of worker reallocation (Section 5.1). We then apply the logic of these models and the evolution of policy parameters discussed in Section 3 to understand the observed reallocation patterns (Section 5.2).

5.1 Basic findings

5.1.1 Employment structure

Our first endeavor is to establish the extent of reallocation from the old to the new sector during the Czech and Estonian transitions. Figure 3 shows the fraction of workers in each of the two main ownership sectors – old (state, privatized, and coops) and new (private firms and self-employed entrepreneurs) in the first month of each quarter of each year. (We do not present the results for the public sector, which holds on to a stable workforce in both countries.) The left graph of Figure 3 presents the share of sectoral employment on the total employment level of 1991, while the right graph uses the concurrent total employment for normalization. The story told by this figure is most extraordinary: within five years of the "big bang" of economic reforms of 1991 more workers were employed in the Czech new sector than in Czech firms inherited from communism. Extrapolating out of our sample, a similar pattern apparently characterizes the Estonian transition as well. This massive reallocation is not a consequence of reclassification as privatized firms remain in the old sector.

Figure 3: Employment evolution by old/new sector



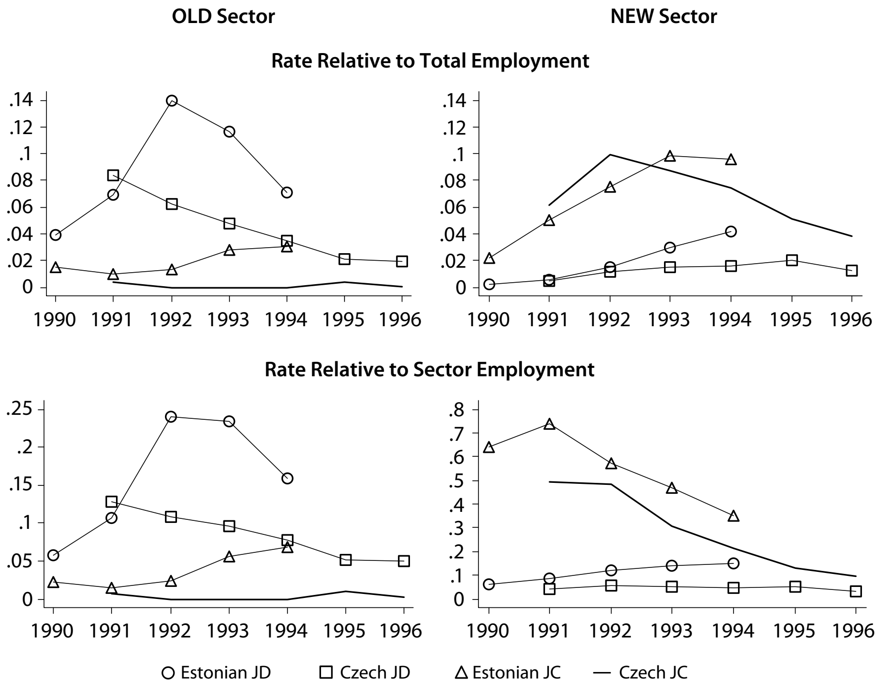
Yet, there is a major difference in the evolution of total employment. While early Estonian transition is characterized by a sharp drop in employment, total Czech employment exhibits slow growth over the entire sample period.[20] Correspondingly, the left graph of Figure 3, which uses 1991 employment for normalization, shows a much sharper decline of the old sector in Estonia and a slower rise of its new sector, compared to the Czech Republic. However, conditional on the overall employment decline, the structure of the economies is remarkably similar in the right graph of Figure 3, except for the somewhat higher and stable employment share of the public sector in Estonia.

These results are important for interpreting the "Czech unemployment puzzle." The Czech unemployment rate stabilized between 3 and 4 percent during early transition in presence of significant unemployment inflows. This was the exception to the rule of quickly emerging double-digit unemployment rates in other transition economies. One interpretation of the low Czech unemployment is that it was the result of slow restructuring and worker churning within the old sector. Using the new/old distinction to measure reallocation, Figure 3 suggests that low unemployment occurred simultaneously with extensive reallocation. Even though the fundamental need for reallocation may differ across the two countries, it is remarkable that, conditional on employment evolution, the degree of reallocation is the same and that it occurs at much lower employment costs in the Czech economy.[21]

20 Our estimate of Estonian employment in 1995 is 10% below its 1991 level. This decline does not include the outflow of native Russians during early transition (Eamets, 2001). On the other hand, we estimate the Czech employment in 1996 to be 5% higher compared to 1991, even after correcting for population growth. The latter finding may appear suspicious given the common wisdom of large employment losses during early transition. However, as we argued in Section 4.1, official statistics relying on firm reporting are likely to miss employment in small newly established firms. Indeed, the employment growth rates based on the Czech Labor Force Survey, which was first collected in 1993, are consistent with our statistics. Similarly, we can match the employment decline of early transition reported in the firm census when we ignore employment in small firms.

21 Our evidence of healthy reallocation disproves the conjecture of Aghion and Blanchard (1994) that the low Czech unemployment rate was largely due to large outflows from the labor force. In unreported calculations

Figure 4: Job creation and destruction by old/new sector



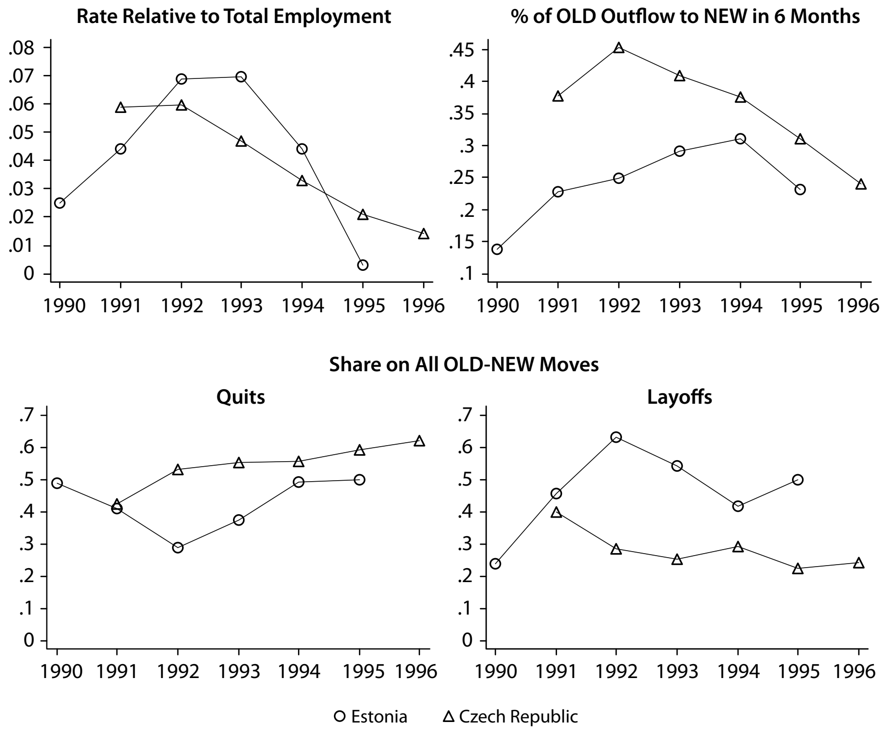
5.1.2 Job Reallocation in the old and new sectors

Next, it is natural to ask how job reallocation differs by sector. Is there simultaneous job creation and destruction in both the declining old sector and the growing new sector? In Figure 4 we plot the rates of job creation and destruction in each sector over time; the upper two graphs present the share of job reallocation on total economy-wide employment and the lower two graphs present the more traditional shares on employment in the relevant sector. A striking result emerges. Using the new/old distinction allows us to effectively separate job creation from job destruction during early transition in the Czech Republic. Old firms are hiring only to replace a fraction of separating workers, as job creation in the old sector is very low. Similarly low is job destruction in the new sector. The sectoral separation of JC and JD is also effective in Estonia up to 1992, but becomes less clear during 1993–94.

Figure 4 also suggests that the two countries followed a very different transition path in terms of their levels of old sector job destruction (JDold) and new sector job

using our data, we find that inflows into long-term non-employment were steady throughout 1991–1996, making labor-force outflow an unlikely culprit for the 3–4% Czech unemployment rate at the time.

Figure 5: Workers moving from old to new sector

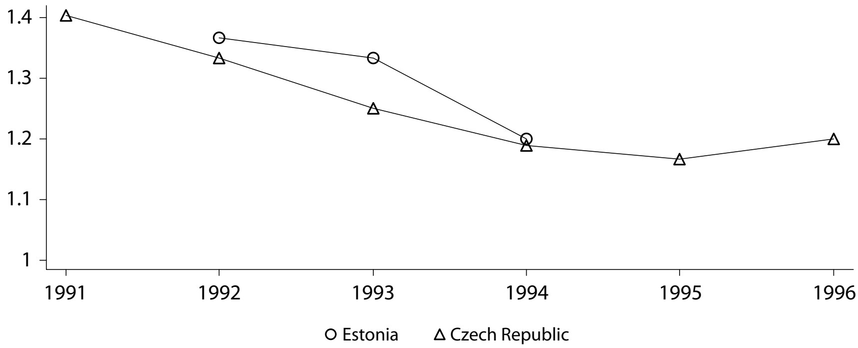


creation (JCnew). At the outset of transition, Estonian JDold peaked at an annual rate of 14 percent of all jobs (or almost 25 percent of old sector jobs) in 1992, while the Czech JDold rate reached only about a half of the Estonian level. Thereafter the rates fell in both countries. The level of JCnew as a share on total employment was somewhat higher in the Czech Republic than in Estonia at the outset of transition. The Czech JCnew rate then declined while the Estonian job creation in the new sector was still close to 10 percent of the economy-wide employment in 1994.

5.1.3 Efficiency of reallocation

It is traditional to describe reallocation rates by sector. However, reallocation occurs across sectors during adjustment periods. In Figure 5, we therefore consider the size and nature of worker flows from the old sector to the new sector. The goal of economic policy in the reallocation theories of Section 2 is to achieve an efficient reallocation. Given the difference in the *JD* policies across our two economies, can we detect efficiency differences other than the employment decline in Estonia discussed above?

Figure 6: Wage premium from moving from old to new sector



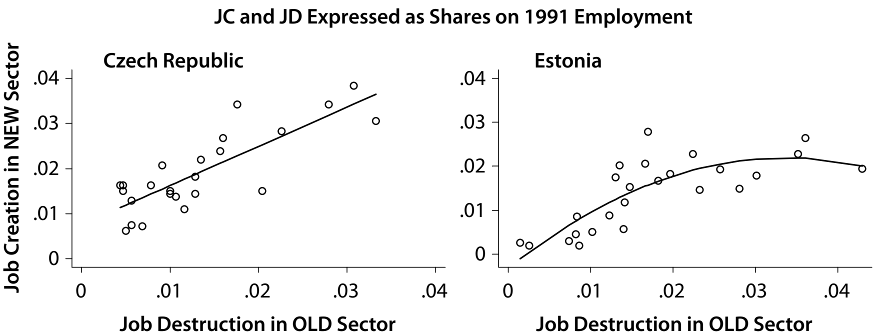
First, to assess the magnitude and timing of the main reallocation flow, the upper left graph of Figure 5 plots the number of workers moving from the old to the new sector as a proportion of total employment using the time of departure from the old sector to define the timing of the flow. In both countries, there are two years of peak reallocation, followed by a gradual decline. Between 1991 and 1994, Estonia's drastic *JD* impelled higher old-new worker flows. However, Estonian *JD* was less efficient in terms of the chances of workers reaching the new sector as documented in the upper right graph of Figure 5. The fraction of old-sector separations resulting in new-sector hires within six months of the separation was much higher in the Czech Republic during the peak years of reallocation.

The lower two graphs of Figure 5 testify to the different nature of the old-new flow in the two transition regimes. They ask to what extent we find workers leaving the old sector voluntarily (quits) vs. being laid off. They indicate that in the Czech Republic, where JDold rates never reached very high levels, quits outweighed layoffs for all old-to-new sector moves throughout the transition. Hence, transition was carried out by old-sector workers quitting their traditional jobs for the new sector. In contrast, the dramatic Estonian JDold in 1992–93 is manifested by the dominant role of layoffs for Estonian old-to-new flows.[22] However, the difference in the *JD* policies of Estonia and the Czech Republic did not affect the wage gain for a typical worker moving from the old to the new sector. Figure 6 shows that the realized wage gain follows a very similar pattern in both economies, starting at about 40 percent during the first year of reforms and gradually declining afterwards.

In sum, the efficiency difference between the two transition paths appears to be concentrated in the lower employment chances of Estonian workers pushed from the their old jobs (compared to Czech workers who leave the old sector voluntarily), not in their wage gain. To the extent that the wage gain serves as a proxy for productivity gains, the two reallocation processes appear similarly productivity enhancing.

