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Enterprise Breakups and Performance During the Transition

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Abstract

In this paper we estimate the effects of the 1991 breakups of Czechoslovak state owned enterprises (SOEs) on subsequent performance of the master enterprises and the spun-off units. Our analysis is based on quarterly and annual data of Czechoslovak industrial enterprises. We estimate the performance effect of a spinoff by comparing the performance of enterprises that were present throughout the 1990-92 period but did not experience any spinoffs to the performance of (a) master enterprises that experienced spinoffs and (b) the newly spun off subsidiaries. Our estimates suggest that the breakups had a significant immediate (1991) effect on productive efficiency and profitability of industrial firms. The effect was positive for small to slightly above average size spinoffs and negative for large ones. One also cannot reject the hypothesis that the estimated effect of spinoffs on performance was identical for the spun off subsidiaries and the master enterprises that experienced the spinoffs. Our 1991 estimates hence strongly suggest that the large firms created under the centrally planned system suffered from inefficiencies that were alleviated by the breakups of these firms into smaller units.

Non-technical Summary

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 transition in Central Europe was the massive breakup of SOEs in Czechoslovakia and to a lesser extent in Hungary in the early 1990s. The question that naturally arises is whether the observed breakups had systematic economic effects in the sense that they improved or worsened the performance of the spun off subsidiaries and/or the remaining master enterprises. In this paper we address this issue using enterprise-level data related to the major wave of breakups of Czechoslovak SOEs during the 1990-1991 period.

Our empirical analysis is based on quarterly and annual data reported by Czechoslovak industrial enterprises 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. As mentioned earlier, at the start of 1990 the data set included about 700 enterprises, while in 1992 it covered approximately 2000 firms.

Since comparisons of means indicate that in 1990 there were no significant differences in performance between firms that later experienced spinoffs and those that did not, our empirical strategy is to estimate the performance effect of a spinoff by comparing the performance of enterprises that were present throughout the 1990-92 period but did not experience any spinoffs to the performance of (a) master enterprises that experienced spinoffs and (b) the newly spun off subsidiaries.

Our econometric estimates suggest that the major wave of breakups of SOEs that took place in Czechoslovakia in the early 1990s had a significant immediate (1991) effect on productive efficiency and profitability of industrial firms. The effect was positive for small to slightly above average size spinoffs and negative for large ones. One also cannot reject the hypothesis that the estimated effect of spinoffs on performance was identical for the spun off subsidiaries and the master enterprises that experienced the spinoffs. Our 1991 estimates hence strongly suggest that the large firms created under the centrally planned system suffered from inefficiencies that were alleviated by the breakups of these firms into smaller units.

For two of the three indicators of performance (value added/labor and profit/labor), we have significantly fewer observations for 1992 than 1991. We also find

that while most 1992 point estimates are similar to those for 1991, many associated standard errors are larger and yield statistically insignificant results. 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 between 1991 and 1992. Our findings indicate that the weakening of the statistical significance of the estimated effects of spinoffs between 1991 and 1992 is in most cases not attributable to the decrease in the sample size. Instead, it is likely generated by phenomena such as (a) increased competition brought about by the spinoffs and the elimination of the 20% import surcharge at the start of 1992, and (b) the possibly growing phenomenon of dissipation of profits by management as central controls were gradually eroded.

Enterprise Breakups and Performance During the Transition

1. Introduction

As the Central and East European (CEE) countries embarked on the transition from plan to market in the early 1990s, restructuring of state owned enterprises (SOEs) became a fundamental policy priority. Indeed, since 1990 policy makers and advisors have spent much time discussing the optimal forms, timing and sequencing of restructuring.[1] A number of models have been developed to examine economic implications of various forms of restructuring and the European Union made the restructuring of CEE firms a matter of its policy by insisting that CEE enterprises must become competitive before CEE countries qualify for Union membership.

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 large SOEs applied in the 1990-91 period to their supervisory ministries for permission to split off from their "master enterprise". The ensuing process of negotiations among government officials, top managers of the SOEs and divisional managers resulted in a phenomenal wave of spinoffs, giving rise to a large number of new firms led by new top management. In particular, 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 virtually tripled to about

[1] The most hotly debated issues have related to the timing, extent and method of restructuring of SOEs. On timing, the arguments have revolved around the question of whether price liberalization should be preceded by SOE restructuring or whether liberalization of prices is needed first in order to send correct signals for restructuring and privatization. With respect to the extent and method, one strand of the debate has focused on whether the SOEs tend to be too large and need to be broken up into smaller units or whether their size is appropriate for the world market. A related discussion concentrated on the issue of manager's interests and whether existing managers, supervisory ministries or external institutions should carry out restructuring.

