

Privatization and Restructuring under Transition

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Abstract

The paper is intended to contribute to the microeconomic analysis of transition. Two alternative decision models of the firm are presented. The difference is analysed between the transformation of a state firm into a firm with a dominant private owner and a firm with dispersed private owners. Restructuring is formally introduced into the firm's decisions. The theoretical model is followed by an empirical analysis of the impact of ownership on the firm's restructuring activities.

Abstrakt

Článek se zabývá mikroekonomickou analýzou transformace pomocí dvou alternativních modelů chování firmy. Autor srovnává případ privatizace státní firmy do rukou dominantního soukromého vlastníka, s privatizací vedoucí k roztržštěnému vlastnictví. Restrukturalizace se stává součástí rozhodovacího problému firmy. Teoretická část je doprovázena empirickou analýzou vlivu vlastnictví na restrukturalizační chování firem.

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1. Introduction

Regardless of the extreme interest of politicians, businessmen and economists in the transition in Eastern Europe, the formal economic theory in this field remains underdeveloped. While some progress has already been made at the macro level, theoretical models of a firm behaviour adapting to market rules are very rare. Searching for related literature, I should first refer to an excellent overview of the theoretical research on Western privatization provided by Vickers and Yarrow (1988). Even recent articles by Green and Price (1993) and Christodoulakis and Katsoulacos (1993), claiming to be directly linked to transitional economies, do not sever their close connections with the British privatization experience.

The arguments for the quite limited applicability of the analyses based on the Western experience are summarized in Laštovička (1995). Restructuring, in the sense of the reduction of unit labour inputs, is investigated. Various aspects of restructuring in the Czech Republic are empirically analysed in Katsoulacos, Laštovička and Zemplerová (1995), which presents the findings of various analyses based on the same data sample as utilized in the empirical part of this paper.

The theoretical analysis is based on the comparison of two extreme outcomes of privatization: dispersed and concentrated ownership. While dispersed ownership motivates managers to fulfil short-term goals, concentrated ownership leads to long-term orientation. Thus, two different objective functions are analysed. In both cases, the choice variables are the output and the adjustment of a part of costs. As a firm restructures costs, the demand for its product is shifted. Dispersed ownership results in higher short-run profit, lower output and lower variable costs. Under concentrated ownership, higher variable costs result in higher demand. Thus, output is higher. The reduction in short-run profits enables the firm to capture a better position on the market and to obtain rather higher profits in the long-run.

Looking for empirical support for the theoretical results, I analysed the influence of several ownership forms on various restructuring activities of firms. Firms dominated by foreign investors are found to be the closest to the concept of the long-run oriented firms with concentrated ownership. On the other hand, employee-dominated firms conform best with the concept of short-run oriented firms with dispersed owners.

In Section 2, the theoretical model is introduced and its implications are discussed. The empirical analysis of the dependence of restructuring activities

on the applied method of privatization is presented in Section 3. Section 4 provides some final remarks and conclusions.

2. The Model

While in the West the economic reasons behind privatization programs are mostly to improve the state budget (see Katsoulacos (1992)) or to decrease the bargaining power of particular trade unions (see Bos (1991)), Eastern European privatization programs are considered as one of the crucial steps in the transition toward market economies. Economies in transition aim to increase their efficiency by establishing efficient market structures. There is no reason for efficient markets to exist under the dominance of state ownership in the economy. The natural growth of the private sector is too slow to decrease the share of state ownership in a reasonably short time period. Ownership is also assumed to be the key factor for efficient incentive mechanisms for insiders.

Additionally, the political reasons for privatization should be mentioned. The successful ownership change, creating rapid improvements in privatized firms, contributes significantly to the popularity of new governments, which face huge external shocks, negatively influencing living standards.

In spite of the strong propaganda against give-away privatization, surprisingly coming mainly from left-oriented politicians, there are obvious positive political benefits from voucher privatization in the Czech Republic, Slovakia and Russia. No doubt, voucher privatization is the quickest known procedure for the transfer of a large stake of state ownership into private hands.

In my analysis I assume that the privatization of a state-owned firm leads to two extreme cases - either to concentrated ownership or to dispersed ownership. The firm with dispersed ownership (D-firm) arises in practice from give-away (voucher) privatization, privatization through the distribution of shares to employees and the transformation of cooperatives.¹ The firm with concentrated ownership (C-firm) is the product of the majority of standard privatization methods, such as direct sale, tender, management buy-out, restitution and sale through auction.

¹ For a detailed description of privatization methods in the Czech Republic see Kotrba (1993) and Laštovička, Marcinčin and Mejstřík (1994).

Under dispersed ownership there is less monitoring of management by owners. As Vickers and Yarrow (1988) point out, the lower the fraction of shares in the hands of a particular shareholder, the weaker his incentive to actively participate in the control of managers. Additionally, the higher the number of owners, the more likely it is that monitoring activities are duplicated, therefore rendering the monitoring less efficient. Managers have a higher chance of influencing the behaviour of a firm according to their personal interests.