22 The graph does not show the two remaining types of job exit in the data: "out-of-labor-force" and "other".

Figure 7: Relationship between contemporaneous values of JCnew and JDold



5.1.4 Relationship between JDold and JCnew

Finally, we ask about the nature of the relationship between the two main job flows, JDold and JCnew. This is motivated by the theories that focus on their evolution and potential feedback. Figure 7 presents plots of the contemporaneous values of quarterly JDold and JCnew together with fitted regression lines. The Czech series move closely together: any number of jobs destroyed in the old sector is matched in the same quarter by an equal number of jobs created in the new sector. The R^2 of the linear regression of JCnew on JDold and a constant is 0.67 and the slope coefficient of 0.87 is within one standard error of unity. The picture is different in Estonia, where a quadratic term delivers a fit similar to the Czech linear regression. Estonian quarterly job destruction exceeding 3 percent of employment was not matched by similarly high job creation.

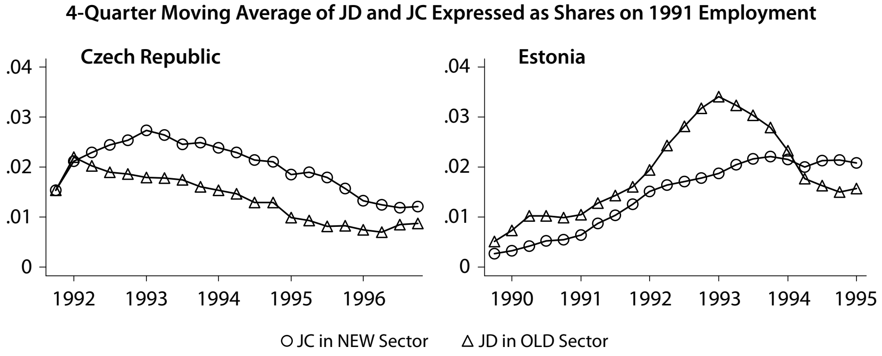
Given that total Czech employment remains relatively stable, it is not surprising that JDold and JCnew have a stable long-run relationship. This is confirmed in Figure 8, which plots the one-year moving average of the quarterly values of JCnew and JDold. While at the outset of Czech transition the filtered JDold matches JCnew, job creation soon starts to dominate job destruction and both measures gradually decline in parallel for most of the transition. In Estonia, on the other hand, JDold is the dominating force until late into transition. When JDold skyrockets in Estonia, JCnew keeps on growing, albeit at a somewhat declining rate.

5.2 Applying the theory to the data

5.2.1 OST theory

Are our findings consistent with the behavior of model economies of the OST literature? First, we ask whether our results are in accord with the OST theory's basic characterization of a two-sector economy where jobs are only created in the

Figure 8: Time series of JCnew and JDold



new sector and only destroyed in the old sector. Indeed, the evidence in Figure 4 suggests that the basic premise of OST models is correct since these two job flows appear to drive all of job reallocation at the beginning of transition.[23] We also note that the evidence supports the dynamic properties of the OST predictions in that, as seen in Figure 3, the job transfer in both countries was "organic," without major breaks due to, e.g., mass privatization.

Second, can we rationalize the Estonian experience within the OST models? The theory predicts rising unemployment if the economy is climbing up the inverted "U" curve of Figure 2. That is, JCnew grows but lags behind JDold possibly because the government is rapidly downsizing the old sector to speed up transition by raising unemployment and lowering wages. This prescription fits early Estonian transition. However, the theory also predicts that either the system converges to the top of the inverted "U" curve, where the economy enjoys an extended time period of equal JCnew and JDold, or, if the scrapping of old firms moves too quickly, we should see a drop in JCnew (bottom right quadrant of Figure 1). In contrast, Estonian JCnew continued to grow even after a dramatic peak in JDold (Figure 8). Given the low level of unemployment benefits, the rise in Estonian *JD* and unemployment did not translate into tax hikes and decreases in *JC* as suggested by the Aghion-Blanchard model. On the other hand, if this feedback mechanism was not in place, the OST perspective is that JCnew should catch up with JDold quickly, while in fact it remained below JDold until late into transition.[24]

23 This success of the theory may be surprising since our definition of the old sector includes privatized firms, which could be producing new jobs. Further, the potential for a significant level of job destruction in the new sector is perhaps a more serious challenge to OST theory since it is well known from U.S. data that new firms are likely to fail early on (see e.g., Davis and Haltiwanger, 1999). Newly emerging small firms can apparently cope with the turmoil of initial transition, probably because they locate in profitable market niches left open by the misallocation of central planning. As one would expect, later on in transition there appears to be more churning in the new sector as separations and *JD* rise.

24 It is difficult to evaluate the role of saving suggested by Castanheira and Roland (2000) for Estonian transition given the effect of hyperinflation on savings. See Section 3.1.

Third, we consider the Czech case in light of the OST theory, which predicts that gradualist JDold should result in an extended period of moderate, but constant reallocation, supported by a stable level of unemployment at which JCnew is able to match JDold. Indeed, this was the case in the Czech Republic, in sharp contrast to the continuous rise of Estonian joblessness (Figures 7 and 8). More importantly, the total reallocation achieved in the Czech Republic was comparable to that observed in Estonia (Figure 3). Hence, it is unlikely that the low Czech unemployment reflects a markedly low level of reallocation. Whether the Czech transition reached the optimal rate of reallocation (upper left quadrant of Figure 1) or remained sub-optimal (bottom left quadrant of Figure 1) is not clear.[25] However, given that the extent of misallocation (and the need for reallocation) was likely to have been higher within the Soviet Union compared to the more independent and more developed central and east European (CEE) economies, we find the similar extent of reallocation in these two economies to be suggestive of a high level of reallocation relative to needs in the Czech case. This notion is further supported by the similar wage premium from moving to the new sector. If we were to observe a very high new-sector wage premium in the Czech Republic, where there were relatively few layoffs from the old sector, and a low premium in Estonia, one might interpret the Czech wage premium as a pull factor necessary to lure workers out of their old jobs, signaling that a sub-optimally low JDold is a bottleneck for Czech reallocation.

The alignment between the Czech experience and the OST theory is surprising, however, because the *JD–JC* mechanisms proposed in the OST theory were apparently not at work. In the Aghion and Blanchard (1994) model, wages were to be depressed and taxes increased as unemployment rose. Yet, Czech taxes were not raised following unemployment increases and wages rose. Second, in the Castanheira and Roland (2000) model, high unemployment would depress savings. Yet, the savings rate was fairly constant from 1991 to 1996 (Table 1). Finally, the OST models are also at odds with the high initial wage premium we found for those moving to the new sector. The similarity of wage patterns in both countries suggests that the premium could be the result of selection on benefits from moving, where the old-sector workers with high potential earnings in the new sector move first. This highlights the importance of labor supply decisions for transition reallocation stressed by Boeri (1999). In the Czech Republic, quits were indeed the dominant way of transfer from the old to the new sector. On the other hand, we note that this pattern is in accord with the Castanheira and Rolland (2000) model, where old firms are not forced to layoff massively, but keep wages low, i.e., close to

25 In a previous version of this paper, we used the time dimension of our data to provide an estimate of the relationship between the speed of job creation in the new sector and the level of unemployment or non-employment. Such estimation could suggest whether most of the Czech reallocation occurred at the top of the inverted "U" curve, i.e., whether it was optimal. Unfortunately, the Czech estimates were not informative. Somewhat surprisingly, we found a statistically significant quadratic function in Estonia.

the actual productivity level. Such firms will see their workers leaving for the new sector, where wages and productivity are higher.

In sum, we offer some support for the OST theory: The Czech transition resembles many aspects of the Castanheira and Rolland model, with the lesson that efficient reallocation may be achieved even with slow JDold, as long as wages are kept low in the old sector. On the other hand, we do not find evidence for the theory channels of the *JD–JC* feedback mechanism. Furthermore, at a very basic level, one may be suspicious about the *JD* → *JC* feedback prediction because the higher JDold in Estonia (roughly double that of the Czech Republic during 1992–93) coexists with a level of JCnew that is equivalent to that of the Czech Republic (top graphs of Figure 4).

5.2.2 CH theory

How do the transition experiences of Estonia and the Czech Republic compare to the predictions of the CH model discussed in Section 2.1? Given the presence of contracting difficulties in the Czech Republic, its gradual *JD* combined with vigorous *JC* support (Section 3.2) should result in a synchronized *JD* and *JC* at high level of reallocation. In contrast, if contracting frictions are present in Estonia, its high *JD* level and lack of *JC* support should lead to high unemployment because *JC* cannot grow sufficiently.

In the case of the Czech Republic, our job reallocation measures indeed show strong synchronization of *JC* and *JD*; *JC* is able to match any *JD* level (Figure 7). Given the presence of appropriability problems, one can use the CH theory to draw the lesson that the Czech *JC* support, working primarily through easy access to credit for starting companies,[26] was very effective in dealing with frictions. For Estonia, the job reallocation pattern in Figure 8 reveals "decoupling" of *JC* and *JD*, but this decoupling occurs at a relatively high level of job creation. As we noted primarily from the BEEPS data, the early years of Estonian pro-market reforms were relatively free of serious contracting frictions which allowed for the vigorous creation of new jobs, in spite of the lack of *JC* support. It remains an open question whether, with *JC* support, the Estonian rate of JCnew would rise much above the rate achieved in the Czech Republic where *JC* support was vigorous.

6. Existing Evidence on Job Reallocation

In order to supplement our two case studies, we turn to the literature on job and worker reallocation in other transition economies and the U.S. to draw out the most important findings relevant to the OST and CH theories and contrast them with

26 See Boeri and Burda (1996) who argue that active labor market policies, which can also be thought of as job creation support, were also an important part of the Czech success.

our analysis of early transition policies and outcomes in Estonia and the Czech Republic. Most of the transition job reallocation research is descriptive and does not examine its findings in the light of reallocation theories. Hence, we unfortunately find only limited evidence outside of our two-country case study on the aggregate *evolution* and relationship between job destruction and creation and must report on simpler evidence on JC and JD in Section 6.1. We also extend the analysis based on the CH theory, which can be performed in a cross-sectional setting: In Section 6.2, we assess the extent to which property rights (appropriability) affect job creation in these countries by assembling a simple cross-country comparison of these measures. Finally, in Section 6.3 we contrast our findings to those from the U.S.

6.1 Comparison to other transition countries

The empirical literature on job creation and destruction in transition usually relies on the methodology of Davis and Haltiwanger (1992) and uses firm-level data typically covering only the manufacturing sector.[27] The findings from this literature on where jobs are created and where they are destroyed are consistent with the reallocation theories as well as with our approach and findings. First, in support of the notion that the definition of the "old sector" should comprise privatized and state-owned firms, several studies have found there is little difference between gross job flows of privatized and those of state-owned companies in Russia (Acquisti and Lehmann, 2000), Ukraine (Konings, Kupets and Lehmann, 2003), or Bulgaria, Hungary and Romania (Bilsen and Konings, 1998). Conversely, a number of studies have identified *de novo* (newly established) private firms as the driving force of job creation and net employment growth during transition, including Bilsen and Konings (1998) for Bulgaria, Hungary, and Romania, Brown and Earle (2003) for Russia, and Haltiwanger and Vodopivec (2003) for Slovenia. Dong and Xu (2006) use industrial firm-level data from the late 1990s to suggest that job reallocation in China shared these two features with the east European transition.

Second, the literature suggests that in most central and east European (CEE) countries, job destruction was leading job creation by a large margin in early transition (Haltiwanger, Lehmann and Terrell, 2003), which underscores the importance of analyzing the unusual Czech case. However, there is little evidence on the relationship between JCnew and JDold available outside of our study. Recently, Dong and Xu (2006) argue that JD and JC was synchronized in China (similarly to the Czech case) thanks to the already larger size of private companies at the time of massive downsizing in the state sector. In the Czech case, small startups were able to absorb the labor gradually shed from large old companies. In the Chinese case,

27 Among the exceptions are Haltiwanger and Vodopivec (2002) who use the worker-level Estonian data we use, and Haltiwanger and Vodopivec (2003) who analyze Slovenian matched employer-employee data.

the private sector was allowed to grow in absence of massive layoffs, which came only later in the transition process.

Similarly, there is little evidence available from other countries on the dynamics of reallocation from old to new sectors. There is a wealth of studies on worker reallocation across industrial sectors, suggesting that in all transition economies the size of the agricultural and manufacturing sectors declined, while employment grew rapidly in construction, trade, services, and finance.[28] This industrial reallocation corresponds to the cross-industry part of the reallocation from "old" to "new." However, Faggio and Konings (2003), Konings, Kupets and Lehmann (2003) and Jurajda and Terrell (2003) suggest that most (old-new) job reallocation occurs within industrial sectors and regions, rather than across them, much in accord with the evidence on excess job reallocation from developed economies (e.g., Davis and Haltiwanger, 1999). The extensive industrial reallocation evidence is therefore not closely linked to the macroeconomic reallocation flows that we study in this paper.