2000.[2] The timing of this restructuring preceded other major reforms, as prices were under state control in 1990 and even in 1991, when prices were already by and large free, the state still owned the firms.[3]

The question that naturally arises is whether the observed breakups had systematic economic effects in the sense that they improved or worsened the performance of the spun off subsidiaries and/or the remaining master enterprises. In this paper we address this issue using enterprise-level data related to the major wave of breakups of Czechoslovak SOEs during the 1990-1991 period. Since Czechoslovakia and subsequently the Czech and Slovak republics have been among the leading transition economies whose policies have been followed by many other transition economies (see e.g., World Bank (1996)), our findings are of specific as well as general interest in the transition context.

We build on Lizal et al.'s (1995) pioneering but preliminary work by using a better data set and superior analytical techniques to address the issue. In particular, Lizal et al. (1995) did not have data on value added of firms and used total output as a proxy for performance. With firms that span all industries this is clearly a poor approximation. In the present project, we have constructed data on value added and thus are able to estimate the effect of spinoffs using a much more appropriate measure of enterprise performance. Second, while Lizal et al. (1995) estimated the effect of the spinoff by comparing only the performance of master enterprises that experienced spinoffs to those that did not, we use the performance of firms that did not experience spinoffs as a base to which we compare the performance of both the master enterprises that experienced spinoffs and the spun off subsidiaries. In doing so, we are hence able to capture the total rather than just partial effect of spinoffs on performance. Third, while Lizal et. al (1995) captured the effect of a spinoff as either an intercept effect or an affine function of the share of spinoff in employment of the

[2] The latter number includes newly created firms as well. However, since only firms with more than 25 employees are included, most of the growth in the number of firms is brought about by the breakups of SOEs.

[3] 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.

(politically motivated) SOEs suffer from diseconomies of scale or other inefficiencies, breakups will result in a superior performance of both the spun off units and the resulting (smaller) master enterprises. Since one cannot observe the relative performance of these two parts of the firm before the spinoff, the estimated effect of the spinoff may also be brought about by the inherently different performance levels of the spun off and remaining parts of the original firm. The effect will thus be positive for the spun off unit and negative for the remaining master enterprise if the spun off division is a better performer than the rest of the firm and prior to the spinoff it cross-subsidized the rest of the firm. The effect will be positive for the spun off unit and insignificant for the remaining master enterprise if the spun off division was equally performing as the rest of the firm but can improve its performance as a result of the breakup. Should the spun off unit be an inferior performer to the rest of the firm, the spinoff will have a positive effect on the recorded performance indicators of the master enterprise and a negative effect on the performance of the spun off unit unless the spinoff results in a better performance of the spun off division. In sum, the combination of differential ex ante performance and the possibility that performance may be improved through unbundling of uneconomically large firms means that at least one part of the original firm should record better performance as a result of the spinoff.

An important countervailing effect is of course brought about by increased competition, stemming from both the breakups themselves and the opening up of the formerly planned economies to world trade. In particular, increased competition is expected to exert downward pressure on output prices and thus reduce nominal value added as well as profits. The Czechoslovak authorities eliminated quantitative import restrictions as early as 1990 and the average level of trade weighted tariffs was as low as 5% (Drabek and Smith (1995)). However, in 1990-91 Czechoslovak enterprises were temporarily protected by a uniform 20% import surcharge tax (Dyba and Svejnar, (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 Svejnar (1995)), one may expect that the combined effect of the breakups of monopoly firms and the 1992 elimination of the 20% import surcharge would tend to reduce the positive impact of breakups on measured value added and profits in 1992 as compared to the immediate effect observed in 1991. Moreover, as government

supervision of SOEs gradually waned during the transition process, it is likely that managers have increasingly been able to conceal and appropriate part of the profit of their firm (e.g., through the widely used "resale practice").[7] If this were a systematic phenomenon, it would tend to diminish the positive effects of spinoffs on measured value added and profitability over time.