But how can one generally characterize the personal interests of managers? Most studies suggest that the decision horizon of managers is rather shorter than the horizon of owners. Managers tend to exploit the firm in order to achieve excellent results in a short period, regardless of weakening its future position. This tendency is supported by the standard compensation schemes of managers, which are based mainly on current profits. My aim is to model the short-run behaviour of firms in transition economies. Thus, the behaviour a short-run oriented firm (D-firm) is formalized as a short-run profit maximization.

However, the mainstream literature on managerial and labour managed firms points out the deviation of such firms from long-run profit maximization; my assumption is not in contradiction with this. Long-run profit maximization in emerging, fast expanding markets like those in Eastern Europe, does not imply a short-run pursuit of profits, but rather an orientation towards the creation of a good market position. A firm's establishment on a new market and the securing of a large stake in it cause the substitution of current profits with higher profits in the future.

C-firm managers are either owners themselves, or they are tightly monitored by the owner. Firms with concentrated ownership are closer to long-run orientation. There is again the question of formalizing the short-term strategy of long-run oriented decision makers. The first precondition for occupying a strong position on the market is the capture of the largest possible part of the demand. This activity could be modeled as revenue maximization by the C-firm.² On the other hand, revenue maximization can not be boundless. The limitation is on the side

² For the readers who do not feel comfortable with the argumentation linking the dispersed ownership with short-run orientation and short-run profit maximization (and the concentrated ownership with the long run orientation causing maximization of revenue in the short-run), it might be better to think about the D-firm directly as the short-run profit maximizer (and, about the C-firm as the short-run revenue maximizer). The empirical part may then be considered as the search for a link between short-run objective function and the ownership.

of costs. The decision process of the C-firm should provide an allowance for loss minimization or profit maximization, which are equivalent problems.

There are two ways in which to formalize the combination of revenue and profit maximization strategies; the more common in literature is to assume that managers are bound by the minimum profit requirement. After meeting this constraint, managers are assumed to fully concentrate on the second objective - revenue maximization. However, in this paper I adopt an alternative approach - weights. If the situation is good, the owner increases his consumption by making higher profits, while in the event of a bad state he sacrifices more, implying lower current profits in the name of better prospects. Therefore, the owner of the C-firm is assumed to place some exogenously determined weights on profit maximization and revenue maximization, respectively.

One of the main characteristics of the rapid transition programs in Eastern Europe is the simultaneity of the numerous changes. In the model, privatization is immediately followed by changes in the behaviour of the firm. For these changes, I shall use the word "restructuring". Restructuring has many different forms.

Since the short-run behaviour is analysed, no changes in capacities happen. The fixed costs remain the same as before privatization. But variable costs change. Restructuring in this sense is the adjustment in the number of employees and stocks, product innovations, investments in quality (such as better materials, more careful assembling and improvements in the production technology) and pro-marketing improvements (for example, better design, improvements in covers, an extended warranty or other extra services). This approach does not reflect aspects like the division or merger of a firm, which are usually understood by "restructuring" in the Western sense. Administrative mergers and divisions were very common activities before the collapse of communism; firms became accustomed to it. In practice, such global organizational changes in Czech firms are not connected with real improvements in behaviour or increases in efficiency.

As product characteristics such as quality, innovation or design improve, demand increases. Restructuring shifts the demand given the price level or, in other words, adjusts the price given the number of products.

Consider a firm privatized into the hands of either dispersed or concentrated owners. The formalization of objective functions of D- and C-firms is the following:

$$\max_{Q_D, \lambda_D} \Pi_D = \max (P(Q_D) * m(\lambda_D) * Q_D - (v + \lambda_D) * Q_D - F)$$

$$\max_{Q_C, \lambda_C} V_C = \max [(1-w) * (P(Q_C) * m(\lambda_C) * Q_C - (v + \lambda_C) * Q_C - F) + w * P(Q_C) * m(\lambda_C) * Q_C]$$

where Π_D stands for the objective of the D-firm (profit maximization), $P(Q_i)$ for the price (the demand function),³ $m(\lambda_i)$ for the shift of demand, and it depends on a particular part of the variable cost λ_i ,⁴ Q_i for quantity of production. $(v + \lambda_i)$ are total variable costs, where λ_i denotes those variable costs which change under restructuring (restructuring variable costs) and v stands for the rest of the variable costs (stable variable costs). F denotes fixed costs. V_C stands for the objective function of the C-firm, w for the weight given to revenue maximization and $(1 - w)$ for the weight given to profit maximization ($0 < w < 1$). All parameters and variables are assumed to be positive, which eliminates the possibility of corner and perverse solutions.

In order to simplify the analysis, some additional assumptions are made. A very simple linear downward sloping demand function is chosen: $P(Q_i) = P_0 - Q_i$. The demand function starts in P_0 (the maximum attainable price for the product) and it has a unit slope. A reasonable requirement for function $m(\lambda_i)$, shifting demand according to restructuring variable costs, is the diminishing effect of λ_i .