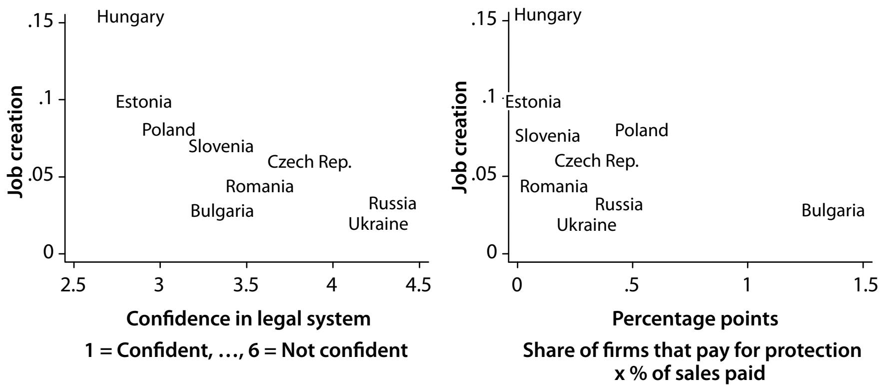
There is particularly little cross-country evidence on the productivity enhancing effect of transition reallocation; yet, such evidence is needed in order to provide a full assessment of the alternative reallocation policies. The only available evidence is based on the 1999 BEEPS survey, which suggests that new companies are more productive than inherited firms in countries as diverse as Hungary and Ukraine.[29] These productivity gaps are consistent with our findings on wage gaps between the new and the old sector. Unfortunately, the BEEPS survey design makes it impossible to measure the share of new enterprises in each country and to assess the effects of reallocation (World Bank, 2002). We therefore cannot form useful cross-country comparisons of gains from reallocation and to match these with the job reallocation policy choices of transition countries.

On the question of whether or not high unemployment is necessary for reallocation, Boeri (1999) suggests that job-to-job movements were the primary form of worker reallocation from the old to new sector not only in the Czech Republic, but also in Hungary and Slovakia. It is clear that the level of social assistance was much greater in these CEE countries than in the former commonwealth of independent states (CIS) countries (Boeri and Terrell, 2002). On the other hand, both Slovakia and Hungary experienced higher unemployment than the Czech Republic in early transition. Here, we stress that the new-old wage gap was comparable in the Czech

28 See Sorm and Terrell (2000) for the Czech Republic, Noorkoiv et al. (1997) for Estonia and Boeri and Terrell (2002) for other countries.

29 A number of related studies estimate the productivity gap between state-owned v. private (*de novo* as well as privatized) firms in the manufacturing sector, e.g., Brown, Earle and Telegdy (2006) and Sabirianova Peter, Švejnar and Terrell (2005), and find domestic privately owned firms to be more productive. Clearly, the productivity gains of reallocation from "old "to "new" sector occur on top of productivity-enhancing reallocation within the inherited "old" sector. For example, Brown and Earle (2006) suggest that job reallocation in "old" Ukrainian manufacturing firms in the 1990s was productivity enhancing.

Figure 9: Aggregate job creation and appropriability



and Estonian case, despite the difference in welfare provision, suggesting that generous benefit replacement ratios do not lead to costly wage hikes in the new sector as long as wages in the old sector are kept low.

6.2 Rule of law and reallocation levels

In this section, we probe further into the existing literature on the relationship between job reallocation and rule of law in light of CH theory predictions. To provide more evidence on this issue, we assemble cross-country measures of job creation estimated in the literature with measures of appropriability and other contracting frictions highlighted in the CH theory. The data in appendix Table A3 indicate that the differences in the rule of law, as measured by the BEEPS, were large across transition countries. The holdup problem was perhaps most severe in the eastern CIS countries as seen with the BEEPS data and also confirmed by the EBRD Legal effectiveness index, which reached the highest level of 4 for both Estonia and the Czech Republic by 1998, while it was still at 2 in Ukraine and Russia.

Next, we contrast available measures of job creation for early transition with the extent of appropriability problems across countries where such measures are available.[30] The patterns of the data in the two graphs in Figure 9 clearly support

30 Ideally, we would like to contrast JCnew with the extent of both appropriability and job creation support across these countries to assess the effectiveness of *JC* subsidies in addressing the appropriability problem. Unfortunately, it is difficult to find measures of *JC* support that exclude subsidies aimed to slow down JDold. Both the EBRD subsidy index (see Table 1) and the amount of credit in the economy reflect not only support for JCnew but also for JDold. Hence, we must limit our analysis to relationship between appropriability and JCnew. Furthermore, as most of the existing literature does not effectively differentiate the *de novo* sector, we rely on measures of *JC* capturing the entire economy. However, given that the literature suggests that most *JC* occurs in the new sector, this measure is likely to reflect cross-country differences in JCnew.

the CH prediction, a question we could not effectively answer within a two-country study. The graphs indicate a negative convex relationship between job creation and appropriability using two measures – confidence in the legal system and percent of sales paid for protection of property – from the BEEPS data.[31]

6.3 Comparison to U.S.

Finally, we conclude the discussion of our empirical results on job flows during an unusually deep structural recession with a comparison to the stylized facts from the U.S. literature on the cyclicality of job reallocation.[32] First, the U.S. job reallocation is large-scale and incessant – on average one job in ten is being created and destroyed every year. Perhaps surprisingly, given the shock to the system, the reallocation rates in the early years of transition were smaller than those found in the U.S. economy. This could be related to the gap between the U.S. and transition economies in terms of rule-of-law/appropriability. Second, in the U.S. there is a negative correlation between *JC* and *JD* over the business cycle, at least in the manufacturing industry. In contrast, we see co-movement of *JD* and *JC* over the transitional recession of the early 1990s. It is likely that the U.S. reallocation corresponds to aggregate shocks affecting productivity in all sectors in the same direction (Mortensen and Pissarides, 1994), while the transition reallocation corresponds to a dispersed shock affecting the new and old sector differently. Third, small firms apparently create and sustain most jobs during transition (at least in countries with good rule of law), unlike in the U.S., where they exhibit high destruction rates (Davis, Haltiwanger and Schuh, 1996). This is likely due to these firms filling in highly profitable market niches left open by inefficient central planning.

7. Final Remarks

This study sheds light on the process of reallocating jobs and workers during economy-wide structural adjustment in two transition economies that differed markedly in their reallocation policies – Estonia and the Czech Republic. We contrast their patterns of job creation and job destruction in light of the theoretical predictions of two models of reallocation – the gradualist theories motivated by transition from central planning and the creative-destruction-with-frictions theoretical work motivated by adjustment crises of the developing world. We

31 We would also like to know whether JDnew was also related to the rule of law, as suggested by Konings, Kupets and Lehmann (2003) and Acquisti and Lehmann (2000) in the context of Ukraine and Russia, respectively. They interpret the evidence of high JDnew as corresponding to the hostile business environment in these countries, i.e., high appropriability. Unfortunately, there is not enough data to evaluate this hypothesis. Specifically, measures of JDnew are available in only 4 countries: i.e., theirs for Russia and Ukraine in the late 1990s and ours for the Czech Republic and Estonia in the mid 1990s.

32 See, e.g., Davis and Haltiwanger (1990, 1992) and Blanchard and Diamond (1990). For similar analysis from Germany see Boeri and Cramer (1992).

describe reallocation for the entire economy, including all firm sizes and economic activities, and not just for one sector as is typical in much of this literature.

We show that in early transition economies most reallocation occurs along a single dimension: from inherited post-soviet enterprises to small newly started private firms. (Yet, most of transition research focused on the issue of enterprise privatization as a way of creating the new economy.) The extent of reallocation is stunning as only a few years into the transition, in each of these countries small *de novo* firms were able to provide more jobs than large old firms, which existed prior to 1990. The overall degree of achieved reallocation was similar in the two economies, despite the smaller employment decline in the Czech Republic.

We also find that the two bodies of macroeconomic theory are useful in helping us understand the process and needed policies in transition economies. Although the gradualist theories of Aghion and Blanchard (1994) or Castanheira and Rolland (2000) do not provide a perfect description of the observed reallocation processes, many aspects of reallocation in both countries do fit the dynamic pattern of these models. The Aghion and Blanchard (1994) model offers an explanation for the coexistence of strong job creation and rapid job destruction in Estonia: taxes were not raised (and job creation was not curbed) because Estonia did not offer much unemployment insurance to its jobless workers. Applying the Castanheira and Rolland (2000) model to the Czech case, we suggest that efficient reallocation may be achieved even with slow scrapping of the old sector, as long as wages are kept low there, allowing the newly created firms to attract workers without unnecessary wage hikes. With respect to the Caballero and Hammour (1996) model, we draw the lesson that even in an environment with widespread contracting problems, one can achieve efficient synchronization of job destruction and creation when there is economic policy supporting job creation, as there was in the Czech Republic. On the other hand, when there is little support for job creation in an environment with contracting problems, the decoupling of job creation and job destruction can create serious problems of unemployment, as in the case of Estonia and other CIS countries.

Returning to the question in the introductory section posed by Caballero and Hammour (1996), our research would therefore suggest that gradualism combined with job creation support may have redressed the transitional employment problem in the Czech Republic. However, the Czech soft-loan gradualism also apparently reduced the transparency of the economy, such that it may not be a long-run efficient policy. During the 1990s, Czech semi-state banks became increasingly inefficient in allocating external finance and the country experienced a mild recession in 1997 and 1998. Czech unemployment thus increased following 1997, even if it stayed somewhat below the Estonian level until the two countries joined the EU in 2004.[33]

The experience of transition economies can be useful for understanding the impact of the speed of job destruction in the old sector on the process of reallocation in other developing countries, where governments have the capacity to provide safety nets and/or subsidies to job creation. Similarly, the macroeconomic models we consider can also be applied to economies in the developing world, where a major economic sector is inefficient and bloated. In particular, Estonia serves as an example of a country that did not have the resources to support the ailing old sector or provide a safety net for workers. Our evidence suggests that rapid job destruction did not bring about a slow-down of job creation, perhaps thanks to very low unemployment insurance, even though job creation support and the availability of credit were not particularly high. Clearly, the holdup problem was not a key issue in Estonia, but may be an issue in Ukraine and Russia.

On the other hand, the Czech Republic serves as an example of a country where governments have the capacity to provide safety nets and/or subsidies to both slow down job destruction and support job creation. The Czech case suggests two policy instruments to achieve reallocation with low unemployment: abundant access to credit and keeping wages low in the declining sector. Most observers would imply that the early Czech reallocation was not sufficient and that the 1997 Czech recession corresponds to postponed reallocation. In contrast, our evidence suggests that early Czech transition was successful in terms of moving jobs to the new sector, at least as much as the Estonian transition did, and that the wage gain from reallocation was similar as well. We therefore find it more likely that the Czech recession and unemployment increase of the late 1990s was caused by the implications of the form of subsidy support combined with other macroeconomic policies. The lesson for LDCs that wish to make a future massive reallocation less painful is that a successful gradual reallocation can be engineered, but that the form and political economy of subsidy provision is crucial.

Using very different early-transition policies, the Czech and Estonian economies ended up with similar levels of sectoral reallocation. The Czechs "paid" for their lower unemployment with subsidies (taxpayers' costs) whereas in Estonia many jobless workers faced unemployment with little welfare support. Future research is needed to investigate whether this policy tradeoff, despite leading to the same level of reallocation, led to differences in outcomes along other dimensions. First, future

33 Unemployment in the Czech Republic rose sharply after 1996, up to almost 9 percent using the Eurostat methodology. In contrast, unemployment in Estonia after 1996 stabilized at nearly a 10 percent level until 2005. The Czech Republic also continued to enjoy somewhat higher employment rates than Estonia until the two countries joined the EU in 2004. Estonian GDP grew at a rate of 5% per annum in 1996–1999 and at about 9% per annum from 2000–2006 while the Czech Republic stagnated with an average of 0% growth in 1996-1999 and only about 5% per annum in 2000-2006. However, this growth rate gap is to some extent related to the lower initial GDP level of Estonia.

studies directly measuring productivity differences can ask whether the new-sector productivity gains depend on the nature of the reallocation process and government policy. For example, they might examine the extent to which government policy can influence productivity differences and raise the technological component of the lagging sector (e.g., Sanchez-Ancochea, 2005). Second, the nature of the transition path may make it more or less difficult for the new economy to move into a steady-state creative-destruction reallocation; as Caballero and Hammour (2000) note, the nature of initial restructuring may affect steady-state reallocation levels through reallocation sclerosis or labor market segmentation.