3. The Empirical Analysis

The outline of the empirical part of the paper is as follows. In Section 3.1. we describe the data and discuss our ability to identify the breakups and the pairs of master enterprises and spun off subsidiaries. In Section 3.2. we present the general econometric models that we use, while in Section 3.3 we discuss particular estimating equations and techniques. The main results of our empirical analysis are presented in Section 3.4.

3.1. The Data and Identification of Breakups

Our empirical analysis is based on quarterly and annual data reported by Czechoslovak industrial enterprises 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. As mentioned earlier, at the start of 1990 the data set included about 700 enterprises, while in 1992 it covered approximately 2000 firms.

The data set was carefully assembled but unfortunately it contains no explicit indicator of breakups of enterprises since the data collection instrument was designed under central planning and no unplanned changes of industrial structure were expected to occur. As a result, major changes such as a sudden decline in production brought about by the firm's loss of the Soviet market cannot be readily distinguished from changes brought about by a breakup of the enterprise.

[7] This is a legally permitted practice that works as follows: The SOE sells its goods at a low price to a private company owned or controlled by the top management, which then sells the goods at a market price or buys them back for the same SOE at a market or above market price. Practices of this kind have been frequently reported in the media of the transition economies.

In order to identify the breakups, we exploited a special feature of the Czechoslovak system of statistical reporting. The system required enterprises to report preceding year's values of most variables together with the current values. Moreover, enterprises experiencing spinoffs were required to report the preceding year's values corresponding to the remaining (post-spinoff) part of the enterprise. If a breakup occurred, the remaining master enterprise therefore reported both current and preceding year's data corresponding to its new (smaller) size. For instance, as we show in the hypothetical example in Table 1, if an enterprise with 700 employees spun off a unit with 400 employees in the second quarter of 1991, it was to report employment of 700 in all quarters of the 1990 and the first quarter of 1991, but only 300 employees as the current and last year's value from the second quarter of 1991 on. In contrast, if an otherwise identical enterprise reduced employment by 400 employees without a spinoff in the second quarter of 1991, it was to report 700 employees in all quarters of 1990 and the first quarter of 1991, 300 employees as the current value from the second quarter of 1991 on and 700 employees as last year's employment in 1991 and the first quarter of 1992. Using quarter by quarter comparisons, we thus identified the breakups and the quarter of their occurrence.

Using the quarterly data, we are able to identify 451 enterprises that were present in the data set continuously from the first quarter of 1990 to the fourth quarter of 1991. Using in addition monthly data furnished by the firms, we were able to increase this number to 476. Unfortunately, we had to drop about 80 of these 476 firms because of the inadequate quality of their data. Some observations were also lost as we proceeded to collect 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 spinoffs, eliminating firms that did not fill out questionnaires reliably and ignoring potential spinoffs involving less than 5% of the labor force or fewer than 5 employees,[8] we were able to identify 152

[8]By imposing the lowerbound on the acceptable size of the spinoff, we eliminated cases where our matching could be affected by minor discrepancies and reporting errors, as well as by the massive entry of small de novo enterprises (see Zemplinerova and Stibal (1995)).

firms that experienced spinoffs. The distribution of these spinoffs by quarter is given in Table 2. As can be seen from the table, most spinoffs occurred in the first quarter of 1991 and, to a lesser extent, the last quarter of 1990. In our empirical investigation, we use data from firms that experienced spinoffs in the first quarter of 1991. By doing so we resolve the problem of endogeneity of right-hand side variables that could arise since we use 1990 values as exogenous variables for the 1991 and 1992 regressions. As can be seen from Tables 2 and 3, there were 78 spinoffs in the first quarter of 1991, of which 66 yielded usable data for empirical analysis in 1991 and at least 50 in 1992.

The data exercise performed so far allows us to compare the performance of master enterprises that experienced spinoffs to the performance of those that did not. However, 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 establish this link, we carried out puzzle-like comparisons of the values of variables such as labor in newly established companies with the decrease in the values of these variables in the master enterprises that were identified as experiencing spinoffs. 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 the master enterprise. This procedure enabled us to identify unambiguously 28 pairs of masters and spun off subsidiaries, 27 of which were usable in our empirical work.[9]

[9]The rules we used in constructing this data set may cause two problems. The potentially more serious one is that an error in filling out a questionnaire may be taken to represent a spinoff. We have tried to prevent this erroneous identification by carrying out careful consistency checks of our questionnaires and we dropped all firms that did not fill out the questionnaires in a reliable way. The potentially less serious problem is that we neglect spinoffs that were minor in size and thus failed to pass the critical value of 5% of the labor force or 5 employees. Since we are interested in estimating the effects of significant organizational changes, this is a minor problem. Finally, in cases when more than 50% of an enterprise splits off, the question arises as to which part constitutes the master enterprise and which part is the subsidiary. We verified with the Czechoslovak Federal Statistical Office that the former master enterprises (top management units) retained their before-split identification numbers. We were therefore able to identify enterprises that were formerly the superior (top management) units within the pre-spinoff enterprises.

