

Restructuring of Czech Manufacturing Enterprises: An Empirical Study*

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Abstract

This study is a contribution to the discussion about restructuring the manufacturing industry of the Czech Republic during the period 1991–1993. The analysis is based on a unique data set created from a survey carried out in February 1994.

The central objective of the study is to test whether the private enterprises perform better and hence restructure more than those owned and administered by the state. The analysis of the data shows that there are significant changes in management, organization, control of quality and production programs in the manufacturing firms from 1991 to 1993. Nevertheless it is interesting to learn how the pattern of change varies according to the structure of property rights, method of privatization, size and sector. The main finding is that private enterprises with a clearly identified owner are restructuring to a greater extent than the state enterprises during the 1991–1993 period.

Abstrakt

Studie je příspěvkem do diskuse o restrukturalizaci zpracovatelského průmyslu v České republice v období 1991 až 1993. Analýza vychází z unikátního datového souboru založeného na výběrovém podnikovém šetření uskutečněném v únoru roku 1994.

Analýza ukázala, že ve sledovaném období došlo k významným změnám jak v řízení a organizaci podniků, tak v kvalitě a skladbě vyráběných výrobků. Analýza prokázala, že proces restrukturalizace byl ve srovnání se státními podniky intenzivnější v případě soukromých podniků s jasně definovanými a koncentrovanými vlastnickými právy.

Práce dále prezentuje korelační a regresní analýzu závislosti restrukturalizace na odvětví, resp. velikosti podniku. Analýza rovněž odhalila významný rozdíl ve výkonu již dříve existujících firem a firem nově založených tzv. na zelené louce. Nově založené podniky jsou produktivnější než podniky dříve existující a rychle rostou.

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1. Introduction

The transition of the Czech economy from a command to a market economy should necessarily be accompanied by a mass restructuring of firms, which must occur at both the sectoral and enterprise levels.

At the sectoral or industry level, market structures are expected to become less concentrated as competitive pressures increase. Other features of such restructuring are faster development and a deeper restructuring of labor-intensive manufacturing industries including textiles, leather, glass, china and light machinery, in which the Czech Republic traditionally has a comparative advantage, and which were suppressed under the command economy. On the contrary, the development of heavy machinery, heavy chemicals, fuel and energy industries was emphasized.

At the enterprise level, restructuring should affect management, the organizational structures, the investment in new capacities and technologies, as well as the training of employees, which lead to an increase in productivity and product quality.

There exists no explicit policy for restructuring in the Czech Republic. Changes in ownership structure together with the increase of the competitive pressure are expected to evoke changes in industry and in the internal structure of enterprises and to ensure an effective allocation of investment. How this attitude of the government towards restructuring and the above mentioned anticipations be proven? The general statistics do not provide detailed information on what is going on inside the firms. Hence, a special survey of the manufacturing firms is the only way of collecting data which would shed more light on the restructuring process.

The definitions of restructuring differ significantly from one another. The closest definition to our point of view is: "To restructure the organization means to change the way it is organized so that it has a different structure, usually in order to make it work more effectively" (English Language Dictionary, Harper Collins Publishers, London 1993).

Although the words "to restructure" are very often used in economic literature as well as in newspapers, we have not really found an exact definition. Most authors use it for personal changes in management, break-up or merging of firms, changes in the internal organization structure, changes in the firm's attitude towards R&D, marketing or advertisement, or exclusively for financial restructuring. Since the definition is vague, restructuring is not measurable.

However, we wanted to find some measure at least of relative achievements in restructuring to be able to compare firms. An indirect way of measuring restructuring is presented in Green and Price (1993). They believe in the efficiency of capital markets. Restructuring in their sense, is any activity of the firm leading to a significant growth of the market value of the firm, therefore directly observable on the stock market.

Despite the general problems with the efficiency of capital markets, we criticize their approach from a different point of view. Restructuring increases the uncertainty of the firm's future development. It can lead to better perspectives as well as to a situation in which the costs of restructuring cannot be covered by improvements in the firm's position. Risk aversion exists even in efficient markets, and this could lead to an initial decrease in the market value of a firm once restructuring starts.

Since the capital market in the Czech Republic has only recently been established, it is very volatile and thus not efficient. Additionally, the impossibility of applying Green and Price's approach is caused by the fact that only firms privatized in the first wave of voucher privatization are tradable on the stock market.

The main objective of this paper is to investigate the relationships between restructuring and the different ownership (property rights) structures. We also investigated whether restructuring depends on the size of enterprises or on the sector. In addition we try to testify whether there is any relationship between the restructuring efforts and firms privatized by different methods of privatization, hence whether the method of privatization can influence the restructuring of the firm.

In the second chapter, we describe the questionnaire, data collection and their main characteristics compared to the total population. We also present the methods and tools for the analysis of the data gathered in the survey and define average distribution of ownership in the firm. In chapter three we provide the basic results of the analysis, we compare the performance of state-owned with privately owned firms and construct the complex variables for restructuring, first in the unweighted and later in the weighted form.

In the first part of this core chapter three, we investigate the influence of the firm's size, its sector and its dominant owner on the internal changes in firms between 1991–1993. This first part of the analysis is based on a LOGIT model structure. The second part of chapter three utilizes advanced descriptive methods: cluster and factor analyses. This approach enables us to compare

standard and non-standard methods of privatization and to relate them to restructuring efforts by extracting the strongest relationships hidden in the data.

In our survey we measured the restructuring of enterprises through various indicators separately, but in the last part of the third chapter, we construct complex variables for restructuring. First, we use the unweighted approach, then we weight the contribution of individual characteristics to our measure of restructuring. Subsequently, both measures are tested for the dependence on ownership, size and sector (industry). The main conclusions of the work are summarized in chapter four of this paper.

2. The Analytical Framework and Research Methodology

We prepared the questionnaire with the aim of collecting data for evaluating the firms' performance and restructuring process during the period 1991–1995. In this part of the work, we built on the experience with research work done on smaller scale before.¹ The final version of the questionnaire is presented in Appendix 1. The questionnaire has three parts and contains 29 questions, each with several answer options, altogether providing about 150 variables.

The first part of the questionnaire asks questions about *the restructuring efforts during the period of 1991–1993* in the following areas:

- change of management;
- break-up or merge of enterprise;
- changes in internal organization (improvement of marketing, creation of a distribution network etc.);
- changes in quality control;
- changes in the training activities;
- changes in the production program (share of the innovative, new and existing products).²

Questions about the market share and changes in competition on the market as well as changes in export and biggest problems to be tackled during the same period are also included in this first part.

¹ Charap J.-Zemplerova A., Restructuring in the Czech Economy, Working paper No.2, EBRD, March 1993.

² These questions constituted the basis for the construction of the complex variable of complex measure of restructuring (see chapter 4.4).

The second part of the questionnaire deals with *the privatization process and the firm's past performance during the period 1991–1993* (profits, investment, sales, debts, employees etc.). The third part of the questionnaire focuses on *future developments, investment and the main barriers to restructuring*.

Although the survey collects the basic "hard" data, particular emphasis is placed on the "soft" data, i.e. the ideas, feelings and judgements of managers. The respondents were given the opportunity to answer anonymously. In addition, a sociologist and psychologist were consulted in designing the questionnaire with the aim of revealing the required information.

Next, we screened the entire population of enterprises for the selection of the sample. From the register of the Czech Statistical Office, we received the addresses and a short description of the total population of manufacturing firms. There existed 3110 firms with more than 25 employees operating in manufacturing in January 1994. Out of the 3110 firms we selected randomly 1036 firms (every third firm from the list, sorted according to the alphabet), to which we mailed the questionnaire with a cover letter in February 1994. We received the answers in March 1994. During that time, all firms had the opportunity to record the results for 1993.

The response rate was unexpectedly high — about one quarter. We succeeded in collecting 257 valid questionnaires from the manufacturing firms. This number is a statistically representative sample for the total population. Nevertheless, for particular questions, the number of valid answers varies and might be substantially lower.

We spent considerable time checking for possible mistakes and irregularities in the answers and for typing errors made in entering the data into computers. We allowed for missing answers, therefore all "strange" and wrong answers were counted as missing. However, the number of valid answers never fell below 157 for any particular question.

2.1. General Characteristics of the Sample and Total Population

Table 1 presents the structure of the total population (i.e. all manufacturing enterprises with more than 25 employees registered by the Czech Statistical Office in January 1994) by legal form of the firm and by region, compared to the structure of our sample. The most frequent legal forms are joint stock companies and limited liability companies. As for the number of companies, about one fifth of the firms are state-owned. The manufacturing industry is not

equally allocated across the eight regions into which the Czech Republic is administratively divided. Nevertheless, our sample corresponds well to the true regional distribution. If we assume that unknown firms are mainly state-owned and Limited liability companies; then the distribution according to the legal form represents the population very well, too.