Appendix

Table A1: Czech retrospective data

Sample counts	
Number of workers	4786
Number of spells (jobs)	7924
Number of spells that ended within sampling frame	4010
Reported distribution of exits (initial *JD* estimate bolded)	
a. I stopped my business	**1.8%**
b. My employer stopped his business	**11.8%**
c. Laid off due to reduction of workforce	**7.4%**
d. Laid off due to other reasons	2.4%
e. I was not satisfied with my job, or I found a better job	28.9%
f. I quit myself due to personal or family reasons	13.8%
g. I quit on the health ground	5.7%
h. School attendance, study, training	5.4%
i. Army service, civil service	2.0%
j. I moved	0.7%
k. Retirement	10.3%
l. Maternity leave	6.2%
m. Other reasons	10.0%
Total	106.5%

Table A2: Estonian retrospective data

Sample counts	
Number of workers	7928
Number of spells (jobs)	14465
Number of spells that ended within sampling frame	8821
Reported distribution of exits (initial JD estimate bolded)[a]	
a. Closing of the enterprise/organization	7.4%
b. Reorganization of the enterprise/organization	8.4%
c. Bankruptcy of the enterprise/organization	2.3%
d. Privatization of the enterprise/organization	0.8%
e. Dismissal initiated by employer	2.9%
f. Personnel reduction	12.4%
g. Expiration of employment contract	4.9%
h. Expiration of the trail time	0.3%
i. Army service	1.3%
j. Imprisonment	0.2%
k. Illnes/injury	4.4%
l. Studies	1.9%
m. Retirement	9.8%
n. Marriage/child birth	6.8%
o. Change of residence	2.5%
p. Wanted/was proposed higher salary	13.6%
q. Wanted/was proposed better working conditions	9.2%
r. Wanted/was proposed more interesting work	5.8%
s. Wanted to start own business	2.6%
t. Main job became second job	0.5%
Total	98.0%

[a] Note: After correction for $JC < 0$ (Section (ii)), the results are not sensitive to alternatively choosing first seven answers as corresponding to *JD*.

Table A3: Data on job creation and "appropriability"

Country	JC	Confidence in legal system (1 = Confident… 6 = Not confident)	Share of firms that pay for protection	Percentage of sales paid for protection	Appropriability
	(1)	(2)	(3)	(4)	(3) x (4)
Bulgaria	0.024	3.25	0.790	1.64	1.30
Czech Republic	0.056	3.71	0.112	2.10	0.24
Estonia	0.095	2.81	0.000	0.00	0.00
Hungary	0.150	2.71	0.033	0.75	0.02
Poland	0.074	2.98	0.445	1.05	0.47
Romania	0.040	3.46	0.031	2.57	0.08
Russia	0.026	4.25	0.202	1.88	0.38
Slovenia	0.072	3.16	0.021	2.33	0.05
Ukraine	0.018	4.19	0.063	3.65	0.23

Notes: *The JC measure* corresponds to the average of available measures from the following studies:

Country	Years	Sectors	Data on	Sources
Bulgaria	1994–97	All sectors	Firms	Faggio and Konings (2003)
Czech Republic	1991–96	All Sectors	Jobs	Author's own calculations
Estonia	1994–97	All sectors	Firms	Faggio and Konings (2003)
Estonia	1991–94	All employees	Firms	Haltiwanger and Vodopivec (2002)
Hungary	1993–2000	All sectors	Firms	Korosi (2003)
Poland	1994–97	All sectors	Firms	Faggio and Konings (2003)
Poland	1991	Manufacturing	Firms	Konings, Lehmann and Schaffer (1996)
Poland	1993–95	All sectors	Firms	Rutkowski (2002)
Romania	1995–97	All sectors	Firms	Faggio and Konings (2003)
Russia	1990–99	All sectors	Firms	Brown and Earle (2002)
Russia	1997	Manufacturing	Firms	Acquisti and Lehman (1999)
Slovenia	1994–97	All sectors	Firms	Faggio and Konings (2003)
Slovenia	1997–99	All sectors	Employer–Employee	Haltiwanger and Vodopivec (2003)
Ukraine	199–96	All sectors	Firms	Konings and Walsh (1999)
Ukraine	1999	All sectors	Firms	Konings et al. (2003)

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9 | Gender Segregation and Wage Gap: An East–West Comparison

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1. Introduction

It is a well-established fact that occupations and industries staffed mainly with female workers pay lower wages to both men and women compared to predominantly male occupations and industries. The observed persistent concentration of women in low-paid groups of workers, coined "gender segregation," is therefore a key explanation for the existence of the gender wage gap.

The contribution of this paper is to survey and update selected recent findings on the structure of the gender wage gap in transition economies and to discuss the implications of the available East-West comparisons for the literature on gender segregation. The advantage of studying the gender pay gap in transition from central planning to a market economy is that we observe dramatic changes in employment rates, which are in part driven by different transition policies. I will argue that the recent transition-based results may shed light not only on cross-country differences in the size of the gap but also on the mechanism giving rise to the typical wage "penalty" to working in predominantly female occupations and industries. The extension of some of the earlier findings with new data in this paper further allows me to asses the immediate impact of the introduction of Western anti-discrimination policies.

The structure of the paper is as follows. The next section provides a brief summary of the existing research on gender wage gaps in transition. Next, Section 3 discusses the available theories of gender segregation and the importance of the transition research for differentiating between them. To support this discussion, I present a set of results based on previous and new research with the purpose of maximizing comparability across countries. Section 4 then offers new evidence on the structure of the gender wage gap in Central Europe after the introduction of standard anti-discrimination legislation.

2. Female Wages in Transition

Female pay was lower than male pay even under communism, which compressed wages and forced near-full labor-force participation (e.g., Brainerd 2000). Hence, during the transition from central planning there are two main, potentially off-setting forces affecting the male-female gender wage gap: (i) an increase in wage dispersion, which is expected to worsen the relative wage position of women, who are predominantly located in the lower part of the wage distribution, and (ii) a drop in employment rates, which is expected to diminish the observed gender wage gap, because dropping out of employment primarily affects low earners, i.e., women.

There is now a battery of results available on the size and structure of the gender wage gap before and during transition. A typical finding in this literature is that gender differences in productive characteristics can "explain" only a small part of the wage gap. Hence, within-job wage discrimination and gender segregation are likely to be important in transition economies. Alternatively, there is a large difference in the relative unobservable labor quality of employed women and men.

Some of the transition studies find the female-male wage gap to be stable over time (e.g., Newell and Reilly 2001), some find it increasing in countries with a dramatic rise in wage inequality (e.g., Brainerd 2000), and some find a decrease in the gap in countries with large outflows of low-earners from employment (e.g., Orazem and Vodopivec 2000). These studies are overwhelmingly based on (repeated) cross-sections of employed workers. They typically do not correct for female selection into employment and when they do (e.g., Jolliffe 2002), they use identification strategies that do not reflect the main shifts in participation between central planning and market.

The major exception that does explicitly consider the effect of the decline in employment rates is Hunt (2002). She follows East Germans employed in 1990 and shows that low-earning workers, i.e., mainly women, are selectively dropping out of the labor force. This selective process explains 40% of the 10-percentage-point decrease in the East German gender wage gap between 1990 and 1994. The East German slashing of low-wage employment was indeed exceptional in the transition context and was driven by a wage explosion following the 1990 monetary union between East and West Germany. In contrast, real wages declined and wage floors remained relatively low in other transition economies (Boeri and Terrell, 2002). To the extent that the evolution of the gap is affected by the changing participation of low-wage women, it is not surprising that wage gaps did not substantially decrease in other transition economies.

Finally, only a few of the existing studies pay close attention to the issue of gender segregation. Ogloblin (1999) uses household survey data to suggest that occupational segregation is driving a large portion of the mid-transition Russian gender pay gap. Jurajda (2003) implies a significant wage penalty to working in "female" occupations, firms and job cells (groups of workers with the same occupation working in the same firm) using a sample of 1998 Czech and Slovak employees. However, Jurajda and Harmgart (2003) recently find that predominantly "female" occupations pay higher wages in early-transition East Germany, in stark contrast to both the transition and western literature. The interpretation of this difference in the findings is the topic of the next section.

3. Segregation and Labor Quality

The extensive U.S. literature on gender segregation puts forward three main hypotheses for why "female" occupations pay less: (i) discriminating employers may prevent women from working in high-wage occupations, (ii) female occupations may offer costly nonwage characteristics preferred by women, and/or (iii) workers employed in female occupations may have lower labor quality.[1]

To get at the importance of explanations (ii) and (iii), researchers have recently controlled for not only observed productive characteristics of workers, but also occupational attributes and unmeasured worker quality. In the U.S. and Canada, controlling for these additional factors substantially reduces the wage penalty to female jobs (Macpherson and Hirsh 1995; Baker and Fortin 2001). In this line of research, unobserved person-specific characteristics are captured using person-fixed-effect regressions, where workers switching occupations provide the key source of identification for the estimation of occupations' "femaleness" on wages. However, switching occupation and participation decisions (i.e., being employed in at least two periods) is likely to be endogenous to the extent of segregation as well as its wage impact. An alternative strategy for studying the sources of the penalty to working in predominantly female occupations is to rely on cross-country differences in labor-market institutions and wage structures (Baker and Fortin 1999).[2] Below, I offer some tantalizing comparisons using this strategy.

Econometric Approach: The vast majority of the gender-wage-gap literature relies on the Oaxaca-Blinder mean-wage decomposition, which quantifies the part of the overall gender wage gap attributable to differences in the average characteristics of men and women. To conserve space, I follow Groshen (1991) and present the decomposition in a particularly simple form: I use pooled regressions based on both male and female data to approximate the counterfactual nondiscriminatory wage structure (as in Oaxaca and Ransom 1994) and consider the female dummy coefficient as an estimate of the unexplained portion of the gap.[3] I therefore decompose the gap between the male and female mean of the natural logarithm of wages as follows:

$$\overline{\ln w_m} - \overline{\ln w_f} = (\overline{X_m} - \overline{X_f})\beta + \alpha \,. \tag{1}$$

Here, $\overline{X_m}$ and $\overline{X_f}$ represent the respective vectors of male and female mean values of explanatory variables, β stands for the set of slope coefficients and α for the female-dummy coefficient from a pooled wage regression. The first term on the right hand side of equation (1) quantifies the explained part of the total logarithmic wage difference using β to approximate a non-discriminatory wage structure, while the second term α captures the remaining unexplained part. The set of explanatory variables X contains not only standard productive characteristics of workers

1 For example, if women are discouraged from entering high-wage occupations by discriminatory barriers, then only highly productive women will enter the typically "male" occupations. The fraction of female workforce then becomes an index of labor quality and only low-quality men will join "female" occupations.

2 Blau and Kahn (2003) use this approach to understand international differences in the size of the gender pay gap.

3 In Jurajda (2003) I find this approach equivalent to the standard Oaxaca–Blinder decomposition.

Table 1: Log wage differentials by gender and femaleness of occupation and industry

	Country	USA	Czech Republic	Slovak Republic	East Germany	West Germany
	Year	1990	2002	2002	1995	1995
		(1)	(2)	(3)	(4)	(5)
Total gap		-0.375	-0.282	-0.234	-0.041	-0.241
Female		-0.241 (0.002)	-0.211 (0.009)	-0.182 (0.01)	-0.123 (0.006)	-0.170 (0.003)
% female in occupation		-0.143 (0.005)	-0.132 (0.019)	-0.097 (0.029)	0.127 (0.011)	0.007 (0.005)
% female in industry		-0.395 (0.012)	-0.168 (0.034)	-0.166 (0.061)	0.060 (0.016)	-0.100 (0.09)
No. of occupations		13	27	27	187	288
No. of industries		236	54	59	57	87
No. of firms		32,931	2,240	875	10,094	35,929
No. of workers		637,718	805,767	334,586	23,561	89,997

Notes: Control variables in all specifications are worker education, age, and firm employment and region (except in Germany). Standard errors in parentheses allow for clustering of residuals at the firm level. Column (1) comes from Bayard et al. (2003) and columns (4) and (5) are based on Jurajda and Harmgart (2003). The Czech and Slovak (U.S.) [German] worker-level data covers business enterprises employing more than 10 (25) [50] workers.

(education and experience) but also the fraction of female workers in a given occupation or industry, which controls for the "femaleness" of a given employment category.