As we mentioned briefly earlier, data problems have prevented us from extending our panel beyond 1992. The problems relate to the 1993 dissolution of Czechoslovakia and completion of the first wave of privatization. In particular, since the establishment of separate Czech and Slovak republics, we have been unable to extend the panel of Slovak firms. In the Czech Republic, we in turn lost a large number of observations as privatized firms were issued new identification numbers. Hence, had we proceeded into 1993, our sample would have dropped to 122 master enterprises and 11 spun off units. In assessing the behavior of firms in 1993, one would also have had to control for the effects of the dissolution of the country and the new forms of ownership and control of firms.

3.2. The Econometric Models

Since comparisons of means indicate that in 1990 there were no significant differences in performance between firms that later experienced spinoffs and those that did not, our empirical strategy is to estimate the performance effect of a spinoff by comparing the performance of enterprises that were present throughout the 1990-92 period but did not experience any spinoffs to the performance of (a) master enterprises that experienced spinoffs and (b) the newly spun off subsidiaries. The method amounts to comparing the performance of a treatment group (enterprises involved in a breakup) to a control group (enterprises not undergoing a breakup). It goes beyong a simple comparison of means by controlling for the relevant pre-spinoff conditions in these firms. Moreover, we estimate the effect of the spinoff on performance as a linear function of the size of the spinoff. In particular, using data on the spun off subsidiaries and master enterprises that experienced breakups as well as those that did not, we estimate coefficients α_0, α_1 and β in the following model:

$$\pi_i = \beta' X_i + \alpha_0 d_i + \alpha_1 df_i + e_i , \qquad \textbf{(1)}$$

where **i** indexes firms, π_i is a measure of enterprise performance (defined below), $\mathbf{X}_i$ are variables controlling for pre-spinoff conditions (discussed below), $\mathbf{d}_i$ is a dummy coded **1** if the enterprise is a spun off subsidiary or a master firm that experienced a spinoff and zero otherwise, and $\mathbf{df}_i$ is a variable measuring the share of a spinoff within the former master enterprise. In our empirical work, we have defined $\mathbf{df}_i$ as the

share that the labor force of the spun off subsidiary represents in the total labor force of the pre-spinoff master enterprise. The values of $\mathbf{d}_i$ and $\mathbf{df}_i$ are zero for firms that did not experience spinoffs. The average, minimum and maximum values of $\mathbf{df}_i$ are reported in Tables 3 and 4.

If unobserved random characteristics of an enterprise did not influence the occurrence of a spinoff and the value of the share variable, the usual estimation methods such as the ordinary least squares (OLS) would give us consistent estimates of α's and β. However, the process of determination of $\mathbf{d}_i$ and $\mathbf{df}_i$ 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

$$E(\boldsymbol{e}_i|\boldsymbol{d}_i) \neq 0, \; E(\boldsymbol{e}_i|\boldsymbol{df}_i) \neq 0. \qquad \textbf{(2)}$$

The error term in equation (1) is hence likely to be correlated with the right hand side variables $\mathbf{d}_i$ and $\mathbf{df}_i$ 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 $\mathbf{d}_i$ and $\mathbf{df}_i$ are variables that are correlated with $\mathbf{d}_i$ and $\mathbf{df}_i$ but not with $\mathbf{e}_i$. Theoretically, one might want to use the more efficient MLE estimates but, in the presence of a dummy variable capturing the breakup as well as a variable measuring the size of the spinoff, 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 prefer to use the more robust IV approach.

3.3. The Empirical Specifications

Enterprise performance may be measured in a number of ways. In order to provide a relatively unbiased set of tests, we have used the following three indicators of performance:[10]

[10] In earlier runs we also used Lizal et al.'s (1995) three performance measures based on capital and total output. However, since capital is likely to suffer from more measurement bias than other variables in the transitional economies and total output is an inferior measure to value added, we have focused on the three measures

1) Value Added/Labor,[11],

2) Profit/Labor,

3) Turnover/Total Cost.