Table 1: *Legal form and regional structure of manufacturing enterprises: Total population compared to the sample*

Share of the enterprises in %		
	Total population*	Sample**
<u>Legal forms</u>		
Limited liability	39	28
Joint-stock company	28	35
State-owned firms	20	15
Cooperatives	8	8
Other or unknown	5	14
TOTAL	100	100
<u>Region</u>		
Prague, the capital	8	6
Central Bohemia	11	7
South Bohemia	6	7
West Bohemia	9	10
North Bohemia	11	9
East Bohemia	17	18
South Moravia	23	18
North Moravia	15	17
Unknown	—	8
TOTAL	100	100
Total number of enterprises	3110	257
* in January 1994; ** in February 1994		

Source: Czech Statistical Office (total population), own computations, 1994.

For the purpose of the analysis, we aggregated the enterprises according to three criteria: the size, sector (industry) and ownership. Tables 2–4 show below how representative the sample is in comparison with the whole population, according to these criteria. The size distribution, as well as the distribution of the enterprises across sectors in the sample is similar to the whole population, as shown in Tables 2 and 3.

The distribution of the population and the sample according to ownership form are compared in Table 4. Ownership forms in Table 4 are defined by the Czech Statistical Office (CSO).³

Table 2: *Size structure of the sample compared to the total population of manufacturing enterprises, 1994*

Size of enterprise by number of employees	Sample	Total population
25 – 99	35%	39%
100 – 299	26%	32%
300 – 499	11%	11%
500 – 999	12%	9%
1000 – 1999	9%	5%
2000 – 2999	3%	2%
3000 – 4999	3%	1%
5000 and more	1%	1%
TOTAL	257	3110

Source: Czech Statistical Office (total population), own computations, 1994.

³ A private company is owned by a private person or a group of private persons, citizens of the country. State ownership is exercised by its sectoral ministries and state organizations. Foreign ownership indicates that company is fully owned by foreign person(s). The company has an international ownership form when it is owned by both domestic and foreign owners. Mixed ownership is a combination of above forms.

Table 3: Enterprises by sector (in %)

Sector	Sample	Total population
Food and beverages	14%	16%
Textile	4%	6%
Clothing & leather products	3%	4%
Wooden goods	5%	5%
Chemical products	4%	2%
Rubber and plastics products	4%	3%
Glass and ceramics	7%	7%
Metal products	14%	12%
Machines and instruments	19%	14%
Furniture	7%	7%
Others	18%	23%
TOTAL	257	3110

Source: Czech Statistical Office (total population), own computations, 1994.

Table 4: Enterprises by ownership

	Sample	Total population
Private	40%	49%
Cooperatives	8%	8%
State	31%	29%
Foreign and international	5%	6%
Others (and non identified)	16%	8%
TOTAL	100%	100%

Source: Czech Statistical Office (total population), own computations, 1994.

The importance of the state sector would be different if indicators as assets, output or number of employees, respectively were used.

We can conclude that the sample of 257 enterprises is a good representation of the whole population. The only bias which could have appeared concerns the bankruptcy expectations of enterprises which answered our questionnaire. We did not receive any response from companies which expected to go bankrupt.

2.2. Methods of Analysis

Several analytical methods have been applied. For analysing the relationship between ownership and the dependent variables (i.e. given in answers to our questionnaire), sectoral and size⁴ variables must be considered to be mutually independent. Tests for the influence of firm's ownership (dominant owner), size and sector to each particular characteristic were based on the *logit model structure*.

We have to consider the sectoral dummies and the size dummies. Only if all three sets of variables (ownership, sector and size) are used, can we explain whether the changes in the enterprises arise simply due to changes across (within) the sectors or to enterprise size, or if they are induced by different ownership structures. The correlations between the explanatory variables (i.e. ownership, size and sector) were found to be low enough for proceeding with the regression analysis.

The majority of questions in our survey require answers in the form of Yes/No or 1/0. To test the hypotheses of the impact of ownership on different indexes and to see the extent of this impact, a logit model was used. The functional form of the logit model is

$$\text{Prob}[Y=0] = 1/(1 + \exp(b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n)),$$

which makes the probability that Y is equal to 0 dependent on the observed variables, in our case ownership, the sectoral dummy, and the number of employees, which was the indicator of size in this part of the analysis.

The task (for TSP) is to find the best values for coefficients b_1 , b_2 and so on (by maximizing the likelihood function). When the coefficient of a particular variable is positive, then higher values of that variable correspond to a lower probability that $Y = 0$ (or to a higher probability that $Y = 1$).

⁴ As the measure of size we use firm's sales.

The coefficients, the standard errors and the t–statistics have a similar interpretation to those from OLS, but the magnitude of the coefficients has a different meaning. It must reflect the functional specification used. We do not present all the regressions here.

Advanced descriptive methods, such as cluster and factor analyses, were used to reveal the main relationships hidden in the data. The complication we face is the large number of variables (the total number of individual options for our 29 questions exceeds 150). Thus, standard methods like correlation and regression analysis cannot be applied for this purpose. However, there are statistical methods available for handling a large number of variables.

The method of principal components (factor analysis) extracts a chosen number of factors from a bundle of variables. Factors can be considered as artificially created variables, each of which captures the effects of several initial variables. The crucial condition for the possibility of drawing any conclusion on the basis of factor analysis is the intuitive interpretability of artificially merged variables. If extraction is followed by successful rotation, it is possible to interpret the factors and to use them later as variables with clear meanings. This is the way of reducing the number of variables without losing most of the information contained in the initial data.

The other advantage of factors is their orthogonality. In other words, there is no dependence between one factor and any other factor formed on the basis of the same variables. Once a factor is well interpreted, it keeps its meaning in subsequent analyses. However, factor analysis does not provide sufficient indicators for the appropriate number of factors to be extracted. Thus, we determine a number of factors through an alternative method for handling many variables – cluster analysis.

Cluster analysis is a sequential process. Every step consists in finding the two variables which are most heavily correlated and merging them into one new variable – cluster. There are two different ways of utilizing clusters. First, they can be used either for selecting the representative variables for particular groups of variables merged into clusters. Alternatively, we can utilize the fact that this technique does not only merge variables, but it also orders them. The ordering is based on their similarity, so that the first one is the most similar to the second one and most different from the last one in the ordered sequence. Therefore we see which explanatory variables are close to each other (more correlated) or further away (less correlated).

The use of the representative variables indicated by cluster analysis leads to a higher loss of information than when applying factors. Thus, we run the cluster analysis only to obtain a hint for the determination of the appropriate number of factors. We rely on the information expressed by the rescaled distance of clusters reported in dendrograms. The rescaled distance shows how much information is relatively lost in each step of merging two clusters. The longer is the horizontal line in the dendrogram, the higher is the loss of information in the point where the line ends (where the particular cluster is combined with the other).

If there is a relatively long interval on the rescaled distance in which no mergers are reported, the number of horizontal lines in that interval corresponds to the appropriate number of representative variables to be selected (consequently, the number of factors to be extracted). On the contrary, in the interval where mergers occur (short horizontal lines), only a small loss of information occurs by using a lower number of representative variables.

We started by dividing the answers into 6 groups, which we analyzed separately:

- * *answers about the firm's past internal development:*
 - changes in the organizational structure, the organization of production, training activities and quality control;
 - changes in management;
 - innovation of products;
 - sources of financing of investment and the use of investment.
- * *answers about the competitiveness of the firm's environment:*
 - changes in the market share
 - changes in competition faced by firms;
 - main competitors.
- * *answers about the firm's main barriers:*

We asked firms separately about their main past barriers and about barriers they expect in the future, but they mostly indicated the same barriers for the past as for the future. Therefore we used only one set of answers in the analysis - main past barriers.
- * *answers about privatization and ownership structure:*
 - the proportion of various types of owners in the firm's capital stock;
 - the proportion of various privatization methods applied to the firm.
- * *answers about economic indicators of past development:*
 - sales, change in sales;
 - wages, change in wages;
 - % of output exported, change in % of output exported;
 - relative employment, change in employment;

relative number of workers, change in number of workers;
relative stocks, change in stocks;
relative credits, change in credits;
relative equity, change in equity;
relative profits, change in profits.

We dispose with firms' data on employment, sales, profits, credits, and so forth, separately for 1993 and 1991. In order to be able to compare small with large firms, we constructed relative indicators:⁵

* *answers about expectations for the future:*

a general characterization of the firm's future;
changes in employment, sales and investment;
use of investment;
market orientation.

We applied both cluster and factor analyses to the above six groups. The cluster analysis showed what the most related answers are and what the appropriate number of representative variables which capture well the majority of the effects of the whole group is. On the basis of the knowledge of the appropriate number of representative variables, we extracted the factors. Then we tried to interpret these factors.