Comparison of Segregation Effects: In Table 1, I present (i) the total log-wage gender gap, and (ii) the female dummy coefficient together with segregation-related slope parameters from pooled regressions estimated for five economies using highly comparable data.[4] Column (1) shows the U.S. estimates, which are taken from Bayard et al. (2003); columns (2) and (3) present new results for the Czech and Slovak Republics; and columns (4) and (5) list unreported specifications estimated for East and West Germany as part of Jurajda and Harmgart (2003) (JH).[5]

Two key findings stand out from the table. First, a major portion of the total gender wage gap remains unexplained in all five economies, after controlling for detailed worker and employer characteristics as well as gender segregation. East Germany is

4 All four data sets, which are samples of nonpublic employees from medium and large firms, provide a coverage of the entire array of occupations and industries in a given economy, and allow one to establish the occupation- and industry-specific share of female workers. See the Appendix for details and references.

5 The results in Table 1 are not fully comparable because of the different categorizations of occupations and industries available in each data set. However, switching from 54 to 187 industries had no material effect on the Czech 2002 parameters of interest (no detailed industrial classification is available for Slovakia) and switching from two- to four-digit occupations had little effect on the estimates in Jurajda (2003) for both the Czech and Slovak Republics.

the extreme case as the pure gender wage gap approximated by the female dummy is three times larger than the overall gender pay gap. Second, gender segregation by occupation and industry is a statistically significant factor contributing to the overall gender pay differences, except in both parts of Germany. In East Germany, "female" occupations and industries pay more. The extremely low overall East German wage gap is therefore supported by the coexistence of significant within-job wage gaps with a positive wage penalty to predominantly female employment segments.[6]

JH suggest an explanation for the exceptional East German findings based on the unique restructuring process of East German transition. German unification brought about the imposition of near-western wage levels against a background of mass layoffs. This resulted in a strong selection of women into employment based on labor quality (Hunt 2002). Indeed, productive characteristics of East German female full-time employees are substantially higher than those of their male colleagues. If the share of women in an occupation becomes a measure of skill quality, high productivity men may sort themselves into predominantly female occupations.[7] The selection process leading to only highest-productivity women attaining full-time jobs may be less extreme in West Germany, which did not experience a rapid dis-employment process and where higher wages are supported by higher productivity. This would explain why the femaleness of occupations plays no role for West German wages, but raises East German wages.

The quality-sorting explanation is supported by fixed-effect regressions of JH, where the positive effect of occupations' femaleness on wages is eliminated by controlling for time-constant unobservable worker quality, and it is also consistent with the comparisons in Table 1. In particular, female full-time employment rates are much lower in Germany than in the United States or Central Europe, but these differences are smaller for men.[8] Correspondingly, wage floors are much lower in the United States or in the Czech and Slovak Republics compared to Germany. This argument is also supported by OECD (2002) – an extensive cross-country study based largely on the European Community Household Panel – which suggests that "cross-country differences in female employment rates are mainly accounted for by the degree of integration of less-educated, lower-paid women into employment" and that compositional effects are important for explaining international differences in the gender pay gap as well as in the extent of segregation.

6 JH provide direct evidence on the significant within-job wage gaps using the matched employer-employee portion of the German data.

7 For a theoretical model where workers of complementary skills are grouped together see Kremer (1993).

8 The gender gap in full-time employment is 31 percentage points in Germany, but ranges from 12 to 19 points in the other three countries in 2000 (OECD 2002). Starting in 1992, the female employment ratio is practically identical in both parts of Germany based on the German Microcensus.

Table 2: Contribution of segregation to the wage gap before and after anti-discrimination legislation

	Coefficient estimate (1)	Mean difference women-men (2)	Relative contribution to wage gap (1)×(2)/ (total gap)	Coefficient estimate (3)	Mean difference women-men (4)	Relative contribution to wage gap (3)×(4)/ (total gap)
	1998			2002		
Czech Republic	total log wage gap = -0.297			total log wage gap = -0.282		
Female	-0.189*	1	0.64	-0.165*	1	0.59
% female in occupation	-0.104	0.328	0.12	-0.084*	0.293	0.09
% female in job cell	-0.104*	0.512	0.18	-0.108*	0.569	0.22
% female in firm	-0.237*	0.236	0.19	-0.034	0.274	0.03
Slovak Republic	total log wage gap = -0.227			total log wage gap = -0.234		
Female	-0.139*	1	0.61	-0.14*	1	0.60
% female in occupation	-0.098*	0.252	0.11	-0.030	0.297	0.04
% female in job cell	-0.061*	0.489	0.13	-0.092*	0.514	0.20
% female in firm	-0.25*	0.211	0.23	-0.192*	0.252	0.21

Notes: 1998 results are based on Jurajda (2003). For the list of control variables and the number of occupational categories, see Table 1.
* Denotes statistical significance at the 1% level.

4. Legislation

Most post-communist economies have recently adopted the standard set of anti-discrimination policies including the equal pay and equal employment opportunity clauses.[9] Each of these clauses affects a different part of the overall male-female pay difference. The equal pay regulation targets wage differences within job cells, where a job cell is defined as a group of workers with the same occupation in the same firm. The equal employment opportunity provisions target all forms of discriminatory segregation resulting in unjust concentration of women in low-paying employment segments. To measure the effect of the new legislation, one can therefore decompose the overall pay gaps into components corresponding to specific anti-discrimination policies.

In East Germany the new legislation came into effect as part of the German unification such that detailed measures of the structure of the gender wage gap before the introduction of the new legislation are not available. In Central Europe, however, the laws came into effect only recently within the EU-accession legislation process. In the Czech Republic the laws were enacted in 2000 while in Slovakia, the

9 While the constitutions of communist countries did include a "no discrimination in remuneration" clause, there was no specific implementation of this principle in labor-market legislation and no enforcement in courts.

legislation became effective as of the second quarter of 2002. In Table 2, I therefore extend the 1998 Czech and Slovak enterprise-sector wage-gap decompositions from Jurajda (2003) to the first quarter of 2002. In the Czech Republic, this corresponds to two years after the enactment of the legislation while in Slovakia, the new estimates correspond to the situation immediately before the new laws came into effect. To the extent that the Slovak wage structure from the first quarter of 2002 was not affected by the upcoming legislation, one can think of this research design as approximating a difference-in-difference comparison, where the Slovak evolution of the gender wage gap serves as a surrogate for the evolution of the Czech gap in absence of the new legislation. Following Groshen (1991) and Bayard et al. (2003) I use matched employer-employee data to control for not only occupational but also within-firm forms of segregation (see Jurajda 2003 for details).[10]

The 2002 results, based on a sample of over 800 (300) thousand Czech (Slovak) workers, suggest a minor change occurred in the structure of the gender pay gap between 1998 and 2002 in both economies. Table 2 presents the relative contributions of the unexplained and segregation-related parts of the gender wage gap according to the decomposition outlined in equation (1). In both countries, about 60% of the wage gap remains unexplained after controlling for detailed worker and firm characteristics and gender segregation, providing a high upper limit on the violation of the equal pay act. The remaining part of the gap is linked to gender segregation, in particular within-firm segregation.[11] The results in Table 2 imply that the size of the gender wage gap as well as its structure remain quite stable between 1998 and 2002 in both economies. The only exception is a small drop in the size of the overall Czech gap[12] and a substantial decrease in the Czech wage-gap contribution of firm-level segregation driven by the drop in the parameter estimate.

5. Conclusions

This paper uses recent results from the transition literature to suggest that cross-country differences in employment rates of low-wage women may be responsible for different wage penalties to mainly female occupations. In the extreme case of East Germany, female occupations pay more. This is consistent with predominantly highly productive women setting foothold in full-time employment, such that a high fraction of female workers signals high labor quality. The comparisons offered

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10 A weakness of this comparison is that both firm samples grew over time and due to strict anonymization procedures it is not possible to focus on the panel subsample; hence, I rely on industry, ownership, and firm-size controls to remove the effect of the changing sample structure.

11 The contribution of all other explanatory variables is small and tends to work to the advantage of women. An important caveat to these results is that the unexplained wage-gap component is likely to reflect in part the lack of information on the actual length of labor market experience in the Czech and Slovak data (see Jurajda, 2003).

12 The gap-change comparison is similar when controlling for characteristics of sampled firms.

here motivate future cross-country research linking the size of the wage penalty to "female" occupations with wage floors and skill structure of female employment. Such research would be complementary to the existing within-country longitudinal studies, which control for unobservable worker skills by relying on the exogeneity of worker occupation moves.

The results presented for the Czech and Slovak Republics also suggest that little immediate change occurred in the structure of the wage gap with the introduction of anti-discrimination legislation, with the possible exception of a decrease in the effect of firm-level gender segregation.[13] Despite the new legislation almost two-thirds of the gender wage gap remains unexplained and segregation continues to represent a major source of the gap. Segregation affects gender wage differences primarily within firms so that an implementation of the anti-discrimination policies aiming to equalize wages in occupations across firms would have little effect.

13 As of 2002, there have been a few court trials concerning unequal hiring practices in the Czech Republic (CHC 2002); however, firm-level gender segregation did not decrease and it is not clear how hiring practices would affect firm-level pay strategies.

Appendix: Data

Czech and Slovak Republic: The data consist of national employer surveys in which participating firms report hourly wages of all of their employees. The stratified sampling is based on the country firm register and covers only firms employing more than ten workers; the budgetary sector of public employees is not included. The data, which cover about one-third of all enterprise employment, are drawn directly from companies' personnel databases. The wage measure is a quarterly average used for social security purposes. For more details see Jurajda (2003).

Germany: The data consist of a 1% random sample of the German Social Security records, better known as the IAB employment subsample. The analysis-ready data correspond to end-of-year updates on each employment spell. German social security reporting excludes civil servants and self-employed workers; as of 1995, the records cover 80% (86%) of total West (East) German employment. The wage measure is a daily average; hence, to minimize gender differences in hours worked, the analysis excludes part-time workers (see Jurajda and Harmgart (2003)).

United States: The U.S. data used Bayard et al. (2003) come from a match between worker responses to the 1990 Decennial Census long form to establishment records maintained by the U.S. Census Bureau. The restrictions implied by the matching procedure exclude small firms as well as part-time and public administration workers. The hourly wage measure is based on annual earnings and hours worked.

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10 | Consumers' Opinion of Inflation Bias Due to Quality Improvements

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1. Introduction and Motivation

The necessity to obtain accurate price measurements is particularly important in transition economies that need to restrain government revenues (and therefore tax rates) in order to promote economic growth at a time when political realities dictate large social programs, often indexed to inflation, to mitigate the effects of the transition. Upwardly biased measures of inflation that overstate apparent income declines during the transition will have clear domestic political consequences, reducing public support of necessary reforms and increasing political instability. In addition, countries seeking European Union membership face considerable pressure to conform to the Maastricht criteria for accession to the European Monetary Union, among which are a low inflation rate (no more than 1.5% above the average inflation rate of the three lowest inflation countries in the EU). Obviously, upwardly biased inflation measures make achieving this criterion more difficult. Similarly, if inflation rates are overstated and, therefore, real incomes understated, citizens of accession countries will appear poorer than in reality theyare, thereby increasing pressure for resource transfers from current members and limitations on labour mobility, making the accession negotiations needlessly difficult.

It has long been recognized that quality improvements pose special problems in calculating measures of inflation including Consumer Price Indices (CPI). As Nordhaus (1998, p. 61) put it:

> Quality change poses severe problems for a statistical agency. It is non-mechanical in the sense that there is no way to determine quality change on a routine basis. It is heterogeneous in the sense that each quality change is *sui generis* and, like a child, requires individual attention. It is informationally demanding because it may require vast quantities of data that are expensive to obtain and often do not pass the test of a market transition. Even though routine procedures are established to handle quality change, in the end quality decisions require the subjective judgement about the extent of quality change, and agencies are reluctant to make subjective judgements.

Greenlees (2000, p. 60) is even less optimistic, saying "quality adjustment is also important because it is so difficult… Moreover, there are few common solutions to the problems that arise." A recent attempt to measure the total extent of bias in the U.S. Consumer Price Index reported that "of the several issues surrounding the topic of CPI bias, measuring quality change is easily the most controversial, both because estimates of the quality-change bias are often large and because estimates of bias frequently involve a large judgmental component and are inherently uncertain" (Lebow and Rudd, 2003, p. 172).

Despite its difficulty, a great deal of effort is expended by statistical agencies throughout the world in attempting to adjust reported measures of increases in consumer prices for quality changes. Greenlees (2000) and Reinsdorf et al. (1996)

discuss the adjustments made in the U.S. while Lowe (1998) summarizes Canadian practice and Armknecht and Mitland-Smith (1999) look at techniques used in a number of countries.