The performance variables are based on 1991 and 1992 annual data and values are expressed in thousands of Czechoslovak crowns.

Our vector of control variables $\mathbf{X_i}$ refers to 1990 values and 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 which represents a second-order approximation to any production function, controlling for industry-specific effects as well as the labor input and net capital stock of each enterprise before the split. Since we are using 1990 $\mathbf{X_i}$s to control for pre-split performance, we do not encounter the standard problem of endogeneity that would arise if we used current period (1991 and 1992) values of $\mathbf{X_i}$s. In fact, in 1990 the values of these variables were still completely predetermined by the centrally planned system. Both spun off subsidiaries and all master enterprises were thus assigned as exogenous control variables the 1990 values of $\mathbf{X_i s}$ that correspond to the enterprise from which they evolved.

In instrumenting $\mathbf{d_i}$ and $\mathbf{df_i}$, the crucial source of identification is a set of six dummy variables for individual supervisory ministries that made the final decisions about the proposed spinoffs (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

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discussed in the text. The results based on Lizal et al.'s (1995) alternative measures were by and large statistically insignificant. They may be obtained from the authors upon request.

[11] 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.

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 good predictors of) the variables measuring the occurence and share of the spinoff.[12] Since the ministries were separate for the Czech and Slovak Republics, the ministry dummies also serve as dummies for the two republics.[13]

3.4. Empirical Results

3.4.1. The Effects of Split on Master Enterprises

In this section we present coefficient estimates of equation (1) based on data from master enterprises that experienced spinoffs 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 spinoff.

In Tables 5 and 6 we present the estimated IV coefficients α_0 and α_1, giving the effect of the spinoff on the three performance measures listed in the lefthand side column of these tables. Table 5 contains the estimates for 1991 and Table 6 for 1992. As mentioned earlier, both sets of estimates are conditioned on the before-split (1990) characteristics of enterprises from which these firms evolved. As can be seen from Table 5, all three estimates of α_0 and α_1 are statistically significant. They indicate that the performance effect declines with the size of the spinoff, being positive for small and medium-sized spinoffs, but becoming negative for those that are above average in size. Indeed, as we show in the column **c** of Table 5, the size of the spinoff at which the effect turns from positive to negative (38% for value added per worker, 52% for

[12] The correlations between industry dummies used in the $\mathbf{X}_i$ vector of control variables and the ministry dummies identifying the effect of the spinoff 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.

[13] Moreover, using finer regional dummies for the location of the enterprise would be inefficient as it would to a large extent capture the place of registration of the enterprise rather than the location of its operations. For example, a significant portion of enterprises has always registered in the capital cities of Prague and Bratislava, but carried out production in locations other than the capital. This tendency is also more prevalent among the larger companies that we analyze.

profit per worker and 50% for turnover/cost) exceeds the average spinoff size of 30% reported in Table 3.[14] The results thus suggest that in the short run master enterprises that experienced small to slightly above average spinoffs gained in terms of both efficiency and profitability. In contrast, firms that lost more than 38% of their labor force through a spinoff tended to suffer in terms of value added per worker. Those that lost more than 50% of their labor in the spinoff experienced a negative effect in terms of profit/labor and turnover/cost.

The estimates reported in Table 6 refer to 1992 and for the first two performance indicators (value added and profit per worker) they are based on a substantially smaller sample than the 1991 estimates (262 vs. 373 observations).[15] As may be seen from the table, while in the case of value added and profit per worker the estimated 1992 coefficients have the same signs as in 1991, the estimated standard errors are relatively large and the estimated effects are statistically insignificant.

In order to check whether the decrease in statistical significance of the estimates between 1991 and 1992 is caused by the decrease in the sample size or by phenomena such as increasing competition and profit dissipation that we discussed earlier, we have re-estimated the 1991 value added/labor and profit/labor regressions using data from firms that constitute the 1992 sample. The estimates have the same signs as those in Tables 5 and 6, with three of the four of them being statistically insignificant at conventional levels of significance. This suggests that the smaller sample size may be the cause of the decrease in significance observed between the two tables.