Our approach can be illustrated with the help of the answers about the competitiveness of firm's environment by the dendrogram in Appendix 2 (Figure A1). We apply a similar procedure to answers concerning the privatization methods and the ownership structure (see the dendrogram in Appendix 2 (Figure A2)).

2.3. The Ownership Distribution of Firms

For the purpose of analysis and its effects on restructuring we defined the dominant owner as the owner or group of owners which owns more than 50% of assets. If no major owner in the above sense exists, the dummy "OTHER" is activated. We identified eight groups of major (dominant) owners: state

⁵ Where indicators starting with the word "relative" are computed as the number for 1993 /Sales 1993 and indicators starting with the word "change" are computed as the number for 1993 - the number for 1991/ABS (the number for 1993). This is one possibility of properly dealing with negative profits

(STATE),⁶ investment privatization funds (IPF), managers (MANAG), foreign owners (FORIN), domestic owners (DOMIN), employees (EMPL), individual investors in the coupon privatization (DIK)⁷ and others (OTHER).⁸ As a result of the analysis of answers to question 15 we got the following distribution of ownership in a firm:

Table 5: *Ownership of assets by groups of owners (in percent of our sample)*

STATE	26.3%
MANAG	20.4%
EMPL	10.3%
IPF	8.5%
DOMIN	8.2%
DIK	5.8%
FORIN	5.6%
OTHER*	14.9%

* includes 4.4% assets owned by restituent and 1.1% assets owned by municipalities

As we can see from Table 5, on average the share of assets owned by the state is still rather high – more than one quarter. The share owned by managers indicates that they succeeded in becoming one of the most important ownership groups.⁹

3. Selected Results of the Analysis

Analyzing the basic distributional statistics of sample answers, we found several interesting results: *70% of the firms replaced the majority of managers in the last three years. Out of the surveyed firms 55% were created through the*

⁶ includes also the property owned by the National Property Fund (NPF)

⁷ see for instance Charap-Zemplerova (1993) for the description of the coupon privatisation

⁸ see Lastovicka, Marcincin and Mejstrik 1994 for more details on this definition.

⁹ see Charap-Zemplerova (1994)

division of a former bigger firm, and 50% changed their internal organization structure. One third of enterprises applied a completely new approach to quality control, and more than one half made a serious improvement of the quality control. About forty percent of the sampled firms intensified their training activities. The rest of the enterprises made only small or no changes, or even reduced, the training activities. On average only 50% of the products are the same as three years ago. Nevertheless it is interesting to learn how the pattern of change varies according to the structure of property rights, method of privatization, size and sector. Results given in the chapters 3.1.–3.6. are based on the Logit analysis.

3.1. Change in Management

With respect to *management restructuring*, the changes have not been directed from above. After the 1989 revolution, there was opposition to the old management from both inside the enterprise and from the public at large, and employees, through the workers' council, had the right to participate in appointing the management. Later, a law prohibiting secret police agents from retaining high positions in the state and public sector led to changes in top management in several state enterprises.

Table 6: *Change in Management between 1991-1993 (number of answers)*

Total replacement of managers	Yes: 67	No: 183
Replacement of majority of managers	105	145
Small changes	58	192
No changes	18	232

The negative answers to the total replacement of managers were associated with enterprises owned by employees (at a 0.13 significance level), as well as with those owned by the state, managers, foreign owners and investment funds. It is interesting that total replacement of managers was more likely in larger enterprises.

A partial replacement of managers is typical for enterprises in textile and clothing, means of transport and especially in those firms owned by domestic and foreign owners, the state and investment funds. Small changes in

management took place in enterprises owned by employees (at a 0.14 significance level), and in the rubber and plastic material industries. No replacement of managers is reported mainly by enterprises owned by managers, some of the foreign-owned firms (at a 0.20 significance level) and by those in food and beverages. About one quarter of all enterprises disclosed small changes in management, and 7.5% enterprises reported no replacement.

3.2. Change in Organization Structure

The majority of enterprises report significant changes in their production organization, but only 67 of them report small changes and 5 of them no changes.

Large enterprises made significant changes in their organization structure, except for enterprises in the rubber and plastic products industries, and aggregates and ceramics ones. Enterprises owned by foreign owners did not report the small changes as an answer. State enterprises did not make changes in organization structure, neither did employees.

Table 7: *Change in the Organization Structure (number of answers)*

Significant change in organization structure	Yes: 122	No: 128
Improvement in marketing and distribution network	132	118
Small changes in organization structure	67	183
No changes in organization structure	5	245

3.3. Change in Quality Control

Enterprises in the chemical and fiber industries as well as those controlled by a foreign owner mostly opted for a completely new approach to quality control. On the contrary, enterprises owned by employees, the state and managers tended to answer negatively to this possibility. A dramatic change in quality control was reported by enterprises in aggregates and ceramics, and those controlled by the state or managers.

Table 8: Changes in quality control (number of answers)

Completely new approach	Yes: 62	No: 188
Major change	141	109
Minor change	40	210
No change	7	243

3.4. Change in Training Activities

Larger enterprises answered that there was an improvement in their training activities. The same is true for foreign-owned. DIK's reported small changes, rather than an improvement (a negative coefficient for Answer 2 and a positive one for Answer 3). There was an improvement of training activities in the aggregates and ceramics industry. Investment funds made only small changes in their training activities. Employees (at a 0.16 significance level), state and domestic-owned enterprises, as well as enterprises of wooden and metal product industries, reduced their training activities. Twenty enterprises reported a reduction of the training activities.

Table 9: Change of the training of employees (number of answers)

No change	Yes: 36	No: 214
Rise in intensity and quality	96	154
Small changes	98	152
Reduction of training activities	20	230

3.5. Change in the Production

The changes in production are shown in Table 10. Production was changed remarkably in the chemical and fibre industries. Small changes are indicated by the following sectors: textile and clothing, wooden goods, pulp, paper and publishing, rubber and plastic materials, aggregates and ceramics, and metal products.

Table 10: Changes in Production (number of answers)

	Yes	No
Rationalisation of production	85	165
Change in the basic phase of production	48	202

3.6. Change in the Production Programme

The innovation activities vary according to the owner: a drastic change in the production program of enterprises belonging to employees (usually in cooperatives, whose production included 35 % of completely new products) and domestic owners (33% completely new products) can be registered, in contrast to the enterprises of state, investment funds and DIK's, which innovated less intensively, as is shown in Table 14. Foreign owners, others and managers innovate products by 32, 33 and 30 %, respectively. The state, DIK's and investment funds kept the majority of their products unchanged (62, 58 and 57% respectively of the existing products in Table 11, last column).

Table 11: Changes in the production program (% of all products)

OWNER	Number of observations	Share of completely different products	Share of innovated products	Share of existing products
DIK	9	17.44	25.00	57.56
DOMIN	20	32.80	25.70	41.50
EMPL	28	34.82	23.93	41.25
FORIN	17	25.88	32.41	41.71
IPF	29	15.46	27.66	56.88
MANAG	48	27.71	29.63	42.67
OTHER	33	14.09	32.58	53.33
STATE	62	11.26	26.69	62.05
TOTAL	250	21.56	27.94	50.51

Enterprises predominantly owned by managers, foreign investors together with domestic investors, and employees (mainly cooperatives) changed the production program more radically during 1991–1993 in compared to the state-owned enterprises and the enterprises owned by individual investors and investment funds from coupon privatization. The former group of owners innovated to higher extent the existing products or started to produce completely new products, compared to the latter.

4. Performance of Private and State Enterprises

Without distinguishing between private and state enterprises, we can illustrate the general tendencies of the restructuring processes using the data on the performance of the firms during 1991–1993. In Table 12 we present a summary of the basic accountancy data for firms participating in the survey.

Table 12: Basic accounting data for 1991 and 1993 (average data – 157 valid observations)

	1991	1993
# employees	785.03	594.36
# workers	565.29	428.41
Sales ^{*)}	370142.12	344638.92
% exported	15.54	27.23
Average wage	3770.61	5458.00
Stocks ^{*)}	90304.92	81616.54
Credits	94.00	113.97
Equity	303.89	335.38
Profit	34.43	12.86

^{*)} In thousands Kč. Current prices and all other financial data are expressed in millions Kč.

The average size of enterprises according to the number of employees decreased between 1991 and 1993 by one quarter. Nevertheless, the share of workers did not change markedly in the same period of time, and was 72% in 1991 and 74% in 1993. The debt/equity ratio increased from 31% in 1991 to 34% in 1993. While the credit burden increased, average profitability decreased radically from

9% in 1991 to 3.8% in 1993. The share of exported goods on outputs almost doubled.