Not withstanding these efforts to capture quality changes, there is a widespread consensus that a substantial fraction of such changes remains unobserved, leading to an upward bias in CPI measures. In the U.S. the Boskin commission from the mid-1990s estimated that the annual bias from unmeasured quality change amounted to 0.6 percentage points, more than half of the total bias they identified and one fifth of average U.S. inflation rates at that time (Boskin, et al., 1998).[1]

The difficulties involved in adjusting for quality changes in measuring inflation can be seen from an examination of currently widely-used techniques and their limitations. Moulton and Moses (1997) report that in a typical month in the U.S. approximately 4 percent of sample price points involve item replacement because the previously sampled item is not available. Overall, some 30 percent of items scheduled to remain in the sample for a full year must be replaced sometime in that year. Of the items that must be replaced, BLS experts decide approximately 65 percent of the time that the new item is comparable to the version no longer available and do not make any quality adjustment. In the remaining 35 percent of cases, some form of quality adjustment is applied (see Schultze and Mackie, 2002 for a discussion of alternatives).

1) The least common technique, *the overlap method*, is applied to slightly over 1 percent of items replaced. It is based on simultaneous observation of prices for both the old and new versions of the product. The price change associated with quality change is estimated as the difference in the market prices in this overlapping period. At the moment when the new product substitutes for the old one in the consumer basket, the price difference between the new product's price in period t and the old product's price in period $t-1$ is divided between a pure price increase and the quality change estimated from the overlapping period:

$$p_{t-1}^{new} - p_{t-1}^{old} = \Delta$$

$$p_{t}^{new} - p_{t-1}^{old} = \delta p_t + \Delta$$

This method may produce distorted results if a producer initially offers the new version at the same price as the previous one, but later adjusts prices to reflect true quality differences. In addition, it requires that both the old and new product version be traded in the same outlet at the same time, something that rarely happens.

1 See Hulten (1997) and Moulton and Moses (1997) for critiques arguing that in theory quality biases could be smaller than found by the Boskin commission. Lebow and Rudd (2003) report that, after recent procedural changes by the Bureau of Labor Statistics (BLS), their best estimate of the extent of upward quality-change bias in the U.S. CPI is 0.37 percentage points a year.

2) Quality changes can also be inferred from related products using either a *link* or *class mean imputation*, a techniques used for about 23 percent of item replacements in the U.S.

First a price index δp_t^{n-1} is calculated based on other, similar goods for the month when a new version of a product is introduced. The percentage change in price between the new and old versions of the product is then decomposed into a price increase effect, assumed to be the same as that for other products of a similar nature, and a residual that is defined as quality change.[2] This methodology suffers from the required assumption that the price behavior for the item being replaced will be the same as for other, continuing items. For example, if producers use new-model introductions as an opportunity to make unusually large price increases, or if old models are heavily discounted prior to being discontinued, this method will overstate quality changes. On the other hand, if producers discount new models as part of an introduction strategy (for example, by providing discount coupons to encourage consumer sampling of new products), the method will understate quality changes.

3) For approximately 11 percent of item replacements, quality improvements are calculated by a *direct quality adjustment*, based on either the market value of measurable differences in physical characteristics when such differences have been priced independently or the change in production cost associated with added product features. Such adjustments can be made only when the quality improvement involves previously optional characteristics becoming bundled into the standard version of the product or where reliable incremental cost data can be isolated by manufacturers. Examples might include air bags and anti-lock brakes for cars, or modems and CD-ROM drives for computers.

For specific products the direct cost adjustment relies on *hedonic regressions*.[3] In this procedure, price is regressed on characteristics of the specific good and the coefficients given by this price-quality relationship used to deduce the "true" value of the new products by applying estimated coefficients to measured differences in characteristics between the old and new goods (see, for example, Feenstra, 1995 and Triplett, 1990).

The U.S. Bureau of Labor Statistics has used such adjustments for a number of years and has recently announced a major expansion of quality adjustments derived from hedonic models (see Fixler et. al. 1999; the series of studies for various products reported at http://stats.bls.gov/cpihome.htm; Schwartz and Scafidi 2001).

2 The difference between the link and class mean methods lies in the set of comparison items used, with the link method assuming that the pure price change is the same as for the composite of all other goods in the CPI stratum, while the class-mean method uses only the subset of items in the stratum for which there has been a comparable item replacement or direct adjustment of quality change during the period.

3 Examples in the U.S. CPI include computers, televisions, audio equipment, college textbooks, clothes washers and dryers, DVD players, microwave ovens, refrigerators, and videocassette recorders.

Such a methodology requires that a wide array of product varieties with differing identifiable characteristics be available in the market at the same time.

Recently Bils and Klenow (2001) have proposed an innovative method of inferring quality improvements over time based on instruments derived from cross-section Engle curves relating expenditure for consumer durables to consumer incomes. The assumption is that the higher prices paid by higher income consumers for specific durables, such as a washing machine, represent the purchase of higher quality items. This enables an adjustment for predicted quality increases as overall levels of consumer incomes rise over time. They find that for a sample of 66 items, BLS quality adjustments capture approximately 40 percent of the predicted quality growth across goods, leaving the remaining 60 percent of true quality growth to show up as an overstatement of inflation rates.

Clearly, there are problems with all of these techniques. As with hedonic regressions, the methodology proposed by Bils and Klenow requires there to be a wide variety of versions of specific products on the market at one time to estimate the cross-section Engle curves. No method will capture subtle quality changes within a product if these are embedded in the product without an identifiable model change. For example, no technique would observe that fresh milk had a longer shelf life or that new treatment methods made an otherwise identical shirt more wrinkle free.

Given the data and methodological problems with current techniques for adjusting for quality changes over time, innovation is required. Diewert (1996) challenged readers as follows: "In order to appreciate how choice sets have changed over time, I invite each (older) reader to think about the bundle [of] goods and services that he or she consumed as a youth." We take up this challenge in a specific context, that of the post-communist Czech Republic. We start with the rather obvious assumption that the best way to ascertain the extent to which consumers believe the quality of the products they purchase has changed is to ask the consumers themselves.

While we believe that the methodology we have used has general applicability, we have chosen to apply it to the transition Czech Republic for several reasons. First of all, the very nature of the transition means that the sort of small, embedded quality changes that the method is particularly well-suited to capturing will be especially common and occur in an especially rapid time frame. In 1990, for example, "fresh" milk sold in the Czech Republic came in a plastic container that gave the milk a chemical smell and resulted in spoilage in less than two days. By 1996 fresh milk from the same dairy came in a paper-pack that assured a natural smell and had durability that was guaranteed for four days. At the start of transition jam from local producers came in a jar with a pry-off cap that could not be resealed and often contained fruit pits and stems. Within a few years the fruit was pitted and the caps could be screwed on and off at will. Similarly, film colors became true and batteries lasted several times as long.

Secondly, mismeasurement of inflation due to factors such as quality improvements poses fundamental problems for understanding the transition from planned to market economies. As Filer and Hanousek (2000) have pointed out, eliminating even a relatively minor overstatement of the inflation rate by 20 per cent "would show that every country in the region grew during the 1990s, turning a story of decline and disruption into one of growth and hope." (p. 293, see also Duchene and Gros, 1994). Quality improvements are likely to be an especially important source of bias in transition economies, largely because initial quality levels were so low. As Stiglitz (1994) and others have pointed out, specification of quality is much more difficult than specification of quantity. Thus, command economies, where personal rewards to management depend on plan fulfillment, have a natural tendency to economize on effort and other resources by continually reducing quality, while meeting numerical quantity goals for imprecisely specified goods.

In this paper we use consumers' expressions of what they would be willing to pay for older versions of products conditional on the current versions' price to derive an indication of their perception of quality differences between current and pre-transition products. Examining 63 products from a wide variety of sectors, consumers in the Czech Republic reported that if they were to purchase the 1990-quality product today they would be willing to pay, on average, only 54 per cent of what they pay for the current-quality product for the earlier version. This implies that the actual price increase for these products during the decade was 66 per cent instead of the official 139 per cent.

2. Methodology

We derive our results from a series of focus groups conducted in the Czech Republic between March and May, 2001. Focus groups have previously been used by economists to determine the price consumers might be willing to pay for hypothetical products and services such as environmental amenities.[4] Among enterprises, focus groups are widely used to investigate consumer acceptance of potential new products prior to their launch, including issues of appropriate pricing for such products.[5] Thus, it seems appropriate to extend the methodology to investigate how consumers would value older, presumably lower quality, products that are no longer on the market relative to how they value today's version of these products. In effect, we asked consumers: "Given the price and quality of a product in the CPI basket today, what would be a reasonable price for the quality

4 See Soderholm (2001); Hanley et al. (2001); Kaplowitz and Hoehn (2001); Kontogianni et al. (2001); Ortuzar, Iacobelli and Velez (2000); Chilton and Hutcheson (1999); Freeman and Rogers (1999); Beattie et al (1998); Knoppers and Mathios (1998); Kramer and Mercer (1997), Lunt (1996), Johnston et al (1995), Desvousges and Smith (1988), and Mitchell and Carson (1986).

5 See Bernacchi (2001); Samel and Henthorne (1993) for examples and Feick et al. (1995) for a use of focus groups in evaluating consumer experiences in the transition.

characteristics of the same product as it existed at the start of the transition were you able to purchase this older product today?"[6] The difference in these prices represents the difference in the quality of the item, expressed in today's currency. Only price increases in excess of this difference can be said to represent true inflation.

We engaged a firm with extensive experience in market research in the Czech Republic to conduct these focus groups. Each group was composed of men and women aged 33 to 55 who were the head or spouse of a head-of-household in 1990 and who had secondary or higher education.[7] We ran a total of 15 focus groups, nine containing women and six containing men. Each group consisted of six individuals who evaluated approximately ten independent products from a variety of the major categories in the consumer basket. Each product was evaluated by between one and seven independent groups, with the average product being discussed by 2.4 groups. Appendix table A1 shows the number of focus groups and respondents for each item.[8]

Each focus group followed a similar script.

1) The moderator presented a product as it existed in 1990 (using a photo or the actual product if available). Group members were asked to recall this particular product and discuss its typical features and what they liked and/or disliked about it. The members of the group worked together to reach a consensus view of the characteristics of the earlier product.

2) The current version of the product was presented and the group discussed its characteristics and how they differ from the product as it existed in 1990.

3) The moderator distributed a record sheet for the product under discussion and asked group members to carefully consider all the differences between the current version of the product and the product as it existed in 1990. The moderator then

6 While it might at first appear that our methodology has much in common with contingent valuation studies, there is a fundamental difference. Contingent valuation involves asking consumers what they would be willing to pay for a hypothetical product or service with which they have no actual experience. We, on the other hand, are asking consumers about appropriate relative prices for two products with which they have actual experience. In general, differences between willingness to pay and willingness to accept have been shown to be smaller when close substitutes exist for the product in question (Shogren, 1994; Adamowicz, Bhardwaj and Macnab, 1993). Surely there can be no closer substitutes than old and new versions of the same product. Moreover, the difference is generally assumed to arise from informational discrepancies between products with which consumers have experience and those that are unknown to them (Kolstad and Guzman, 1999). In our case, consumers have full information on both the old and new versions of the products, having actually consumed both.

7 We excluded those less than 33 years of age since they were not likely to be main shoppers and have well-developed product knowledge from ten years earlier when they were 23 or younger. In the Czech Republic fewer than 10 percent of workers in this age group have less than a secondary school education. These are likely to be recent immigrants or members of minority groups from whom it would be difficult to elicit reliable data in the current research framework. Within the age group and education level specified, respondents mirrored the Czech population distribution.

8 The number of respondents is not always a perfect multiple of six since, on occasion, an individual opted not to participate at the last minute and was not replaced, causing this group to have five members.

revealed the current price of the product[9] and asked, "if both versions of the product were sold on the market today alongside each other what would you consider to be a fair and appropriate price for the 1990 version, provided that the current version costs _____ crowns?[10]"

4) After the price was assigned individually by the respondents, the individual choices were discussed among the group. The moderator would probe to elicit discussion of why the participants assigned the relative prices they did.

5) At the end of the session, after discussing about ten different products, respondents were asked again to record their relative evaluations for each product. This gave respondents a chance to revise their evaluations in light of the group discussion and the patterns revealed across the several products being considered. We retained both the initial and revised evaluations although there were minimal differences. Results below are based on the revised figures.

3. Results

The Czech consumer price basket consists of approximately 750 individual referent items defined at a level such "mayonnaise" or "leather walking shoes for boys." There have been almost no changes in these broadly defined items during the 1990s, although the specific brand or model priced for each item may have been changed several times and may differ across different sample points (stores) at any given time. Our focus groups evaluated 63 items that comprised 16.2 per cent of the total weight in the consumer basket as of 1990 and 15.8 per cent of the total weight in 2000.[11] The specific items were chosen to encompass all strata, and within strata, to be both varied in nature and among the most heavily weighted items.