Imagine, for instance, that λ_i stands for investments in quality. Once these investments are doubled, the demand shifts up somewhat. If it is tripled, the demand rises again, but less than before; this is just what I mean by the diminishing effect of restructuring variable costs. Probably the simplest function with such a property is $m(\lambda_i) = \lambda_i^{1/2}$, which suggests that the demand could be slightly increased quite cheaply but that it is progressively more expensive for subsequent increases.

Assume that the firm before privatization (for this case the subscript S is used, since the firm is state-owned) has restructuring variable costs equal to one ($\lambda_S = 1$). It is a normalization assumption which makes part of the variable costs subject to change under restructuring equal to the reference point 1. The demand

³ Subscript $i = D, C$ denotes the D-firm and the C-firm, respectively.

⁴ The demand shifts up if $m(\lambda_i)$ is greater than one and down if $0 < m(\lambda_i) < 1$.

shift before privatization is therefore $\lambda_s^{1/2} = 1$. This asserts that the demand is not shifted anywhere before restructuring.⁵

Proceeding with the formal analysis, let us substitute for $P(Q_i)$ and $m(\lambda_i)$. The first derivatives of the objective function with respect to Q_D and λ_D lead to the following first order conditions for the D-firm:⁶

$$Q_D = \frac{P_0 * \lambda_D^{1/2} - v - \lambda_D}{2\lambda_D^{1/2}} \quad , \quad \lambda_D = \left[\frac{P_0 - Q_D}{2} \right]^2$$

Combining the first order conditions, the quadratic equation for the optimal Q_D we reach:

$$3Q_D^2 - 4P_0 * Q_D + P_0^2 - 4v = 0$$

Obviously, this quadratic equation has two solutions. But it is easy to show that the positive root violates the assumption of positive price.⁷ Therefore, the single valid solution is:

$$Q_D^* = \frac{2P_0 - \sqrt{P_0^2 + 12v}}{3}$$

The known optimal value of output is resubstituted into the first order condition for λ_D . After rearranging, the expression for the optimal restructuring variable costs is obtained:

$$\lambda_D^* = \left[\frac{P_0 + \sqrt{P_0^2 + 12v}}{6} \right]^2$$

⁵ Note that the ownership change is considered as given. Because there are many problems concerning the formal analysis of a state-owned firm under the communist regime, its decision problem is not formally specified here. Since no objective function of the firm before privatization is defined, it might be that spent costs do not lead to an efficient amount of output.

⁶ As I have already pointed out, the analysis is concentrated exclusively on interior solutions. The price is always positive as well as the output, λ_D and all parameters.

⁷ The positive price requirement says that $P_0 - Q_D > 0$. Substituting for Q_D the positive root of the quadratic equation $Q_D = 1/3(2P_0 + \sqrt{P_0^2 + 12v})$ and rearranging, I reach the condition $v < 0$, which violates the assumption of positive parameter values.

The necessary condition for the above values to be solutions of the maximization problem is the negative definition of the matrix of second derivatives. The Hessian matrix has the following form:

$$H = \begin{vmatrix} -2 * \lambda^{1/2} & \frac{P_0 * \lambda^{-1/2}}{2} - Q * \lambda^{-1/2} - 1 \\ \frac{P_0 * \lambda^{-1/2}}{2} - Q * \lambda^{-1/2} - 1 & \frac{-(P_0 - Q) * Q * \lambda^{-3/2}}{4} \end{vmatrix}$$

Evaluating the necessary second order condition for the maximum $\mathbf{x}'\mathbf{H}\mathbf{x} < 0$, where \mathbf{x} is the vector of choice variables, the following condition should be satisfied:

$$P_0 < 5Q_D + \frac{2}{3}(1 - w) \lambda_D^{1/2}$$

Combining the facts that the above condition holds for Q_D^* and λ_D^* ,⁸ and that the values of choice variables satisfying the first order conditions are unique in the considered range, Q_D^* and λ_D^* are definitely the unique solutions for the maximization problem.

Since the analysis is constrained to positive prices, outputs and restructuring variable costs, this feature should be checked. Both the price and the optimal restructuring variable costs are always positive, but for the optimal output to be positive, it requires the following constraint upon the parameters:⁹

$$P_0^2 > 4v$$

Similarly, the expressions for the optimal output and the optimal restructuring variable costs are evaluated for the C-firm and the parameter constraint is reached:

⁸ It could be easily seen by substituting the first order condition for restructuring variable costs $\lambda_D^{1/2} = (P_0 - Q_D)/2$. The second order condition then collapses to $0 < 11Q_D + P_0$.