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[14] This size at which the effect turns from being positive to becoming negative may be referred to as the critical size of a spinoff. In our case, it is measured in terms of the share of labor of the master enterprise that experienced a spinoff. As may be seen from the calculated values in Tables 5-10, the 1991 estimates of the critical size of the spinoff 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 spinoff is hence estimated to be positive within a sizable range of spinoff values, including the average spinoff size of about 30% (Tables 3 and 4).

[15] The 1992 sample size is reduced dramatically because many firms did not report data for the labor variable in 1992.

In contrast, the 1992 estimates for turnover/cost, reported in Table 6, are based on a very similar number of observations as the 1991 estimates reported in Table 5. For this indicator the issue of a reduced sample size hence 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 profit dissipation.

3.4.2. Effects of a Spinoff on the Subsidiary

In this section we focus on the difference between the performance of spun off subsidiaries and enterprises that did not experience spinoffs. 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 27 observations on the spun off subsidiaries in 1991 and, in the case of value added and profit per worker, only 12 in 1992. As mentioned earlier, in the case of the spun off subsidiaries the left-hand side variables are performance variables of the subsidiary in 1991 and 1992, while the right-hand side variables are the 1990 (before split) values of the $\mathbf{X}_i$ variables of the master enterprise in which the spinoff occurred. The estimates of α_0 and α_1 may hence be interpreted as reflecting the difference between the performance of a subsidiary in 1991 and 1992 and the performance of an enterprise that did not undergo spinoff but had the same characteristics as the enterprise from which the subsidiary split in 1990.

In Table 7, we present the estimated effects of the spinoff on performance of the spun off units in 1991. As in the case of master enterprises, we find that the estimated effect of a spinoff on the newly independent subsidiary's value added per worker, profit per worker and the ratio of turnover to cost is statistically significant. Moreover, as in the case of the master enterprises, the estimates also yield a negative function of the relative size of the spinoff, with positive effects for small to average spinoffs and negative effects for above average spinoffs (i.e., those exceeding about one-third of the labor force of the original firm).

The estimates of the effects of spinoffs on 1992 performance of the spun off subsidiaries are given in Table 8. The estimates show significant downward sloping effects on profit/labor and insignificant ones for value added/labor and turnover/cost.

There is hence again evidence of a weakening of the effect of spinoffs over time, but the weakening is less uniform than in the case of the master enterprises.

In order to check the cause of this weakening of statistical significance, we have again re-estimated the 1991 value added/labor and profit/labor regressions with data from firms that are present in the 1992 sample. Unlike for master enterprises, the re-estimation generates statistically significant coefficients that have the same signs as those in Table 7. In the case of the spun off subsidiaries, the weakening of the statistical significance over time hence appears to be brought about by phenomena such as increased competition and dissipation of profits rather than reduced sample size.

3.4.3 Joint Estimates

In view of the similar estimates obtained for the master firms that experienced spinoffs and the spun off units, we have also carried out joint estimation and tested the hypothesis of equality of the effects of the spinoff on these two sets of firms. The estimates for 1991 and 1992 are presented in Tables 9 and 10, respectively. As can be seen from these tables, the joint estimates are similar to those found in individual regressions earlier. Moreover, as the p values in the ultimate 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 split is identical for the spun off subsidiaries and the master firms.

In view of these results, we have also generated joint 1991 estimates using only data from firms that are present in the 1992 sample. In this case, four of the six coefficients are statistically significant, suggesting that the statistically insignificant joint estimates for 1992 are brought about primarily by phenomena such as increased competition and dissipation of profit.

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 types of enterprise restructuring observed in several transition economies was the breaking up of large state owned enterprises (SOEs) into smaller units. Our econometric estimates suggest that the major wave of

breakups of SOEs that took place in Czechoslovakia in the early 1990s had a significant immediate (1991) effect on productive efficiency and profitability of industrial firms. The effect was positive for small to slightly above average size spinoffs and negative for large ones. One also cannot reject the hypothesis that the estimated effect of spinoffs on performance was identical for the spun off subsidiaries and the master enterprises that experienced the spinoffs. Our 1991 estimates hence strongly suggest that the large firms created under the centrally planned system suffered from inefficiencies that were alleviated by the breakups of these firms into smaller units.