Table 13: Basic Activity Indicators of firms by ownership in 1991 and 1993

Ownership	State		Private	
	1991	1993	1991	1993
Employees	1344	968	597	477
Sales*)	650	558	302	298
Investment within the period**)	112		102	
Average Wage	3705	5428	3764	5440
Share of output exported (in%)	16.0	27.7	14.9	25.8
Employees per sales	3.21	2.82	3.71	2.75
Profit per sales	.064	.013	.095	.039
Inventories per sales	.311	.318	.260	.234
Credits per sales	.221	.283	.256	.281
Investment per sales	.167		.210	
Debt/equity ratio	.283	.293	.455	.535
# firms	42		87	

Note: *) State firms involve firms previously defined as STATE. Private firms involve previously defined categories: MANAG, EMPL, IPF, DOMIN, DIK, and FORIN.

***) Measured in millions of crowns.

4.1. Private versus State Enterprises

Turning to the performance *differences between the state-owned and private firms*, we analyze the changes in number of employees, sales, average wage, share of exported goods, and relative indicators of performance such as profit per sales, inventories per sales, credits per sales investment per sales and debt/equity ratio in firms from 1991 and 1993. From Table 13 we can conclude that private firms were performing better than the state-owned enterprises. Private enterprises have a higher productivity and profitability, they have, on average lower inventories but a higher credit burden which increases in time.

One of the reasons can be a more intensive investment activity in the private firms, which is related to more intensive restructuring (see further).

Private firms are, on average smaller than the state ones. This is the result of the continuing process of breaking up of enterprises during privatization and is also due to the fact that newly established firms are prevalently of small and medium size.

4.2. Standard Methods versus Non-standard Methods of Privatization

Since the Czech Republic is far ahead with its privatization, we are interested in the impact of particular privatization methods on the behaviour of firms.

Thanks to previous factorization, we are now left with a relatively small number of variables, and we can apply standard correlation analysis (Table A7 in Appendix 2). The correlation analysis suggests that *firms privatized through voucher privatization* can be characterized by the following:

- will invest in machinery, and will have mass production;
- did not use credits, did not innovate, and were not internally stable;
- their main barrier is low demand, not taxes and interest;
- fired employees, decreased sales, had low labor input and high wages;
- were under competitive pressure,

firms privatized by restitution:

- used credits and innovated;
- considered their main barrier to be demand, not taxes and interests;
- hired employees and increased sales;
- will not expand, but will keep the same position,

transformed cooperatives:

- were labor-intensive with low wages;
- did not make organizational changes;
- believe their barriers are low demand, employees and legislation, not taxes and interest,

firms privatized by sales (auctions and direct sales) to domestic investors:

- changed organization;
- will invest in machinery and will have mass production;

It was interesting to learn whether there exist differences in restructuring between enterprises privatized through the coupon method and standard methods of privatization. The following table shows the results of the correlation analysis between the method and the selected factors of restructuring (extracted from table A7 in Appendix 2).

Table 14: *Correlation between the selected characteristics and the method of privatization*

FACTOR	Coupon method	Sale of the firm
Organizational change	0,0231	0,1215*
Change in production	-0,1588**	0,0164
Growth of the firm	-0,2215**	0,1115
Innovation activity	-0,1569**	0,0322
Productivity	-0,2335**	-0,0518

* significance level=0.1, ** significance level=0.05.

The analysis confirms our previous finding that firms privatized through coupon method are less innovative. In addition, it can be concluded that they also pay more attention to questions concerning quality, and that they are less productive than the firms privatized through sale.

4.3. New Start-ups versus Incumbent Firms

About 15% from the total sample are new start-ups; these firms have all been established in the sector of machinery, metal and plastic products. The group of newly-established firms invests more than the old firms and has increased the number of employees as well as sales. The new start-ups have a productivity three times higher than that of the incumbent firms; they are also more productive and are growing faster in comparison to incumbent firms. These firms have more stable management, give more attention to the quality of products and innovate more (34% new products in comparison with 19.8% in incumbent).

New firms have more problems with the acquisition of credits; they nevertheless have higher expectations for the future (71% compared with the incumbent firms' 31%). These start-ups not only have a higher labor productivity; their sales grow rapidly, too. Their characteristics indicate internal stability and excellent perspectives.

Table 15: Comparison of the growth of new-start ups and incumbent firms, 1991–1993

	New start-ups	Incumbent firms
Growth of sales*	+22%	- 1%
Growth of profit*	+14%	-64%
Growth of average number of employees	+23%	-32%
Inventories	-32%	-24%
Average salary	+34%	+31%

* In current prices.

4.4. Restructuring – Construction of the Complex Variable.

4.4.1. Unweighted Measure of Restructuring

Since we have several answers about the firms' activities contributing to what we understand as restructuring, we utilize these for the measurement and constructed complex measure of restructuring.

The six considered attributes of the firms restructuring efforts during last three years are: changes in management, changes in the organization structure, change in production, the intensification of quality control, the intensification of training activities and the innovation of the majority of products.

If for at least five of the above attributes the answer was positive, we consider the intensity of restructuring as "very high restructuring." In the case of four positive answers we use the expression "high restructuring." Three positive answers indicate "low restructuring," and below three "very low restructuring." The intervals are chosen in order to have a similar number of firms in each group.

We aimed at shedding more light on the following question: Do the private enterprises restructure more than those owned and administered by the state? Results are summarized in table 16 below.

From table 16 we can conclude that *in comparison to state enterprises private enterprise restructure more if they have clearly defined and concentrated ownership.*

Table 16: The dependence between ownership and the unweighted measure of restructuring (RESTR)

Ownership RESTR	State	Private dispersed			Private concentrated			Others	Total
	State	Employees	IPF	Individual investors	Managers	Domestic owner	Foreign owner		
Very low restructuring	12.9%	17.9%	10.3%	0%	25.5%	10%	6.2%	12.9%	14.5%
Low restructuring	41.9%	28.6%	24.1%	44.4%	25.5%	25%	0%	29%	29.3%
High restructuring	25.8%	32.1%	37.9%	33.3%	34%	20%	50%	32.3%	31.8%
Very high restructuring	19.4%	21.4%	27.6%	22.2%	14.9%	45%	43.8%	25.8%	24.4%
# firms	62	28	29	9	47	20	16	31	242

4.4.2. A Weighted Measure of Restructuring

Looking at the results of the previous section, the reader can argue that not all the attributes of restructuring are of the same importance. For instance, the training activities are probably rather less important than product innovations or changes in quality. Thus, we redefine restructuring according to some other attributes (now we use even more attributes), and we rank them according to the importance we think they have. From now on, we will understand restructuring as:

- first: implementation of new products, intensification of quality control and improvement in marketing;
- second: division or merger of the firm, new internal organizational structure, partial innovations and rapid change in the number of employees (the size of the firm);
- third: organizational improvements in the production process, changes in the basic phase of production, intensification of training and changes in management.

Additionally, we define the attributes of no restructuring:

- first: the firm has not changed its organizational structure, and it did not improve the organization of the production process, it did not improve its marketing, and it did not make changes in the basic phase of production;
- second: the firm decreased quality control;
- third: the firm reduced training activities.

For analytical purposes, we apply the score model to the above definition. Each attribute contributes to the artificially created variable RES (= the degree of restructuring) with a specific amount of points: 10 points for the 1st attributes, 6.6 points for the second and 3.3 points for the 3rd. Similarly, the first attributes of no restructuring represent - 10 points, the second - 6.6 points, and the third - 3.3 points. Thus the theoretically achievable minimum is - 19.9 points and the theoretical maximum is 63 points. The applied computational algorithm is presented in Appendix 2.

Since we constructed a new artificial variable which serves as the basis for the subsequent analysis, we should check its applicability. Note that we have not included any attribute of financial restructuring. Nevertheless, restructuring in our sense controls for the main activities to be undertaken in the transformation of firm operating in the command economy into the market-oriented firm.

Every standard economic analysis starts with a descriptive analysis. This step is even more important since we are not sure if the dependent variable in the analysis (RES) has desirable properties.

On the basis of the interquartile range, four outliers with a low degree of restructuring were identified and none extreme.¹⁰ The quartiles are presented in the boxplot (Figure 1).

Figure 1: Boxplot of the degree of restructuring (RES).



Variable	RES	Number of cases	257.00
Symbol Key:		* - Median	(O) - Outlier (E) - Extreme

Looking carefully at these four outliers, we found that their major characteristic is (aside from those contributing by definition to a low value of RES) a very low level of investment. Three of these outliers are waiting for privatization and one is a recently established foreign firm. Three outliers export the majority of the production. Surprisingly, all of them are very optimistic about the future. In fact, we have not found any good common reason for their low degree of restructuring except a slightly lower competitive pressure than on average. They are probably outliers in the standard sense, and we omit them from further analysis.