⁹ First, the optimal output $Q_D^* = 1/3(2P_0 - \sqrt{(P_0^2 + 12v)})$ is substituted into the condition for positive price $P_0 - Q_D > 0$. Rearranging, the condition $-\sqrt{(P_0^2 + 12v)} < P_0$ is reached. It is always fulfilled. Second, the optimal output is checked to be positive. This condition leads directly to $P_0 > 4v$. Third, the constraint $\lambda_D^* > 0$ is evaluated. Substituting for λ_D^* and rearranging, the condition $\sqrt{(P_0^2 + 12v)} > -P_0$ is reached. The last inequality always holds.

$$Q_C^* = \frac{2P_0 - \sqrt{P_0^2 + 12v*(1-w)^2}}{3}$$

$$\lambda_C^* = \left[\frac{P_0 + \sqrt{P_0^2 + 12v*(1-w)^2}}{6*(1-w)} \right]^2$$

$$P_0^2 > 4v*(1-w)^2$$

Comparing the parameter constraints of both types of firm, the stronger one is that of the D-firm. Thus the single parameter constraint ensuring positive equilibrium outputs, demands and prices of the D-firm as well as the C-firm is $P_0^2 > 4v$.

Since the expressions for optimal values of the D-firm are very similar to those of the C-firm, the results for both firms can be analysed together, with the exception of the impact of the weight w . It is easy to see how the optimal values respond to the change in the constant part of variable costs v . The higher the stable variable costs, the lower the produced quantity and, in turn, the higher the optimum restructuring variable costs. The intuitive explanation is quite natural: the higher the costs, the lower the amount of products that could be sold at a price acceptable to both the buyer and the producer. It follows that the greater the one part of variable costs (the stable one) is, so will be the second part (the restructuring variable costs).

Analysing the impact of P_0 is trivial for the optimum restructuring variable costs. As P_0 increases, λ_{i*} increases as well. Determining the dependence between P_0 and Q_{i*} is a little more difficult. However, using the first order derivatives, a positive dependence is revealed.¹⁰ The higher P_0 , the higher the demand and the production.

Fixed costs F are not considered in the firm's decision on the size of output and restructuring variable costs. Fixed costs influence only the profitability of a firm. As this is an analysis of short-run behaviour, it is not necessary to concern ourselves with the positivity or negativity of short-run profits.

¹⁰ For the purpose of simplicity, the impact of P_0 is illustrated on the optimum output for the D-firm. Taking the first derivative of Q_D^* with respect to P_0 , I obtain: $\partial Q_D^*/\partial P_0 = 2/3 - 1/3 * P_0 * (P_0^2 + 12v)^{-1/2}$. Let us see for which parameters $\partial Q_D^*/\partial P_0 > 0$. Rearranging, I reach $P_0^2 + 12v > 0$, which always holds. It proves that Q_D^* is an upward sloping function of P_0 .

While the above model's implications are common to both types of firm, I now turn the attention to the effect of w - the measure of the importance of the long-term orientation represented by the strategy to capture a market. The effect on the optimal output of the C-firm is straightforward. As w decreases (more weight to profit maximization, less weight to revenue maximization), Q_C^* decreases. As w tends to zero, Q_C^* approaches Q_D^* . The output of the C-firm is always higher than the output of the D-firm.

For deriving the effect of the change in weight on λ_C^* , a little trick is used. The nominator can be partitioned and then the denominator can be introduced into the internal square root.¹¹ In this way I show that a decrease in w implies a decrease in the optimal restructuring variable costs. Similar to the optimal outputs, λ_C^* is always higher than λ_D^* . As w approaches zero, λ_C^* is closer and closer to λ_D^* .

As to the difference between the C-firm and the D-firm, the model implications are very strong. The model suggests that the privatization methods leading to dispersed ownership cause lower output levels and lower restructuring variable costs than in the case of privatization methods leading to concentrated ownership. The more strategically the firm behaves (the more weight it places on market position), the higher are its expenditures for quality, design, labour input and stocks.

Depending on the value of the optimal restructuring investment, the demand function (the price) shifts either up or down. The upward shift in the case of the D-firm happens if $v > 3 - P_0$. Similarly, the demand function shifts up for the C-firm if $v > 3 - P_0/(1 - w)$. It follows from the previous paragraph that the demand for the firm with concentrated ownership is always higher than the demand for the firm with dispersed ownership. If $3 - P_0 > v > 3 - P_0/(1 - w)$, the demand of the C-firm is above the demand before privatization, while the demand of the D-firm is below the demand before privatization.

¹¹ I rearrange it as $\lambda_C^{*1/2} = p_0/6(1-w) + \sqrt{((p_0/6(1-w))^2 + v/3)}$. Thus, there is a positive relationship between the change in w and the change in λ_C^* .

3. An Empirical Analysis of the Dependence of Restructuring on Ownership

In this section, the idea that the method of privatization influences subsequent restructuring in the sense of the theoretical model is tested. For this purpose are utilized the data collected within the ACE project "Obstacles to Restructuring in Eastern Europe."¹² The sample consists of 257 Czech manufacturing firms with 25 and more employees. The answers to the mailed questionnaire were collected in February 1994.

Although the basic "hard" data were recorded (profits, investment, sales, debts, employees, etc., separately for 1991 and 1993), the special emphasis was on "soft" data - the ideas, feelings and judgements of managers. I believe that these data are less manipulated than other existing samples because managers were given the choice to answer anonymously. There are often differences between the firm's situation suggested by the "hard" data and evaluations of the firm's position expressed by managers. Aware of the managers' frequent opportunities to manipulate the statistical data (both legally and illegally), I tend to rely more upon the "soft" data.