For two of the three indicators of performance (value added/labor and profit/labor), we have significantly fewer observations for 1992 than 1991. We also find that while most 1992 point estimates are similar to those for 1991, many associated standard errors are larger and yield statistically insignificant results. 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 between 1991 and 1992. Our findings indicate that the weakening of the statistical significance of the estimated effects of spinoffs between 1991 and 1992 is in most cases not attributable to the decrease in the sample size. Instead, it is likely generated by phenomena such as (a) increased competition brought about by the spinoffs and the elimination of the 20% import surcharge at the start of 1992, and (b) the possibly growing phenomenon of dissipation of profits by management as central controls were gradually eroded.

Table 1: An Example of Identification of a Spinoff

Year of Report by Type of Firm	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.

Table 2: Number of Spinoffs in 8 Consecutive Quarters of 1990 - 1991

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

Table 3: The Average Size of a Spinoff and the Typical Sample Size

	Average Spinoff	Standard Deviation	Number of Spinoffs of Master Enterprises / Total Available Sample (Typical)	Minimum Spinoff	Maximum Spinoff
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%

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

Table 4: The Average Size of a Spun off Subsidiary

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

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

Table 5: Estimated Effects of a Breakup on Master Firms in 1991

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- The sample contains 66 master enterprises that experienced a breakup.

Table 6: Estimated Effects of a Breakup on Master Firms in 1992

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- There are 66 master enterprises that experienced a breakup in the samples with 367 observations and 50 in the other samples.

Table 7: Estimated Effects of a Breakup on the Subsidiaries in 1991

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- There are 27 subsidiaries in the sample.

Table 8: Estimated Effects of a Breakup on the Subsidiaries in 1992

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- There are 22 subsidiaries in the sample with 324 observations and 12 subsidiaries in the sample with 224 observations.

Table 9: Joint Estimates of the Effects of a Breakup in 1991

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

Dependent Variable	IV Coefficients and Statistics					
	α_0	α_1	c [%]	$\bar{R}^2$	N	p-value
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff 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 spinoff on the subsidiaries and master firms;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- The sample contains 27 subsidiaries and 66 master enterprises that experienced a breakup.

Table 10: Joint Estimates of the Effects of a Breakup in 1992

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

Dependent Variable	IV Coefficients and Statistics					
	α_0	α_1	c [%]	$\bar{R}^2$	N	p-value
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

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on the 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 spinoff on the subsidiaries and master firms;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- There are 22 subsidiaries and 66 master enterprises that experienced a breakup in the sample with 389 observations, and 12 subsidiaries and 50 master enterprises experiencing a breakup in the other samples.

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Appendix

Table A1: Estimated Effects of a Split on Master Firms in 1991, Sample Size as in 1992

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
Value Added / Labor	18.92 (86.49)	-271.39 (202.30)	7.0 (27.4)	0.58	262
Profit / Labor	194.88 (126.96)	-594.31** (260.41)	32.8*** (11.0)	0.49	262

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- The sample contains 50 master enterprises that experienced a breakup.

Table A2: Estimated Effects of a Split on the Subsidiaries in 1991, Sample Size as in 1992

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

Dependent Variable	IV Coefficients and Statistics				
	α_0	α_1	c [%]	$\bar{R}^2$	N
Value Added / Labor	525.17** (245.38)	-1673.98** (732.95)	31.4*** (4.0)	0.14	224
Profit / Labor	742.41** (321.08)	-2294.52** (941.31)	32.4*** (3.8)	0.07	224

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff on performance is zero, i.e., $c = -(\alpha_0/\alpha_1)\cdot 100\%$;
- N = number of observations;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- There are 12 subsidiaries in the sample.

Table A3: Joint Estimates of the Effects of a Split in 1991, Sample Size as in 1992

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

Dependent Variable	IV Coefficients and Statistics					
	α_0	α_1	c [%]	$\bar{R}^2$	N	p-value
Value Added / Labor	64.15 (71.37)	-353.55* (184.62)	19.6 (12.1)	0.58	274	0.14
Profit / Labor	210.58** (102.52)	-625.67*** (232.95)	33.7*** (8.2)	0.47	274	0.44

Notes:
- Values in parentheses are standard errors;
- c = critical size of the spinoff, defined as the size (percentage of the labor force of the original master enterprise) at which the effect of the spinoff 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 spinoff on the subsidiaries and master firms;
- * = significantly different from zero at 10% level of significance;
- ** = significantly different from zero at 5% level of significance;
- *** = significantly different from zero at 1% level of significance;
- The sample contains 12 subsidiaries and 50 master enterprises experiencing a breakup.