Although the highest values of RES were not identified as outliers, we examined the firms with the top five degrees of restructuring, all of which were already privatized. Privatization led to one strong owner – either a foreign owner or a

¹⁰ It is standard to use the following definition of outliers and extremes: if the value lies further away than 1.5 times the interquartile range from the outside quartiles it is an outlier. Once it lies more than three times the distance away, it is an extreme.

direct domestic one. They rapidly increased exports, especially to the West, and they intend to be export-oriented. All of them feel the rapid increase in competition. Their investment was financed by credits and by raising the equity. All the five firms show signs of progressive management with good future perspectives. Looking at the firms with the highest values of RES fully supports the proper construction of our measure of restructuring.

The other desirable property of RES should be its fairly even distribution around the firms. Ideally, this would be a normal distribution, which provides the best properties for a relative comparative analysis. The standard tool for presenting the distribution is the histogram. Figure 2 shows the histogram of RES for the sample without outliers. It is accompanied by the basic distributional statistics.

Figure 2: *Histogram and distributional statistics of the degree of restructuring (RES)*

Mean	30.481	Std err	.695	Median	30.840
Mode	11.070	Std dev	11.047	Variance	122.032
Kurtosis	-.304	S E Kurt	.305	Skewness	-.295
S E Skew	.153	Range	56.890	Minimum	2.810
Maximum	59.700	Sum	7711.600		
Valid cases	253	Dropped cases (outliers)	4		

Considering Figure 2 and all the above findings, we conclude that our artificially created measure of the degree of restructuring is good enough to be used in our later analysis.

Now we use RES to analyze the dependence of restructuring on three sets of characteristics: the firm's size, the dominant owner and the industry. There are several measures for the size of a firm. The most common are sales, the number of employees and the equity. Equity cannot apply to the Czech Republic because newly-established firms do not have strong enough incentives to raise it. It is quite common that fast-growing new firms with tens of millions of sales and hundreds of employees keep their declared equity at the initial level (usually below half a million crowns). We decided to take the sales in 1993 as the measure of the firm's size.

For analyzing the impact of ownership we again apply the definition from chapter 2.2. (a dominant owner is defined as owning more than 50% of the firm).

The additional explanatory variables are fifteen dummies for industries. Altogether, we analyze the impact of twenty-four variables on RES. With the exception of sales, they are dummy variables.

Searching for linear interdependence, we undertake the correlation analysis. No extremely strong correlations between explanatory variables exist. The strongest dependence exists between the size of the firm and the industry "means of transport" (the correlation coefficient is 0.32). Thus, there are no serious problems with multicollinearity for the later regression analysis.

Surprisingly, only two explanatory variables are marked as significantly correlated with the degree of restructuring. They are the dummies for the foreign majority owner and the direct domestic majority owner. The linear dependence between the size of the firm and RES is below 10%. But it would be wrong to conclude that the size affects the degree of restructuring very little. We only know that the dependence is low when it is assumed to be linear.

A corollary of the analysis is regressions. We first regress the RES on a whole set of explanatory variables, checking for the nonlinear influence of size. The simplest way of allowing for an unknown nonlinear functional form is to use a polynomial function. Most functions can be approximated by a polynomial function with sufficient accuracy. Since we do not predict that the appropriate functional form of the influence of the size of the firm is too wild (too many peaks), we use a polynomial expression in the third degree (sales in 1993 to the powers one, two and three).

Since the majority of variables do not significantly contribute to explaining the degree of restructuring, we increased the number of degrees of freedom by omitting some of them. In the following regression, we employ only variables with higher correlation coefficients (with respect to RES) and with higher t-statistic values. The remaining seven explanatory variables are the size (SALES) and the dummies for the foreign major owner (FORIN), direct domestic major owner (DOMIN), state as the major owner (STATE), the non-identified major owner (OTHER), the wooden goods industry (WOOD) and pulp, the paper and publishing industry (PAPER). The results of the regression are summarized in Table 17.

Table 17: *The impact of the firm's characteristics on the degree of restructuring – results of regression*

Dependent Variable...	RES		
Multiple R	.37948		
R Squared	.14400		
Adjusted R Squared	.11051		
Standard Error	10.29872		
Variable	Estimated coefficient	T	Sig T
(Constant)	29.673087	28.736	.0000
SALES	.004822	2.751	.0064
SALES ²	-3.24136E-07	-1.320	.1880
SALES ³	5.496659E-12	.940	.3480
FORIN	5.985100	2.119	.0352
DOMIN	6.244167	2.371	.0186
STATE	-4.220839	-2.416	.0165
OTHER	-2.616360	-1.267	.2064
WOOD	-1.491606	-.596	.5518
PAPER	-7.629954	-1.776	.0770

Although the explanatory power of the regression is not very high (the adjusted R-squared is 0.11), we are able to draw some conclusions.¹¹ The extremely high t-statistic for the constant suggests a concentration around the overall degree of restructuring. Note that the value of the constant is very close to the mean and the median of the distribution of RES. The size, after applying the nonlinear form, is now one of the most determining variables. Concerning the rest of the explanatory variables, the strong, positive impact of domestic and foreign owners in restructuring should be stressed. Firms still owned by the state restructured less than others.

¹¹ There are well known arguments against mechanical evaluation of goodness of fit on the basis of R^2 , without testing for omitted variables, wrong functional form, etc. As Kenedy (92) says "A high R^2 is not necessary for "good" estimates; R^2 could be low because of a high variance of the disturbance terms".

Since RES is a relative measure, the estimated value of the positive impact of the private owner (about 6 points for DOMIN and FORIN) does not impart much information. Therefore, we added the estimated coefficients to the median separately for STATE, DOMIN and FORIN. Then we found the corresponding position in the distribution of RES.

For the median, it holds that 50% of the firms restructured more and the same proportion restructured less. Where the state was the major owner, 66% of the firms restructured more. When the majority owner is a direct domestic or foreign one, there are only 30% of firms which restructured more. Since the t-statistics for all three dummies (STATE, DOMIN, FORIN) are highly significant, and the shift of the firm's position in the distribution of RES is substantial, we proved a distinct effect of ownership on restructuring.

Despite the extremely high significance of the constant and the acceptable significance of some ownership dummies, we have not found any notable effect of the industry on restructuring. Because of the introduction of size through the polynomial expression of the third degree, we cannot say that small firms restructure more or less than large ones do.

An alternative interpretation of the regression results is possible. Once we assume that we have not omitted any relevant explanatory variables, that we chose the appropriate functional form and that our regression satisfies all other standard assumptions, the dominant role of the constant then implies that the degree of restructuring does not depend crucially on the characteristics of firms.

5. Conclusions

The general progress in restructuring is high between 1991 and 1993. We can conclude that, compared with state enterprises, private enterprise restructure more, especially if they have a clearly defined and concentrated ownership. Private enterprises have a higher productivity and profitability; they have on average lower inventories, but a higher credit burden which increases with time. A more intensive investment activity of private firms suggests more intensive restructuring. Additionally, the analysis shows that, among the private firms, those privatized by the coupon method are less innovative and pay less attention to quality.

Focusing on the differences between industries, we obtained reached the following results:

The market share decreased significantly for enterprises in wooden goods,

decreased for those in textiles and clothing, metal products, and machinery and instruments. An increase in market share of firms was recorded in pulp, paper and publishing, and means of transport, and a significant increase in food and beverages, and rubber and plastic materials.

Concerning the effect of size, larger enterprises were more likely to improve training activities and replace managers. They are more export-oriented and one of their main barriers is the foreign trade restrictions.

This work can be used as a starting point for more detailed analysis of particular aspects of restructuring and for testing theoretical models and hypotheses. Furthermore, some issues such as competition and barriers to growth and entry may be included to broaden the analysis.

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APPENDIX 1 – Questionnaire

The questionnaire of Národohospodářský ústav České akademie věd
"Restructuralization of the Czech economy"

If you prefer to answer anonymously, do not fulfil name, address, tel. no.

Name of firm _____

Name and position of person completing the questionnaire _____

Address of firm _____

Tel./fax _____

If you decided to include your address, please mark one or two possibilities:

1. please send me results of the project
2. I agree with a visit of a person from NHÚ for deeper analyses of restructuralization of our firm

The following questions have to enable us to identify changes which relate to the restructuralization of your firm in the period of 1991–1993.