Several analytical studies based on this data sample have already been published. Laštovička, Marcinčin and Zemplerová (1995) present good representative properties of the sample, descriptive statistics and the impact of the size, the industry and the ownership form on the behaviour of firms. Additionally, they analyse the firm's characteristics which influence restructuring. They define restructuring as a complex measure based on the combination of recorded characteristics. Marcinčin (1994) highlights the progress made by firms owned by their managers. Laštovička and Zemplerová (1994) confront the empirical results with various statements made in interviews with representatives of key governing institutions. Laštovička (1995) empirically evaluates the results of the theoretical model of restructuring investment in the reduction of labour requirements under capital and financial market imperfections.

In this paper, the definition of dominant owners formulated in the above studies is utilized. The dominant owners are those who control more than 50% of the firm's assets. Eight such groups are distinguished: firms dominated by investment privatization funds from voucher privatization (IPF), firms dominated

¹² The coordinator of the project for the Czech Republic is A. Zemplerová (CERGE-EI). The author is her assistant. The project as a whole is coordinated by Y. Katsoulacos from the Athens University of Economics and Business.

by individual investors from voucher privatization (II), firms dominated by employees (EMPL), firms dominantly owned by their managers (MANAG), firms dominated by a direct domestic investor (DOMIN), firms dominated by a direct foreign investor (FORIN), firms remaining under the dominance of the state (STATE) and firms which do not fit into any of the above groups (OTHER). Because the model analyses the differences between the methods of privatization, I omit the last two groups (STATE and OTHER) in the analysis.

Restructuring, in the sense of adjusting a part of variable costs, has various forms. Linking it to the data I dispose of, restructuring is understood as:

- dramatic improvements in marketing;
- a change in the organization of production;
- adoption of a new system of quality control;
- product innovation;
- a change in employment;
- a change in wages;
- a change in stocks.

If the improvement in marketing is made through better design or extra services offered for each product, then it can be viewed just as the increase in restructuring variable costs. Similarly, a change in the organization of production leading to more careful assembling, as well as the introduction of additional control activities, can be modeled as the increase in a part of variable costs. These three restructuring activities are recorded in the data as dummy variables (the answer is either yes or no).

The remaining four restructuring activities have a numerical form in the data. Innovation is recorded as the percentage of completely new products in total output and the percentage of innovated products in total output. To link it with the change in variable costs, I understand innovation as the use of better and more expensive materials, introduction of additional production operations leading to an increase in the comfort of consumers or better properties of the product.

In order to connect the change in employment to the variable costs, it is rearranged as the change in labour input relative to the output.¹³ The advantage of this measure is that it removes the effect of the size of the firm. The change

¹³ Formally written, the change in employment is measured as the inverse productivity in 1993 over the inverse productivity in 1991, where the inverse productivity is the number of employees over sales in the respective year.

in wages is measured as the average wage in 1993 over the average wage in 1991. Similar to employment, the effect of the size of the firm should be removed in the case of a change in stocks. The relative change in stocks is therefore measured as relative stocks in 1993 over relative stocks in 1991, where relative stocks are stocks over sales in the respective year. If relative stocks increase, there are the costs for storing them. Thus, a part of the variable costs increases.

The first step in the analysis is to find which restructuring activities are related with the privatization method. By the privatization method is understood the dominant ownership form arising from privatization. The available statistical tool for the analysing the relationship between variables is the contingency table with its statistics. Although the most popular tools in such a case are the correlation analysis or the linear regression, the discrete character of ownership form implies serious problems with significance measurements. On the other hand, contingency tables are appropriate in the case of discrete variables. However, some restructuring activities are measured by continuous variables. In order to apply contingency tables to them, transformation into discrete variables is necessary. Thus, innovation activities are defined as very high if more than half of the output in 1993 consists of new products, high if more than half of the output in 1993 is achieved through new and innovated products, and low otherwise. Relative changes in employment and stocks are divided into two cases - increase and decrease or unchanged. Since wages increased in all firms within the considered period, a high increase in wages is defined as higher than 50%. Otherwise, the increase in wages is low.

By simplifying the continuous variables into two or three discrete cases, naturally some information is lost.¹⁴ Therefore, looking for the relationships between continuously measured restructuring activities and the dominant ownership, both contingency table statistics and standard correlation significances are considered. The correlation matrix between the privatization methods and the continuously measured restructuring activities is reported in Table 1. The results of the contingency tables are summarized in Table 2.

¹⁴ But once the contingency table statistics indicate a significant relationship for the simplified discrete form of a restructuring activity, such relationship obviously holds also for its continuous form.

Table 1: Correlations between dominant ownership groups and continuously measured restructuring activities.