Table 1 reports the results for these 63 products. The second column shows the price of the referent good in official data in 1990 while the third column shows the price for the same item in December 2000. The fourth column shows the percentage increase in prices between 1990 and the end of 2000. The Czech Statistical Office (CSO), however, made conventional adjustments in months when there was an obvious change in the referent item sampled. Thus, column 5 shows the official increase in the price index for each item after incorporating any CSO adjustments, Column 6,

9 Defined as the official price in the December 2000 market basket as determined by the Czech Statistical Office (CSO).

10 We tried a number of alternative wordings of this question in developing the study. Debriefing of participants led us to believe that the version asked elicited responses that were closest to the economist's conceptual ideal, e.g. "what price would leave the consumer indifferent between the old and new versions of the product?" It should be noted that the old and new versions are such close substitutes that it is unlikely that any particular consumer would purchase both at the same time.

11 This compares with the 12.4 percent of the U.S. consumer basket represented by the items studied by Bils and Klenow (2001), or the 7.0 percent of the U.S. basket for which estimates of quality-change bias are based in what Lebow and Rudd (2003, p. 174) report as having "at least a moderate degree of hard evidence."

Table 1: Summary of focus group quality adjustment estimates

Product Description 1990 Weights (thousandths) are in parentheses (1)	Price 1990 (2)	Price 2000 (3)	% Price Increase (4)	Index Increase (5)	Captured Change (6)	Today's Price for 1990 Product (7)		% Quality Change (8)		% Actual Price Increase (9)	
						Median	(Q25, Q75)	Median	(Q25, Q75)	Median	(Q25, Q75)
Food											
milk (3.5)	3	12	329	333	-4	8	(6.5, 8)	50	(50, 84.6)	186	(135, 189)
bread (5.7)	4	15	302	314	-12	15	(15, 15)	0	(0, 0)	303	(306, 306)
roll (7.4)	1	2	220	225	-5	1	(1, 1.6)	33	(1.6, 33)	140	(167, 250)
pie (1.1)	1	3	213	193	20	3	(2.5, 3.2)	-14	(-21, 2)	263	(192, 275)
chicken (6.4)	31	46	51	52	-1	40	(40, 44.6)	16	(3.6, 16)	31	(31, 46)
sausages (2.5)	40	71	80	77	3	65	(60, 71)	10	(0.2, 19)	64	(52, 80)
yoghurt (2.3)	3	12	252	262	-10	8	(7.2, 10.6)	45	(9.4, 61)	142	(121, 226)
cheese (3.2)	33	110	238	187	51	110	(110, 110)	0	(0, 0)	238	(238, 238)
mayonnaise (1.4)	3	9	183	177	6	6	(5, 8)	42	(6, 62)	100	(73, 164)
butter (10.9)	53	96	81	80	1	95	(77, 95)	1	(1, 24)	79	(46, 79)
rape-seed oil (1.8)	15	36	139	159	-20	31	(24, 36)	19	(0, 50)	101	(60, 139)
bananas (4.3)	17	27	59	58	1	27	(27, 27)	0	(0, 0)	59	(59, 59)
coffee (16.1)	18	13	-28	-15	-13	13	(13, 13)	0	(-1.7, 0)	-28	(-28, -27)
tea (0.7)	4	37	905	747	158	20	(18, 23)	86	(63, 108)	441	(383, 515)
milk chocolate (1.9)	10	18	75	71	4	14	(10, 16)	31	(13, 77)	34	(-1, 57)
chewing gum (1.4)	5	9	75	75	0	3	(2, 5)	213	(75, 349)	-44	(-61, 0)
ice cream (0.7)	32	97	200	142	58	98	(83, 120)	-1	(-19, 18)	202	(155, 271)
ketchup (0.5)	7	45	585	609	-24	40	(10, 45)	13	(0, 352)	506	(52, 586)
Total (68.3)			**111**	**111**	**0**			**16**	**(5, 30)**	**98**	**(82, 118)**
Drinks											
carbonated water (0.7)	1	6	700	636	64	6	(6, 6)	0	(0, 0)	700	(700, 700)
bottle of wine (4.2)	30	80	167	160	7	70	(70, 70)	14	(14, 14)	133	(133, 133)
Total (4.9)			**243**	**228**	**15**			**12**	**(12, 12)**	**213**	**(213, 213)**
Clothes											
cotton dress (2.5)	318	1521	378	324	55	500	(275, 600)	204	(154, 453)	57	(-14, 89)
bra (1)	91	385	322	251	72	83	(30, 90)	366	(328, 1183)	-9	(-67, -1)
night gown (0.2)	127	420	230	213	17	200	(145, 300)	110	(40, 190)	57	(14, 135)
t-shirt (0.8)	125	236	90	57	32	236	(236, 236)	0	(0, 0)	90	(90, 90)
jeans (0.8)	350	589	68	61	8	589	(190, 589)	0	(0, 210)	68	(-46, 68)
women's handbag (0.3)	402	603	50	286	-236	325	(263, 425)	86	(42, 130)	-19	(-35, 6)
Total (5.6)			**260**	**229**	**31**			**170**	**(135, 470)**	**47**	**(-14, 66)**
Shoes											
men's walking shoes (1.1)	347	1322	281	266	15	650	(525, 700)	103	(89, 152)	87	(51, 102)
ladies' shoes (0.3)	276	1180	327	295	32	650	(346, 1425)	81	(-17, 239)	135	(26, 416)
Total (1.4)			**291**	**272**	**18**			**99**	**(66, 170)**	**97**	**(46, 168)**
Accommodation											
hotel class B/*** (0.1)	128	1082	744	638	106	700	(638, 800)	55	(35, 70)	446	(397, 524)
latex painting (0.8)	14	43	204	214	-10	18	(11, 20)	147	(116, 284)	23	(-21, 41)
Total (0.9)			**264**	**261**	**3**			**135**	**(106, 256)**	**78**	**(34, 104)**

Table 1: Summary of focus group quality adjustment estimates *(continued)*

Product Description 1990 Weights (thousandths) are in parentheses (1)	Price 1990 (2)	Price 2000 (3)	% Price Increase (4)	Index Increase (5)	Captured Change (6)	Today's Price for 1990 Product (7)		% Quality Change (8)		% Actual Price Increase (9)	
						Median	(Q25, Q75)	Median	(Q25, Q75)	Median	(Q25, Q75)
Household											
kitchen unit (4)	4295	17705	312	287	26	7000	(5000, 8500)	153	(108, 254)	63	(16, 98)
bed for kids (0.2)	390	2865	635	614	21	2000	(2000, 2150)	43	(33, 43)	413	(413, 451)
electric bulb (4.1)	5	11	131	133	-1	11	(10, 11)	0	(0, 11)	131	(110, 133)
table lamp (1.4)	258	530	106	111	-6	400	(277, 400)	33	(33, 91)	55	(7, 55)
Total (9.7)			**213**	**203**	**10**			**69**	**(50, 124)**	**98**	**(63, 114)**
Dry Goods											
cotton sheet, pillow case (.2)	253	452	79	75	3	490	(371, 525)	-8	(-14, 22)	94	(47, 107)
towel (1.4)	32	112	248	237	11	112	(103, 120)	0	(-7, 8)	248	(222, 276)
Total (1.6)			227	217	10			-1	(-8, 10)	227	(197, 252)
Home Appliances											
washing machine (2.8)	6068	14480	139	133	6	9500	(6750,10375)	52	(40, 115)	57	(11, 71)
refrigerator (2.6)	5720	10000	75	61	13	4970	(3180, 7085)	101	(41, 214)	-13	(-44, 24)
vacuum cleaner (0.9)	1606	3842	139	100	39	2000	(1713, 2500)	92	(54, 124)	25	(7, 56)
electric hair dryer (0.2)	332	691	108	67	41	350	(275, 520)	97	(33, 151)	5	(-17, 56)
safety razor (0.2)	411	2151	423	373	50	650	(463, 925)	231	(132, 365)	58	(12, 125)
electric iron (0.2)	160	1982	1136	1231	-95	900	(425, 1338)	120	(48, 366)	461	(165, 734)
Total (7.3)			**205**	**198**	**7**			**86**	**(45, 179)**	**58**	**(2, 105)**
Electrical Supplies											
battery (1.1)	2	7	310	330	-20	2	(1, 3)	267	(140, 597)	12	(-40, 74)
			310	**330**	**-20**			**267**	**(140, 597)**	**12**	**(-40, 74)**
Home Care Products											
washing powder (2.1)	13	86	555	538	17	40	(34, 50)	116	(73, 154)	203	(157, 279)
detergent for dishes (1.2)	10	64	545	520	24	20	(19, 25)	222	(158, 248)	100	(85, 150)
dry-cleaning (0.2)	22	63	183	177	5	48	(34, 60)	33	(6, 88)	112	(51, 168)
Total (3.5)			**530**	**511**	**19**			**148**	**(99, 183)**	**163**	**(127, 228)**
Transport											
personal car Skoda (25.3)	86708	260000	200	155	45	135000	(115k, 150k)	93	(73, 126)	56	(33, 73)
bike for kids (0.5)	817	3535	333	246	87	2650	(2500, 2950)	33	(20, 41)	224	(206, 261)
motor oil (0.2)	28	80	184	160	25	45	(40, 60)	79	(34, 101)	59	(41, 112)
repair of car brakes (1.6)	296	1115	277	264	13	1000	(900, 1100)	12	(1, 24)	238	(204, 272)
Total (27.6)			**207**	**163**	**44**			**87**	**(68, 118)**	**69**	**(46, 88)**
Recreational Products											
color TV (9.3)	12277	11485	-6	-6	-1	2750	(2000, 3000)	318	(283, 474)	-78	(-84, -76)
video recorder (1.6)	8372	10420	24	22	3	2350	(2000, 2925)	343	(256, 421)	-72	(-76, -65)
portable radio & tape (1)	3420	2335	-32	-29	-2	650	(500, 800)	259	(192, 367)	-81	(-85, -77)
cinefilm (2.1)	46	114	147	146	1	50	(40, 60)	129	(91, 186)	8	(-14, 30)
cross country ski (1.2)	579	1570	171	138	33	800	(700, 1000)	96	(57, 124)	38	(21, 73)
rose (0.4)	11	40	275	267	8	30	(29, 40)	33	(-1, 38)	183	(171, 278)
Total (15.6)			**37**	**34**	**2**			**267**	**(224, 385)**	**-50**	**(-59, -40)**

Table 1: Summary of focus group quality adjustment estimates *(continued)*

Product Description 1990 Weights (thousandths) are in parentheses (1)	Price 1990 (2)	Price 2000 (3)	% Price Increase (4)	Index Increase (5)	Captured Change (6)	Today's Price for 1990 Product (7)		% Quality Change (8)		% Actual Price Increase (9)	
						Median	(Q25, Q75)	Median	(Q25, Q75)	Median	(Q25, Q75)
Amusement Services											
cinema ticket (0.1)	16	55	245	240	5	33	(31, 69)	70	(-20, 77)	103	(95, 330)
MF daily (1.8)	3	8	200	200	0	4	(3.6, 6.4)	97	(18, 107)	52	(45, 155)
Total (1.9)			**202**	**202**	**0**			**99**	**(16, 106)**	**52**	**(47, 161)**
Personal Care Products											
toothpaste (1.1)	3	14	321	291	29	8	(7, 10)	79	(43, 104)	135	(106, 195)
soap (0.3)	66	25	-62	225	-287	18	(14, 18)	38	(38, 77)	-73	(112, 173)
hair shampoo (0.6)	17	31	81	47	34	27	(23, 30)	15	(3, 35)	58	(34, 75)
toilet paper (6.7)	4	5	23	16	6	1	(0.9, 1.1)	367	(345, 434)	-74	(-77, -72)
paper tissues (0.3)	4	18	351	365	-15	8	(5, 10)	120	(76, 243)	105	(31, 156)
Total (9)			**71**	**71**	**1**			**288**	**(265, 347)**	**-24**	**(-36, -13)**
Total weight (161.9)			**150**	**139**	**11**			**86**	**(64, 134)**	**74**	**(52, 95)**

which is the difference between Columns 4 and 5, therefore, shows the part of the increase in prices excluded by the CSO through adjustment for quality changes.

Columns 7 though 9 contain the heart of our research. Column 7 shows the median[12] response among our focus-group members to the question "What would be a fair price today for the 1990 version of product X, given the actual price charged today for the current version of the product?" In order to obtain a measure of the dispersion across respondents, it also shows the 25th and 75th percentile of answers to this question.[13] Column 8, showing the percentage difference between these hypothetical current prices for the 1990 version of the product and the actual market price for the current version of the product (column 3), represents consumers' opinion of the value of the difference in quality between these two product today. Finally, column 9 indicates the percentage difference between the actual 1990 price of the product (column 2) and what consumers would be willing to pay for the constant-quality version of the product today (column 7). As such, it represents the true cumulative inflation rate for this product purged of the effect of quality changes. Again, both the median and 25th and 75th percentile of responses are shown.