1. How was your organization structure changed? (Mark one or two possibilities.)

- 1. original firm was divided into the new firms
- 2. relations changed, but original organization units remained the same
- 3. firm merged with other firm
- 4. no changes happened

2. How was the organization of production changed? (Mark one to three possibilities.)

- 1. significant change in organization structure of firm
- 2. rationalization of production
- 3. improvement in marketing, distribution network was created
- 4. changes in basic phase of production
- 5. some changes
- 6. no changes

3. How was the quality control changed?

- 1. completely new approach
- 2. more serious attempt
- 3. some small changes
- 4. no changes

4. How was the training of employees changed?

- 1. no change
- 2. rise of intensity and quality
- 3. small change
- 4. reduction of training activities

5. The change in management after the privatization or after the year 1989?

- 1. total replacement of managers
- 2. replacement of a majority of managers
- 3. small changes
- 4. no changes

6. How was the production program changed? (total number of goods produced = 100%)
1. completely different products from before%
 2. innovated products in the original branch%
 3. the same products as before%

7. For how many percent have the sales changed (use +/- and write a change in percent).
- | | | | |
|------------------|--------|-----------------------------------|--------|
| 1. Czech market |% | 4. other countries of old COMECON |% |
| 2. Slovak market |% | 5. developed countries |% |
| 3. Russia |% | 6. third world countries |% |

8. The change in market share of your firm
- | | |
|---|--|
| <input type="checkbox"/> 1. significant decrease | <input type="checkbox"/> 4. increase |
| <input type="checkbox"/> 2. decrease | <input type="checkbox"/> 5. significant increase |
| <input type="checkbox"/> 3. no significant change | <input type="checkbox"/> 6. for some product increase/decrease |

9. How did the competitiveness of your markets change?
- | | |
|---|--|
| <input type="checkbox"/> 1. a significant rise of competition | <input type="checkbox"/> 4. decline of competitiveness |
| <input type="checkbox"/> 2. rise of competitiveness | <input type="checkbox"/> 5. significant decline of competitiveness |
| <input type="checkbox"/> 3. no change | |

10. If the competitiveness of your markets changed, what was your reaction?

11. Who are your main competitors?
- | | |
|---|---|
| <input type="checkbox"/> 1. small private firms | <input type="checkbox"/> 5. foreign firms based in the ČR |
| <input type="checkbox"/> 2. large private firms | <input type="checkbox"/> 6. foreign firms importing to the ČR |
| <input type="checkbox"/> 3. state-owned firms | <input type="checkbox"/> 7. we do not feel any competition |
| <input type="checkbox"/> 4. cooperatives | |

12. What were the biggest problems of the last three years? (Mark one to three the most important.)
- | | |
|---|---|
| <input type="checkbox"/> 1. existing legislation | <input type="checkbox"/> 8. high interest rates |
| <input type="checkbox"/> 2. low demand | <input type="checkbox"/> 9. uncertain environment |
| <input type="checkbox"/> 3. barriers in the foreign trade | <input type="checkbox"/> 10. unpaid receipts |
| <input type="checkbox"/> 4. technology and know-how | <input type="checkbox"/> 11. high taxation |
| <input type="checkbox"/> 5. obtaining credit | <input type="checkbox"/> 12. domestic and foreign competition |
| <input type="checkbox"/> 6. problems with employees | <input type="checkbox"/> 13. other (please, specify) |
| <input type="checkbox"/> 7. wage regulation | |

The following questions will help us to categorize your firm:

13. Industry
- | | |
|--|---|
| <input type="checkbox"/> 1. food processing | <input type="checkbox"/> 8. rubber and plastic products |
| <input type="checkbox"/> 2. textile and clothing | <input type="checkbox"/> 9. aggregates and ceramics |
| <input type="checkbox"/> 3. leather production | <input type="checkbox"/> 10. metal products |
| <input type="checkbox"/> 4. wooden goods production | <input type="checkbox"/> 11. machineries and instruments |
| <input type="checkbox"/> 5. pulp, paper and publishing | <input type="checkbox"/> 12. electrical and optic devices |

- 6. production of fuel
- 7. chemicals and fibers
- 13. means of transport
- 14. other (please, specify)

14. Legal form

- 1. joint stock company
- 2. Ltd
- 3. cooperative
- 4. state enterprise
- 5. other

15. Structure of owners

- | | | | |
|-----------------------------------|--------|------------------------|--------|
| 1. Fund of National Property |% | 7. restituent |% |
| 2. other state body |% | 8. municipalities |% |
| 3. investment privatization funds |% | 9. foreign investors |% |
| 4. ind. investors from vouch. pr. |% | 10. domestic investors |% |
| 5. managers |% | 11. other |% |
| 6. employees |% | | |

16. Year of privatization of your firm (resp. future privatization)?

- will not be privatized

17. Privatization methods applied (resp. likely to be applied) on your firm (when combination of methods please mark them and write percents for each.)

- | | | | |
|---|--------|---|--------|
| <input type="checkbox"/> 1. new private firm |% | <input type="checkbox"/> 5. direct sale |% |
| <input type="checkbox"/> 2. voucher privatization |% | <input type="checkbox"/> 6. restitution |% |
| <input type="checkbox"/> 3. auction |% | <input type="checkbox"/> 7. other |% |
| <input type="checkbox"/> 4. tender |% | | |

18. When privatized, where there made any restructuralization commitments (same employment level, future investments, compensation of old debts, environmental improvement)?

- 1. no
- 2. yes. In this case, please specify:

.....

19. (If you do not have data for year 1993, please estimate.)

	<u>1991</u>	<u>1993</u>
1. Number of employees
2. of which workers (%)
3. Sales (thousands Kč)
4. of which export (%)
5. Average wage
6. Inventories (thousands Kč)
7. Total credits (million Kč)
8. Equity (million Kč)
9. Profit (loss)

20. Total investment in million Kč, made in years 1991 – 1993?

21. Investment was financed by

- 1. cash flow%
- 2. credits%
- 3. equity%

22) The investment was directed to (in % of total investment)?

- 1. environment% 4. computerization%
- 2. technology and machinery% 5. other (please specify)%
- 3. training of employees%

The last block of questions is about your expectations for years 1994–1995.

23. How do you estimate the performance of your firm in 1995? (Mark one answer.)

- 1. development of firm
- 2. small change
- 3. reduction of production
- 4. bankruptcy (in this case go to question 29)

24. Number of employees will

- 1. decrease
- 2. remain the same
- 3. rise

25. Production of your firm will

- 1. decrease
- 2. remain the same
- 3. rise

26. The firm will be oriented on (mark one to two answers):

- 1. luxury goods
- 2. middle series
- 3. large series
- 4. mainly domestic market
- 5. mainly foreign market

27. The investment of the firm will

- 1. decrease
- 2. remain the same
- 3. increase
- 4. significantly increase

28. The investment will be directed to (sum of all investment = 100%):

- 1. environment% 4. computerization%
- 2. technology and machinery% 5. other (please specify)%
- 3. training of employees%

29. What are the main barriers for entering a market with a **new product**? (Mark one to three most important.)

- 1. existing legislation
- 2. low demand
- 3. barriers for foreign trade
- 4. obtaining technology and know-how
- 5. obtaining credit
- 6. problems with employees
- 7. wage regulation
- 8. lack of qualified managers
- 9. uncertain environment
- 10. lack of skilled labour capital
- 11. high taxation
- 12. domestic and foreign competition
- 13. infrastructure (telecommunications)
- 14. other (please specify)

APPENDIX 2 – Factor and cluster analyses

Figure A1 shows a very strong relationship between answers: no change of market share and no competition pressure. All the other answers are rather less interdependent (the rescaled distance is rather higher when they merge).

On the right hand side of the dendrogram we see what the appropriate number of representative variables is. On the rescaled distance of about 20 there are six clusters, on about 21 five clusters, on about 22 four clusters and on about 23 two clusters. Merging directly from four to two clusters can be interpreted as the fact that the same information is held by three clusters as by two clusters. Therefore, extracting three representative variables instead of two is pointless.

The largest jump in distances occurs in the case of two clusters (from 23 to 25). We extract, by the method of principal components, two, four and five factors (but not three). Both four and five factors are difficult to interpret, so we are left with the case of two factors (Table A1). The first factor is based on two variables: an increase in competition and not huge rise of competition. It is natural to call it "increase in competition, but not huge." The three variables that contribute most to the third factor are: no change in competition, no competition at all and no decrease in market share. We abbreviate it as "no competition".