Correlations	NEW	INOV	EM	WA	ST
IPF	-.1719	-.0008	.0301	-.0596	-.0506
II	-.0728	-.0243	-.1220	-.0664	-.0279
EMPL	-.0580	.0961	-.0961	-.1328	-.0353
MANAG	.0256	.0466	-.0584	.0973	.1572
DOMIN	.0780	-.0280	.1348	-.0012	-.0377
FORIN	-.0074	.0597	.1234	.2148*	-.0340

1-tailed Signif: * - .01 ** - .001

Notation: NEW - the percentage of new products in output, INOV - the percentage of innovated products in output, EM - relative employment growth, WA - wage growth, ST - the growth of relative stocks.

Table 2: Summarized report of contingency table analyses.

		Dominant ownership					P-values of test statistics		
		IPF	II	EMPL	MANAG	DOMIN	FORIN	Pearson	M-H test
Restructuring activity									
Improvements in marketing		62.1%	55.6%	39.3%	59.6%	65%	50%	0.441	0.913
Improvements in the organization of production		48.3%	44.4%	46.4%	51.9%	55%	66.7%	0.800	0.219
Introduction of a new system of quality control		27.6%	33.3%	10.7%	15.4%	50%	61.1%	0.000	0.020
Innovation activity	very high	27.6%	22.2%	21.4%	37.5%	40%	41.2%	0.362	0.167
	high	13.8%	22.2%	42.9%	25%	20%	23.5%		
Growth of relative employment		17.2%	11.1%	28.6%	13.5%	25%	16.7%	0.593	0.967
High wage growth		36%	33%	22.7%	51.5%	47.1%	75%	0.059	0.020
Growth of relative stocks		70.8%	37.5%	40.9%	51.6%	46.7%	66.7%	0.279	0.559

Note: Each row represents one contingency table. The remaining option to each restructuring activity represents the rest to 100%. The last two columns present P-values for the Pearson test and the Mantel-Haenszel test for linear association for the zero hypothesis that the particular restructuring activity is not associated with the dominant ownership.

The only significant correlation coefficient is between foreign-dominated firms and the wage growth. The contingency table statistics also confirm that the high wage growth varies with the ownership form. The contingency tables additionally indicate the introduction of a new system of quality control to differ according to the dominant ownership. Although some of the activities, which I call restructuring in the sense of the model, can be attacked as indirectly connected with the change in variable costs, the wage growth and the intensification of quality control are obviously linked to the growth in a part of the variable costs.

In the case of all other restructuring activities - improvements in marketing, improvements in the organization of production, innovations, adjustment in employment and adjustment in stocks - I am forced to accept the alternative that they do not depend on the ownership type.

Despite finding an empirical support for two of the analysed restructuring activities to differ significantly with the ownership, I can not yet assert that restructuring "depends" on ownership. The applied privatization method might depend on the expected ability of the firm to restructure after privatization. If this were true, the statement that different ownership structure leads to different restructuring would be false. To test the direction of causality, I use Hausman exogeneity tests.¹⁵

More specifically, the single-equation version of the test derived by Spencer and Berk (1981) is applied. It is based on the idea that if the variable can be treated as exogenous, then the estimation based on two stage least squares (2SLS) leads to approximately the same result as the estimation based on OLS. 2SLS is consistent both for exogenous and endogenous, but OLS is efficient for exogenous and not consistent for endogenous variables. Thus, the Wald test approach can be applied:

- (1) run OLS for exogenous specification of dominant ownership and save estimated coefficients and variance-covariance matrix
- (2) run modification of 2SLS for the case of discrete variables for endogenous specification of dominant ownership
 - in the first stage dominant ownership is estimated by exogenous variables
 - in the second stage are obtained estimators plugged to specification (1) and coefficients and variance-covariance matrix are saved

¹⁵ Exogeneity is implicit to Granger's non-causality (see Handbook of Econometrics 2).

- (3) knowing coefficients and variance-covariance matrixes for unrestricted (2) and restricted (1) versions, the Wald test is applied.

This test procedure is utilized on wage growth and presented in detail in the Appendix.

The only change in the case of the introduction of a new system of quality control consists of using probit instead of OLS, because this restructuring variable is the dummy variable.

Testing the hypothesis that dominant ownership is exogenous with respect to wage growth leads to the t-statistics distributed according to the Chi-square distribution with eight degrees of freedom equal to 0.000109. The corresponding P-value is very close to 1. The hypothesis can not be rejected. The Wald test for the hypothesis that the dominant ownership is exogenous with respect to the improvements in quality control leads to the t-statistics distributed according to the Chi-square distribution with eight degrees of freedom equal to 2.946556 and the corresponding P-value is equal to 0.93767. The hypothesis again can not be rejected on any reasonable significance level. The empirical evidence suggests the dependence of wage growth and improvements in quality control on dominant ownership.

4. Conclusions

The model contributes to the analysis of the behaviour of firms under transition by distinguishing the type of owner and introducing restructuring as an endogenous choice variable. The main finding is that firms with concentrated ownership restructure more. Firms with dispersed owners tend to have relatively higher short-run profit levels but lower output levels. Additionally, it is found that firms with a higher proportion of variable costs tend to restructure more than those with a higher proportion of fixed costs.