Looking at the first row of data in Table 1 makes the importance of adjusting for hidden quality improvements clear. In 1990 a liter of milk sold for 2.8 crowns while in December 2000 it sold for 12 crowns according to official price data. This was a 329 per cent increase, as shown in column 4. There were no significant adjustments made by the CSO, so the official price increase used for calculating the CPI over this period was 333 percent as shown in column 5. Consumers who were asked to

12 Results are virtually identical if we use the mean response instead.

13 With small samples the interquartile range is a better measure of dispersion than standard deviations.

recall the characteristics (including packaging, flavor and shelf life) of milk as they existed in 1990 and evaluate how much they would be willing to pay for such milk today, reported that, on average, 8 crowns would be a fair price given that milk with today's characteristics sold for 12 crowns. Twenty-five per cent would be willing to pay 6.5 crowns or less for 1990 variety milk today and 25 per cent more than 8 crowns. The value of the increased quality is the difference between today's price of 12 crowns and the hypothetical "fair" price for the older quality product of 8 crowns today or 50 per cent as shown in column 8. Thus, for the median consumer the actual price increase for milk of constant quality is not 329 per cent, but the 186 per cent shown in column 9 that results from an increase from 2.8 crowns per liter in 1990 to a hypothetical price of 8 crowns for the 1990 product version today. At the 25th percentile of hypothetical current prices for the 1990 product, consumers report a quality improvement of 85 per cent and a price increase of 135 per cent.[14]

We asked focus groups about a variety of products from across the consumer basket. The items evaluated cannot be claimed to be random, but they do account for a sixth of the entire basket and were not explicitly selected to be ones with large presumed quality changes. Instead, we selected items that were relatively large within their stratum and appeared to reflect the variety of items within the stratum. The average price increase for all products we surveyed, weighted by their share in the consumer basket, was 150 per cent, while the official increase in the CPI for these components after all adjustments by the CSO was 139 per cent, implying that the CSO found only 8 per cent of the price increase to be due to quality improvements.[15] Our focus group respondents, however, found the average quality improvement across the 63 products to be 86 percent. In other words, they reported that they would be willing to purchase the 1990 quality product today only if it were to be sold at a price averaging 54 per cent of the price for the current quality product.[16] Similarly, our results imply that the actual increase in prices for the decade for these products was 74 per cent instead of the official 139 per cent.[17]

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14 Given that prices at the median and 75th percentile for the 1990 product are the same, there is no difference in reported quality and price increases for these percentiles.

15 While there is a positive relationship between the extent of quality improvement found by the CSO (column 6) and that reported by our focus groups (column 8), the overall correlation between these figures is only 0.05.

16 An additional two items evaluated by the focus groups have been excluded from the analysis because the groups concluded that the 1990 quality was so low that the proper current price would be zero or negative, implying an infinite quality improvement. These items were hair coloring and hair permanents. Respondents indicated that the damage the earlier versions inflicted on their hair meant that they would not purchase them at any price if the current version were available. Thus, these items had an infinite implied quality improvement. Assuming that they had a price change of -100 per cent has trivial impact on overall weighted average price changes. The same cannot be said for the implicit infinite quality change, however, since any positive weight assigned to them would mean that overall quality change was also infinite.

17 While a seemingly large difference, these results are consistent with those derived from surveys conducted in Romania in 2000, where consumers who reported their economic situation in terms of purchasing power to be "about the same as last year" reported income increases of less than half of the official inflation rate (Filer and Hanousek 2001).

On an annual basis, the official inflation rate across all these items (weighted by their share in the consumer price basket) during 1990s was 9.1 per cent after official quality adjustments (and 9.6 per cent a year without such adjustments). When consumers' perceptions of quality improvements are allowed for, however, the annual increase in prices is reduced to approximately 4.3 percent.[18]

We can obtain an indication of the precision of this conclusion by examining results for the 25th and 75th percentiles of reported quality change. Assuming that the lower extent of quality change yields an estimated weighted average quality change of 64 per cent, and an estimated annual rate of price increase of 5.4 per cent a year. If we assume that the actual quality change lies at the 75th percentile of responses from our focus group members, the weighted average quality change across our 63 products would be 134 per cent and the implicit annual rate of price increase would be 1.6 per cent.[19]

The results in Table 1 are grouped according to broad categories of goods. The patterns are intuitively appealing, giving confidence that the focus group methodology is sound. Reported quality improvements are smallest for food and beverages, standardized and relatively simple items. Thus, the vast majority of the price increase of somewhat over 100 per cent for these items was true inflation. Indeed, for some foodstuffs, our consumer groups reported no quality improvement or even a quality decline since the end of communism. Our respondents reported the greatest increase in quality for personal care products and recreational products, followed by clothing and home care products.

If we assume that other items within each broad product group behaved in the same way as those we sampled, then scaling up the sampled items to reflect weights for the full consumer basket implies a slightly greater official index increase of 152 per cent, a median quality improvement of 71 per cent, and a median true price increase of 77 percent, results very close to those for our sample reported above.

4. Conclusions

Overall, it appears that the Czech Statistical Office has captured only a fraction (at the median, perhaps 15 percent) of the quality change that our respondents believe has occurred over the first decade of the transition. This figure compares

18 This is the geometric mean of the implicit inflation rates generated from the weighted average quality improvement (3.2 per cent) and weighted average actual price increases (5.7 per cent). The range is generated by the nonlinearities implicit in taking weighted averages of quality changes and actual price changes across individual items.

19 Again, these are the geometric means of the rates of increase in prices derived from weighted quality changes and weighted actual price increases. The extreme bounds would be 0.6 per cent price increase per year using the actual 75th percentile of quality change (134 per cent) and 6.9 per cent price increase per year using the weighted average actual price increase implied by quality changes at the 25th percentile (95 percent).

with the 40 percent that Bils and Klenow (2001) suggest the BLS captured in the U.S. Intuitively, the greater uncaptured component of quality change makes perfect sense given the extensive and rapid changes in basic products that occurred as a part of transition and the relative lack of sophistication of the CSO at the start of transition. These results suggest that average quality-adjusted consumption growth rates in the Czech Republic during the 1990s may have been considerably greater than the official figures suggest.

The reader is cautioned, however, to view the findings as preliminary. We have not sampled the full consumer price basket.[20] More importantly, consumers were evaluating the quality of goods assuming that they were actually available and not assigning any reduction in quality for scarcity. As one group member said during the discussion, "You had to line up for them and couldn't always find baked goods, but when you did you knew they were fresh!" It is hard to know how to evaluate the quality change implicit in reduction of what were often multi-year queuing times for telephone service or rental apartments, but it is clear that the true price increase should be substantially smaller than the recorded monetary price increase in our data once search and scarcity (waiting) costs are factored into prices at the start of the transition. Obviously, this would make quality improvement an even more significant fraction of the real price change.

In addition, the recall period of ten years may impart unknown biases. While we believe that the discussion and revision inherent in the focus group methodology will minimize recall biases, it is possible that individuals have faulty memories regarding the true quality (or lack thereof) of consumer goods produced under communism.

Measuring quality change and its impact on price changes is an inherently difficult process. As the Conference Board concluded (1999, p. 21) "there is no alternative to thorough, detailed analyses that slog through the data category by category, item by item. This is difficult, costly work, but no shortcuts are available." We believe that the focus group methodology used in this study adds a useful method of investigating quality changes in at least some items. Like other methods of measuring quality change it will be more useful in some situations than in others. We suspect that the method has the most potential in assessing quality change in products where improvements are small and continuous and will be least useful when there are major considerations of style or fashion.

In this spirit we would call for extension of this research to other transition economies as well as to more items in the Czech consumer price basket, as well as applying the focus group methodology in a developed economy such as the U.S.

20 Although even if there were no quality improvement in the remaining items in the consumer price basket, the biases we have identified in the 16 per cent of the basket we have studied would be sufficient to substantially increase measured growth rates. Of course, the assumption that no other goods exhibited a quality increase is totally unjustified.

Results need to be compared with those derived from other methods and a composite picture assembled from the most appropriate method for each product. There is no reason to believe, however, that such extensions would change the bottom line: that a substantial understatement of the degree of quality improvement and, therefore, a substantial overstatement of inflation rates has resulted in a serious downward bias in estimates of growth rates of post-communist economies. The move to free markets has apparently improved consumers' welfare more by improving what they can purchase than by increasing how much they can purchase.

Appendix

Table A1: Number of focus groups and participants evaluating each product

Product name	Focus Groups	Participants		
		Total	Female	Male
chicken	2	11	11	0
milk	1	6	6	0
cotton dress	2	11	11	0
yoghurt	3	17	17	0
bed for kids	1	6	6	0
mayonnaise	2	11	11	0
vacuum cleaner	2	12	12	0
electric bulb	3	18	6	12
MF daily	7	42	18	24
toothpaste	3	17	17	0
personal car Skoda	2	12	0	12
color TV	2	12	0	12
refrigerator	4	23	0	23
washing machine	1	6	0	6
bike for kids	1	6	0	6
cross country ski	2	12	0	12
ice cream	2	12	6	6
hotel class B/***	2	12	0	12
washing powder	1	5	5	0
hair shampoo	2	11	11	0
soap	2	11	5	6
electric hair dryer	2	11	11	0
cotton sheet, pillow case	2	11	11	0
videorecorder	1	6	0	6
portable radio & tape	1	6	0	6
latex painting	1	6	0	6
men's walking shoes	1	6	0	6
electric iron	1	6	6	0
women's hadbag	1	6	6	0
bananas	3	18	18	0
tea	2	12	12	0
drycleaning	2	12	12	0
milk chocolate	3	18	18	0
jeans	3	17	6	11
safety razor	2	12	0	12
bread	6	35	18	17
coffee	3	18	12	6
ketchup	3	17	6	11
cinefilm	3	17	0	17
kitchen unit	3	17	0	17
butter	4	24	24	0
night gown	2	12	12	0
paper tissues	3	18	18	0
roll	3	18	18	0
bra	3	18	18	0
detergent for dishes	3	18	18	0
pie	3	18	18	0
carbonated water	2	12	12	0
rose	2	12	12	0
rape-seed oil	2	12	12	0
towel	3	18	18	0
repair of car brakes	3	17	0	17
cheese	2	12	6	6
ladies' shoes	2	12	12	0
toilet paper	2	12	12	0
battery	3	17	0	17
table lamp	2	11	0	11
sausages	2	12	0	12
t-shirt	1	5	0	5
cinema ticket	3	18	6	12
chewing gum	4	24	18	6
motor oil	3	18	0	18
bottle of wine	3	16	16	0
AVERAGE	**2.4**	**13.9**	**8.3**	**5.6**

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SUBJECT INDEX

The transition from communism to a market economy remains clouded in mystery. What do we really know about this process? Was it a success? Did voucher privatization create an ownership society or allow insiders to misappropriate assets? Was high unemployment necessary or a consequence of misguided policies? There is no shortage of arguments based on casual observation, anecdotal evidence, or speculation that can be used to defend agendas – inevitably painting a black-or-white picture of the whole process.

Those suspecting that the answers may not be entirely black or white would do well to turn to the academic field spawned by the death of Marxism: the Economics of Transition. Hundreds of economists around the world have been trying to answer questions about transition with their research toolkit including mathematical models and sophisticated econometric methods. Twenty years on, this research has produced many lessons about transition and, even more importantly, generated many new insights into fundamental questions of economics.

Since its founding in 1991, CERGE-EI has been a major hub of research on transition. CERGE-EI's combination of western academic standards, its location in Prague, and its flow of graduate students from throughout the transition countries has produced hundreds of academic papers and doctoral dissertations on the various aspects of transition. This book contains a collection of 10 of these papers, studying the effects of privatization methods on enterprise performance, the behavior of managers of privatized firms, human capital, and unemployment under transition. This small sample from the work of CERGE-EI's researchers will serve to show that in the last two decades remarkable and surprising things have been learned about the transition to market economies, and much more in the field is waiting to be explored.

"These papers represent the path breaking research done in an institution (CERGE-EI) that itself is vitally important in its mission and unique in its accomplishments."

Orley C. Ashenfelter, Professor of Economics, Princeton University

"The work done at CERGE-EI furnishes thorough and up-to-date insights into crucial aspects of the transition. It is of great value to policy makers, scholars, and those interested in understanding the complex process of transition to a market economy."

Nicholas Stern, IG Patel Professor of Economics, London School of Economics

"In recent years, there have been numerous papers on the transition from centrally planned to market economies, most of them quite general or focused on specific issues. CERGE-EI's initiative is different: it is both complex and rigorous at the same time. Everyone interested in a deeper knowledge of transition should carefully study this publication."

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