Figure A1: *Dendrogram for competitiveness of firm's environment*

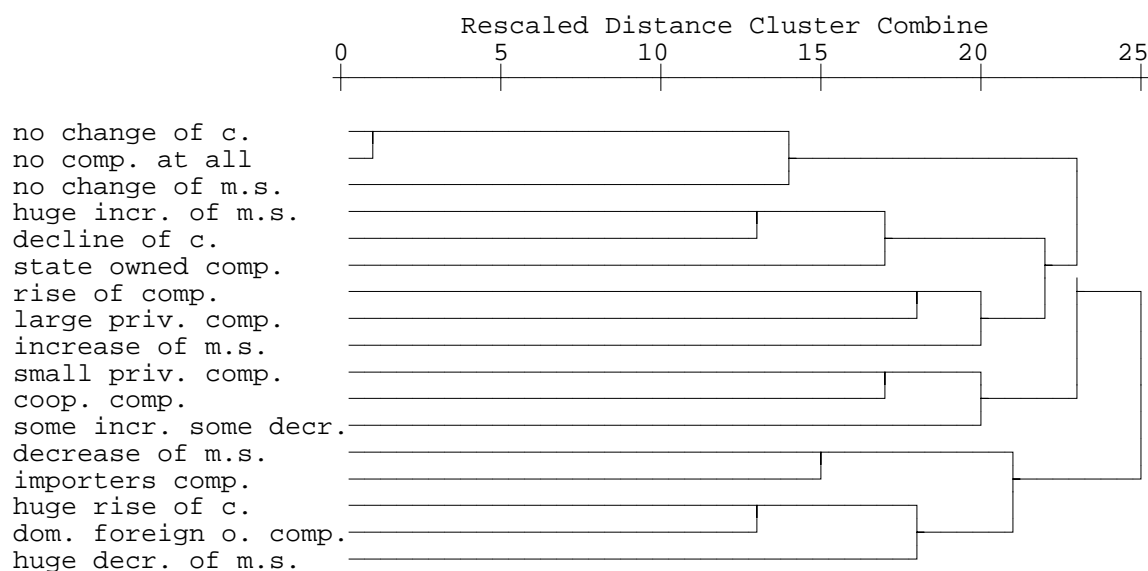


Table A1: Factor extraction for competitiveness of firm's environment

	Factor 1	Factor 2
	Rise (moderate) in competition	No competition
huge rise in competition	-,90807	-,13505
rise in competition	,85043	-,33077
domestic/foreign-owned company	-,34493	-,04506
importers company	-,33823	-,14893
huge decrease in market share	-,31099	,12613
some incr., some decr.	-,14264	-,07584
cooperative company	,07331	,05070
state-owned company	,07241	,00923
no change of competition	,17822	,76970
no competition at all	,16781	,66627
decrease in market share	,08711	-,51344
no change of market share	,25255	,43892
small private company	,14003	-,22721
huge increase in market share	,08837	,18332
large private company	,14241	-,16035
decline of competition	,04297	,12790
increase in market share	,00096	-,00624

The dendrogram (Figure A2) shows a strong relationship between restitution and the share of restituted property in the firm's property, other (unlisted) method of privatization and employee ownership, and voucher privatization and share of privatization funds and individual voucher investors in the firm's property respectively. The appropriate number of representative variables is either 2, 5 or 7, but surely not 3, 4 or 6. Extraction of only two factors would lead to oversimplification, while seven factors for seven alternative methods (we asked only about seven methods of privatization in our questionnaire) would not lead to any simplification of the analysis. So, we extracted 5 factors (Table A2).

The first factor clearly represents "voucher privatization." The variables contributing most are voucher privatization as the method, and privatization funds and individual voucher investors as owners. The second factor stands for "restitution". The third one is based on other (unlisted) privatization methods and employee ownership. The privatization method belonging here is mostly transformation of cooperatives. A minor part is represented by free transfers to central restitution fund, etc.. This factor we call "cooperative transformation". The fourth factor represents "new private firms" recently established. It is formed from the answer: newly established firm, which is an alternative option to the privatization method. All newly established firms in our sample are private. The second most important variable is the proportion of state ownership. This variable contributes with a negative sign to the factor formation, therefore the interpretation is: no (or extremely low) state ownership in the firm. The last factor stands for "sale to domestic owner". The variables most contributing are direct domestic ownership, and the methods of privatization are auctions and direct sales.

Figure A2: *Dendrogram for privatization methods and ownership structure*

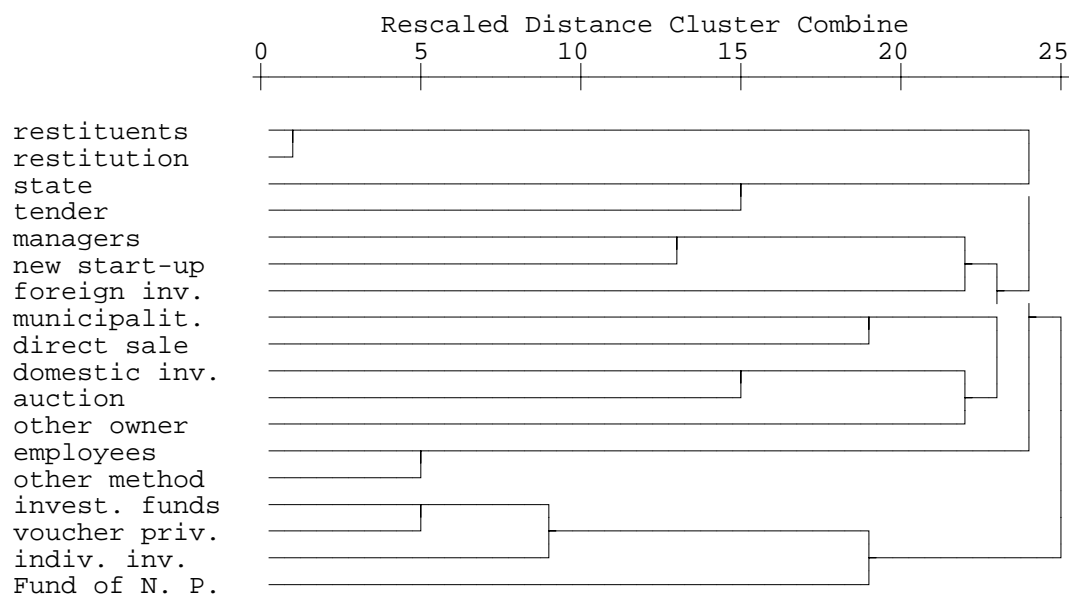


Table A2: Factor extraction for privatization methods and ownership structure

	Factor 1 (voucher pr.)	Factor 2 (restitution)	Factor 3 (coop. trans.)	Factor 4 (new private)	Factor 5 (sale to dom.)
Voucher priv.	,92090	-,07487	-,10728	-,06172	-,13011
Invest. funds	,78556	-,04692	-,10141	,06363	-,16144
Indiv. inv.	,71019	-,06292	-,07234	,08334	-,11628
Managers	-,50710	-,17560	-,38136	,35208	-,29888
Restitution	-,08890	,96260	-,04968	-,04218	-,06909
Restituents	-,07064	,96218	-,03983	-,00327	-,06352
Other method	-,09332	-,03825	,91791	,00007	-,03192
Employees	-,16780	-,07830	,86654	,03097	-,15861
New start-up	-,31534	-,14389	-,15047	,70710	-,30732
State	-,24750	-,09734	-,11031	-,60624	-,14895
Tender	-,27406	-,15278	-,15606	-,47895	-,43040
Foreign inv.	-,00740	-,06088	-,03174	,34378	,08436
Fund of N. P.	,33445	-,06735	-,08814	-,34339	,00710
Domestic inv.	-,10036	-,06568	,08195	,12348	,65593
Direct sale	-,31783	-,13431	-,27573	-,23768	,49123
Auction	-,05590	-,01693	-,02081	,12111	,48801
Other owner	-,10510	,00526	-,00454	,02321	,22368
Municipality	,04371	-,01288	-,07565	-,03915	,19424

The cluster analysis for the firm's past internal development results in the choice of either 4 or 5 representative variables. The factor analysis fails for 5 factors, but it is quite good in the case of 4 factors, which we call "human resources development", "organizational change", "credit financed innovation" and "internal stability."

Table A3: Factor extraction for firms' past internal development

	Factor 1 (human res. development)	Factor 2 (organizational change)	Factor 3 (credit fin. innovations)	Factor 4 (internal stability)
More training	,70307	-,05112	,06251	-,03984
Training unchanged	-,66513	,04098	,00613	-,26650
More new managers	,53829	-,23788	-,06236	-,15209
New quality control	,48177	,33488	,03690	-,02590
Some new managers	-,46992	-,29935	-,03223	-,12750
Inv. in training	,34929	,05626	-,03411	-,04847
Small ch. in pr. or.	-,34516	-,31736	-,02085	,08571
Small change in q. c.	-,33154	,11871	-,06804	,31677
Impr. of marketing	,30965	-,07252	,04171	-,22897
Rationalization	,27973	-,02623	,12952	-,13198
New management	-,11536	,59972	,12532	,00010
Former firm divided	-,15184	,57364	,11051	-,32210
Inv. in machines	-,06688	-,53938	,24729	-,36519
New org. structure	,34641	,47564	-,08117	-,20667
More qual. control	-,15249	-,41376	,07909	-,20354
Some org. changes	,34405	-,35109	-,28358	-,12762
Other investment	-,08293	,32960	-,05238	-,03455
Inv. in ecology	,09276	,29359	-,25313	-,15651
Inv. from cash-flow	,01191	-,22241	-,79069	-,06133
Inv. from credits	,01693	,24972	,67733	,10892
Old products	-,22384	,02317	-,61122	-,06043
New products	,14625	-,05032	,42680	-,06954
New prepar. of pr.	-,11638	-,01817	,33893	-,15061
Inv. from equity i.	-,05257	-,02134	,29719	-,07689
Innovated products	,11131	,02513	,27537	,14361

	Factor 1 (human res. development)	Factor 2 (organizational change)	Factor 3 (credit fin. innovations)	Factor 4 (internal stability)
Reduction in training	,03533	,06314	-,27359	-,04056
Inv. in computers	,07476	,12709	-,24400	-,08196
Old quality control	-,10718	,11004	-,18953	,00924
Merged firms	,09903	,10901	,13298	-,09842
Old org. of prod.	-,04329	-,09262	,01308	,64409
Inv. in buildings	,00520	,20761	,03905	,60902
Old management	-,07401	-,09493	-,04833	,56239
Old org. structure	-,15188	-,37000	,12734	,55007

The factorization of the main past barriers is the best in the case of 3 factors, where the first one combines "competition, uncertainty, know-how", the second is "demand, no taxes, no interests", and the third is "employees, legislation." See table A4, overleaf.