In the later part, the author presents the empirical support for the hypotheses that improvements in quality control and wage growth are significantly influenced by the type of ownership. Referring to Tables 1 and 2, the highest levels of restructuring activities are recorded in the case of foreign dominant ownership. Employee-owned firms represent the group with the lowest restructuring activities. Linking these empirical findings to the theoretical model, the employee-dominated firms are the closest to dispersed ownership in the model, and foreign-dominated firms correspond to concentrated ownership. Firms dominated by owners from voucher privatization exhibit close to average levels

of restructuring activities. Firms dominated by a domestic direct investor fit into the category of long-run oriented firms with concentrated ownership. The model fails in the case of firms dominantly owned by their managers. While their wage growth is above the average, they are quite passive concerning improvements in quality control.

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APPENDIX

(0) Selection of observations without missing values

(1) Restricted OLS estimation for the wage growth (using observed dominant ownership).

Dependent variable: wage growth
 R-squared = .293870
 Adjusted R-squared = .233774
 Log of likelihood function = 36.5254

Variable	Estimated Coefficient	Standard Error	t-statistic
C	1.95839	.103197	18.9772
DIK	-.015686	.077073	-.203523
EMPL	-.118595	.056839	-2.08651
MANAG	.044535	.050946	.874150
DOMIN	-.012102	.061559	-.196587
FORIN	.143209	.066872	2.14155
E91	.341503E-06	.614594E-05	.055566
PROD91	.383997E-04	.372826E-04	1.02996
WAGE91	-.135485E-03	.246078E-04	-5.50580

where wage growth is measured as the average wage in 1993 over the average wage in 1991, dominant ownership groups are II, EMPL, MANAG, DOMIN and FORIN (IPF is skipped because of overdetermination) and remaining explanatory variables are: the number of employees in 1991 (E91), the labour productivity in 1991 (PROD91) and the average wage in 1991 (WAGE91).

(2a) Estimation of dominant ownership using multinomial logit

(2aa) Log-likelihood function

$$\text{logl} = \text{IPF} \cdot \text{XA1} + \text{II} \cdot \text{XA2} + \text{EMPL} \cdot \text{XA3} + \text{MANAG} \cdot \text{XA4} + \text{DOMIN} \cdot \text{XA5} - \log(1 + (\exp(\text{XA1}) + \exp(\text{XA2}) + \exp(\text{XA3}) + \exp(\text{XA4}) + \exp(\text{XA5})))$$

where logl states for log-likelihood, FORIN is omitted because of overdetermination, XA1 to XA5 are the respective probability ratios of belonging to the particular dominant ownership group. The probability ratios are estimated according to:

$$\begin{aligned} \text{XA1} &= a_0 + a_1 \cdot \text{E91} + a_2 \cdot \text{PROD91} + a_3 \cdot \text{STOC91} + a_4 \cdot \text{DEBT91} + a_5 \cdot \text{PROF91} + a_6 \cdot \text{EXP91} + a_7 \cdot \text{WAGE91} \\ \text{XA2} &= b_0 + b_1 \cdot \text{E91} + b_2 \cdot \text{PROD91} + b_3 \cdot \text{STOC91} + b_4 \cdot \text{DEBT91} + b_5 \cdot \text{PROF91} + b_6 \cdot \text{EXP91} + b_7 \cdot \text{WAGE91} \\ \text{XA3} &= c_0 + c_1 \cdot \text{E91} + c_2 \cdot \text{PROD91} + c_3 \cdot \text{STOC91} + c_4 \cdot \text{DEBT91} + c_5 \cdot \text{PROF91} + c_6 \cdot \text{EXP91} + c_7 \cdot \text{WAGE91} \\ \text{XA4} &= d_0 + d_1 \cdot \text{E91} + d_2 \cdot \text{PROD91} + d_3 \cdot \text{STOC91} + d_4 \cdot \text{DEBT91} + d_5 \cdot \text{PROF91} + d_6 \cdot \text{EXP91} + d_7 \cdot \text{WAGE91} \\ \text{XA5} &= e_0 + e_1 \cdot \text{E91} + e_2 \cdot \text{PROD91} + e_3 \cdot \text{STOC91} + e_4 \cdot \text{DEBT91} + e_5 \cdot \text{PROF91} + e_6 \cdot \text{EXP91} + e_7 \cdot \text{WAGE91} \end{aligned}$$

where a0 to e7 are parameters to be estimated and the explanatory variables are: the number of employees in 1991 (E91), the labour productivity in 1991 (PROD91), the ratio of stocks over the number of employees in 1991 (STOC91), the ratio of debts over the number of employees in 1991 (DEBT91), the ratio of profits over the number of employees in 1991 (PROF91), the percentage of exported output in 1991 (EXP91) and the average wage in 1991 (WAGE91). The method of estimation is the maximum likelihood. The results of the estimation are:

Log of likelihood function = -102.467

Parameter	Estimate	Standard Error	t-statistic
e0	3.39924	8.31125	.408993
e1	-.239535E-02	.238648E-02	-1.00371
e2	-.878894E-03	.156049E-02	-.563217
e3	.739964E-02	.012121	.610476
e4	-1.71992	4.84671	-.354864
e5	-24.6365	32.9044	-.748728
e6	-.038177	.037456	-1.01923
e7	.552197E-04	.233765E-02	.023622
d0	4.88694	7.65363	.638513
d1	-.364155E-02	.936562E-03	-3.88821
d2	-.239989E-02	.297699E-02	-.806144
d3	.010233	.013360	.765954

Parameter	Estimate	Standard Error	t-statistic
d4	-12.9468	8.91132	-1.45285
d5	4.59706	24.9659	.184133
d6	-.038921	.031122	-1.25061
d7	.525995E-04	.212826E-02	.024715
c0	13.7373	9.06381	1.51562
c1	-.221760E-02	.176049E-02	-1.25965
c2	-.022284	.953249E-02	-2.33766
c3	.027174	.016423	1.65459
c4	-26.3462	23.3271	-1.12942
c5	2.78233	39.3887	.070638
c6	.012427	.058055	.214054
c7	-.153411E-02	.249327E-02	-.615303
b0	4.36292	15.8942	.274498
b1	.129996E-03	.122138E-02	.106434
b2	-.017101	.012188	-1.40315
b3	.030893	.019604	1.57583
b4	-5.67215	25.7487	-.220289
b5	10.9725	30.6559	.357925
b6	-.029574	.068472	-.431904
b7	-.282351E-03	.435845E-02	-.064782
a0	1.85708	7.47723	.248365
a1	-.334202E-05	.529946E-03	-.630635E-02
a2	-.278397E-02	.273373E-02	-1.01838
a3	.020563	.013112	1.56827
a4	-9.43980	12.7622	-.739670
a5	5.06361	19.325	1.262022
a6	-.034475	.031426	-1.09700
a7	.283000E-04	.212537E-02	.013315

(2ab) Computation of estimated probabilities of ownership groups (XA1hat - XA6hat)

For the parameters a0 - e7 are now plugged the estimated values.

$$\begin{aligned} XA1hat &= a0 + a1 * E91 + a2 * PROD91 + a3 * STOC91 + a4 * DEBT91 + a5 * PROF91 + a6 * EXP91 + a7 * WAGE91 \\ XA2hat &= b0 + b1 * E91 + b2 * PROD91 + b3 * STOC91 + b4 * DEBT91 + b5 * PROF91 + b6 * EXP91 + b7 * WAGE91 \\ XA3hat &= c0 + c1 * E91 + c2 * PROD91 + c3 * STOC91 + c4 * DEBT91 + c5 * PROF91 + c6 * EXP91 + c7 * WAGE91 \\ XA4hat &= d0 + d1 * E91 + d2 * PROD91 + d3 * STOC91 + d4 * DEBT91 + d5 * PROF91 + d6 * EXP91 + d7 * WAGE91 \\ XA5hat &= e0 + e1 * E91 + e2 * PROD91 + e3 * STOC91 + e4 * DEBT91 + e5 * PROF91 + e6 * EXP91 + e7 * WAGE91 \\ XA6hat &= -\log(1 + (\exp(XA1hat) + \exp(XA2hat) + \exp(XA3hat) + \exp(XA4hat) + \exp(XA5hat))) \end{aligned}$$

(2ac) Generation of the estimator for the dominant ownership

The estimated dominant ownership is such that estimated probability (XA1hat - XA6hat) is the highest. The estimated dominant ownership is denoted by the letter H (HIPF to HFORIN).

(2b) Unrestricted OLS estimation for wage growth (using estimated dominant ownership)

Dependent variable: wage growth

R-squared = .253169

Adjusted R-squared = .189609

Log of likelihood function = 33.6394

Variable	Estimated Coefficient	Standard Error	t-statistic
C	1.83776	.094206	19.5079
HDIK	-.042643	.112181	-.380130
HEMPL	.112696	.095418	1.18107
HMANAG	.094625	.042490	2.22698
HDOMIN	.011865	.065921	.179995
HFORIN	.188259	.098926	1.90303
E91	.430029E-05	.697672E-05	.616378
PROD91	.535036E-04	.400067E-04	1.33737
WAGE91	-.117525E-03	.250905E-04	-4.68404

(3) Wald test

The zero hypothesis is that the dominant ownership is exogenous with respect to the wage growth. The test statistics t is computed as

$$t = dc' DVC dc$$

where dc' is the row vector of the difference between coefficients estimated by unrestricted and restricted models, dc is the corresponding column vector and DVC is the difference of variance-covariance matrixes of unrestricted and restricted models. The t -statistics has approximately the Chi-square distribution with the number of degrees of freedom equal to the number of explanatory variables used in estimation of probabilities of the ownership groups.

CHISQ(8) test statistic: .1093988E-03, P-value = 1

The zero hypothesis can not be rejected.