Table A4: Factor extraction for main firm's barriers

	Factor1	Factor 2	Factor 3
	(competition uncertainty know-how)	(demand, no taxes, no interests)	(employees legislation)
Competition	,63455	,10299	-,09600
Uncertainty	,61889	-,20969	,00416
Know-how	,54913	,01955	,00534
Access to cred.	-,28470	-,15366	,02626
Low demand	-,08392	,62875	-,41660
High taxes	-,27140	-,61378	-,28571
High interest	-,31263	-,50950	-,16000
Unpaid receipts	,01369	,42504	,10134
Trade barriers	-,22648	,40646	-,18416
Employees	,09584	-,08795	,62750
Legislation	-,30385	-,03394	,56036
Wage regulation	-,16158	,16690	,43538
Others	-,04046	-,04286	-,27850

It is obvious that sales play a unique role in the group of answers about economic indicators, because they are used to normalize other variables. In such a case, it is useful to exclude sales from the rest of economic indicators and use sales separately. The most appropriate number of representative variables for the rest of the economic indicators is 4, with the following meanings: "increase in size", "large labor input, low wage", "large capital input, low profitability", and "change in exports and profits".

Table A5: Factor extraction for economic indicators

	Factor 1 (rise of size)	Factor 2 (large lab. input low wage)	Factor 3 (large cap. input low profitab.)	Factor 4 (change of exports and profits)
Ch. of workers	.92726	-.00286	-.19703	-.04554
Ch. of employment	.92550	.02199	-.16122	-.05439
Ch. of sales	.86510	-.15126	-.14437	-.01809
Ch. of credits	.56827	-.24962	.36566	.20851
Rel. workers	-.00873	.84852	.16467	.13298
Rel. employment	-.15966	.83631	.26226	.13144
Wages	.03895	-.81650	.07238	-.06274
Ch. of wages	.25236	-.49560	.04467	-.42870
Ch. of stocks	.03111	.30443	.02520	-.13099
Rel. credits	.00463	.01353	.76110	-.00295
Rel. stocks	-.22085	.29284	.72559	-.03062
Rel. profits	.14716	-.25997	-.67081	-.04269
Rel. equity	-.27628	.04691	.65104	.19390
Rel. investment	.21824	-.17556	.38409	-.01633
Ch. of profits	.01191	-.06323	-.03939	.69199
Ch. of exports	-.02480	.11302	-.00700	.58514
Export share	.02579	-.02075	.24479	.50226
Ch. of equity	-.14824	-.03403	-.00194	-.15397

The analysis of the expectations about the future leads to four factors: "no expansion, former position", "reduction", "export orientation" and "no investment in machinery, no mass production". Table A3: Factor extraction for firm's past internal development.

Table A6: Factor extraction for future expectations

	Factor 1 (no expansion, former position)	Factor 2 (reduction)	Factor 3 (export orientation)	Factor 4 (no inv. in machines, no mass prod.)
Expansion	-,83662	-,16891	,14564	-,07806
Former position	,82336	-,12946	-,12624	,00036
Former sales	,81649	,04259	-,03820	,00217
Higher sales	-,80497	-,30968	,06854	-,04739
Higher employment	-,58074	-,08844	,11176	-,05468
Former investment	,45202	,00868	,18226	-,01884
Higher investment	-,30122	-,27007	-,13420	,06996
Reduction	,11026	,78118	-,06307	,20656
Lower sales	,07118	,72766	-,08684	,12258
Lower employment	,21909	,57560	,10128	-,02830
Former employment	,40175	-,45043	-,21266	,08399
Middle size pr.	-,00092	-,34887	-,01583	,28231
Dom. market or.	,02949	-,02382	-,85316	,04102
Export orientat.	-,02607	,02154	,84744	,03052
Rather higher i.	-,19678	,09031	,34666	-,20705
Lower investment	,01944	,30804	-,32783	,09437
Small size prod.	,04931	,07801	,15818	,14611
Inv. in training	-,06671	-,09656	,14448	,11895
Inv. in machines	-,00270	-,11797	,05952	-,87002
Mass production	-,02199	,15755	-,15840	-,54663
Inv. in computers	-,03071	-,24070	,28631	,49698
Other investment	-,00898	,08547	-,24462	,38613
Inv. in ecology	,03848	,07448	-,05269	,31098
Inv. in buildings	,01996	,23377	-,11272	,30606

Table A7: Final correlation analysis for privatization methods

	voucher pr.	restitution	coop. trans.	new private	sale to dom.
Human sources development	-,0212	-,0892	-,0036	,0097	,0367
Organizational change	,0231	,0428	-,1304*	,1274*	,1215*
Credit financed innovations	-,1569**	,1299*	-,0034	,2581***	,0322
Internal stability	-,1588**	-,0043	-,0440	,1695**	,0164
Rise in comp., but not huge	,0666	,0349	-,0958	,0477	-,0422
No competition	-,1171*	,0059	-,0090	,0908	,0017
Competition unc., know-how	,0716	-,1010	-,0345	-,1745***	-,0154
Demand, not tax., not int.	,1628**	,1155*	,1185*	-,2141***	-,0046
Employees, legislation	-,0449	,0780	,1098*	,0079	,0858
Increase in size	-,2215**	,1875*	-,1242	,2075**	,1115
Large labor i., low wage	-,2335**	,0599	,3455***	-,2001**	-,0518
Large capital i., low prof.	,0524	,0929	-,0147	-,0048	,1549
Change of ex. and profits	,0680	,1394	-,0079	,1213	,1310
Sales	,0630	-,0459	-,0453	-,1105*	-,0752
Not expansion former posit.	,0840	,1311*	,0522	-,1252*	-,0959
Reduction	,0089	-,0665	,0102	-,0445	-,0216
Export orientation	,0016	,0071	-,0374	,0026	,0844
Not in. to m., not mass prod.	-,1846***	-,1036	,1079	,0416	-,1211*

Where stars indicate significance: * = 0.1, ** = 0.5, *** = 0.01 (All variables in the matrix are factors except sales).

APPENDIX 3 – Construction algorithm of RES

Positive answer to the question (or positive number)	Added points
Percentage share of new products on output	0.1 * the number
Completely new approach to quality control	10
Improvement in marketing and creation of distributional network	10
Original firm was divided into new firms	6.6
Firm merged with other firm	6.6
There was a significant change in the organizational structure of the firm	6.6
Percentage share of innovated products on output	0.066 * the num.
Organization of production was improved	3.3
Changes in the basic phase of production	3.3
Intensity and quality of training increased rapidly	3.3
Managers were completely replaced	3.3
Majority of managers was replaced	2.2
Intensity and quality of training increased slightly	1.65
Some managers were replaced	1.1
Training activities were reduced	-3.3
Quality control was not intensified	-6.6
There were no changes in organization structure and production and marketing	-10

Note: the considered time horizon is the last three years.

At the end we added the points for the effect of change in the number of employees. First we computed the change as $CHANGE = 1 - \frac{\text{MIN}(\text{employees in 1991}, \text{employees in 1993})}{\text{MAX}(\text{employees in 1991}, \text{employees in 1993})}$. For better understanding we list some values of it: $CHANGE = 0$ for the same number of employees in 1991 and 1993, $CHANGE = 0.5$ for doubling or reducing to one half of the number of employees, $CHANGE = 0.9$ for ten times increase or ten times decrease of the number of employees.

Since it is rather more important to double or reduce to one half the number of employees for large firms than for small ones, we reflect this by computing the points as: $CHANGE * COEFFICIENT$, where $COEFFICIENT$ is 3.3 for firms with up to 25 employees, 4.4 up to 100 employees, 5.5 up to 1000 employees and 6.6 for larger.