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**Growth and Performance Factors in Polish Manufacturing
Firms in 1998-2003 in the Light of Survey Data**

Warsaw, June 2006



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Contents

1. Introduction	6
2. About the survey	6
3. Analysis of employment growth rates and its factors	7
3.1. Changes in employment between 1998 and 2003	7
3.2. Statistical analysis of growth factors.	8
2.2.1. Changes in employment vs. competitiveness	8
2.2.2. Employment changes vs. changes in domestic demand	10
2.2.3. Changes in employment vs. technology	10
2.2.4. Employment changes vs. changes in ownership.	12
4. Early privatisation and foreign ownership and performance factors of the surveyed enterprises	13
5. Conclusions	14
Annex	16
References	17

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Abstract

We investigate possible factors of change in employment between 1998 and 2003 in 220 companies from four industries of Polish manufacturing (food, electronics, automotive and pharmaceuticals), that were subject to an enterprise survey. We also seek to explain the differences in performance among companies. We find that firms that were more competitive and more innovative laid off relatively less workers. Ownership status and history seem to be relevant factors too, as companies that were started as private businesses slightly increased employment, while the state-owned enterprises experienced proportionally the largest employment cuts; as for privatized companies, those taken over earlier performed better in terms of employment than those privatized later. However, econometric analysis of premia of early privatization and foreign ownership showed that only the latter factor played a significantly positive role for companies' revenues, productivity, profitability and the level of wages.



1. Introduction

In this paper we use the data from a survey of about 200 manufacturing firms to investigate the determinants of their growth and performance. In particular we examine the role of two institutional factors: privatization and foreign ownership.

The study consists of two principal parts. In the first one, we follow up on our earlier work on the factors of structural change (Marczewski, Szczygielski 2006). In that paper we examined changes in employment and value added of Polish manufacturing branches (as defined by the 3-digit level of NACE classification) between 1995 and 2003 and we looked at possible factors of observed developments such as changes in demand, competitive performance, competitive effort and institutional factors. In the present study we examine the same relationships on the enterprise level (instead of industry level), and we add new dimensions that could not have been analysed on a more aggregate level such as changes in technology and product innovation.

Secondly, since our analyses of structural changes has indicated a profound role of early privatization and foreign ownership, we take a closer look at these two factors and we check whether they co-determined the performance of firms as measured by profitability, productivity, skilled labour share and other indicators.

In terms of the paper structure, we start by discussing our data set (section 1). Then we present the two parts of the study outlined above (sections 2 and 3) and finally we formulate the conclusions (section 4).

2. About the survey

We use data from the enterprise survey realised by the research team of Richard Woodward for their analysis of networks in four branches of Polish manufacturing: food and beverages, automotive, electronics and pharmaceuticals (Woodward 2005). Although our focus was completely different than Woodward's, we managed to extract data relevant for our study. In particular the fact that companies were asked after a number of basic data including different kinds of staff at two points of time, in 1998 and 2003, enabled us to analyze their employment growth and changes in performance.

The sample of companies covered by the research was characterised in details by Woodward et al. (2005). While in the part on performance factors we analysed from 143 to 220 firms (depending on the data availability)¹, in the part on employment growth we had to limit ourselves to 165 cases, because we had to narrow down our pool to the companies that provided data on their employment both for 1998 and 2003. In particular, we had to exclude companies that did specify their employment for both points of time, but the starting point was not 1998, but 1999 or even 2001. This was because in 1998-1999 Polish labour market experienced a shock following a breakdown of export to Russia and the CIS countries. We found it crucial to start the analysis from 1998 given that "(...) in the course of 1999 employment fell by almost 700 000 persons, reducing employment rate by about 4 percentage points to 54.9% and raising unemployment rate by more than a half to 16.4%" (Bukowski 2005).

¹ Original sample consisted of 227 but we excluded seven cases which showed extreme values and thus they must have been either inaccurate or some exceptional stories.

3. Analysis of employment growth rates and its factors

3.1. Changes in employment between 1998 and 2003

Our sample consisted of 165 companies: 98 from the food and beverages industry, 23 from the automotive industry, 30 electronic companies and 14 pharmaceutical ones. In terms of employment proportions between the industries the sample was not representative. Table 1 compares the percentages in the survey with the ones taken from the industry statistics² (F-01). We ascribe the following NACE codes to the industries: food and beverages – 15, automotive industry – 34, electronics – 32, pharmaceuticals – 244. Apparently, food industry was underrepresented in the survey to the advantage of the remaining industries.

Table 1. Comparison of data on employment in the four industries according to the survey and to the industry statistics

Industry	Survey 1998	Industry statistics 1998	Survey 2003	Industry statistics 2003
Food	38,02%	71,45%	39,11%	71,47%
Automotive	35,71%	17,68%	30,72%	18,13%
Electronic	18,63%	6,14%	19,76%	5,01%
Pharmaceutical	7,63%	4,74%	10,41%	5,39%
Total	100,00%	100,00%	100,00%	100,00%

Source: Own calculations based on the survey and on the F-01 statistics of GUS

Between 1998 and 2003 employment in the four branches under consideration fell by 16.87%, according to the industry statistics. The decline in the firms covered by the survey was even bigger and reached 37.91% (Table 2). The only exception is the electronic industry, which developed similarly according to both sources.

Calculating changes in total industry employment is equivalent with calculating weighted average of changes in employment in individual companies, with companies' shares in employment as weights. By implication, unweighted means being much better than weighted means suggests that it was mainly the bigger companies in the sample that made workers redundant.

Table 2. Employment growth rates of the surveyed companies and industry-wide 1998-2003

Industry	Average weighted by employment in firms (or change in total industry employment)		Unweighted average (survey)	Median (survey)
	Industry statistics	Survey		
Food	-16,84%	-36,14%	-3,84%	-16,03%
Automotive	-14,75%	-46,58%	-7,69%	-25,13%
Electronic	-32,20%	-34,15%	-10,79%	-35,10%
Pharmaceutical	-5,31%	-15,27%	0,54%	-8,58%
TOTAL	-16,87%	-37,91%	-5,27%	-16,92%

² It contains data on employment as for 31.12.2003, while respondents of the questionnaire were asked to specify employment for 31.03.2004. The difference of 3 months should not distort the picture. For brevity we use the dates 1998 and 2003 in the remainder of this paper.

3.2. Statistical analysis of growth factors

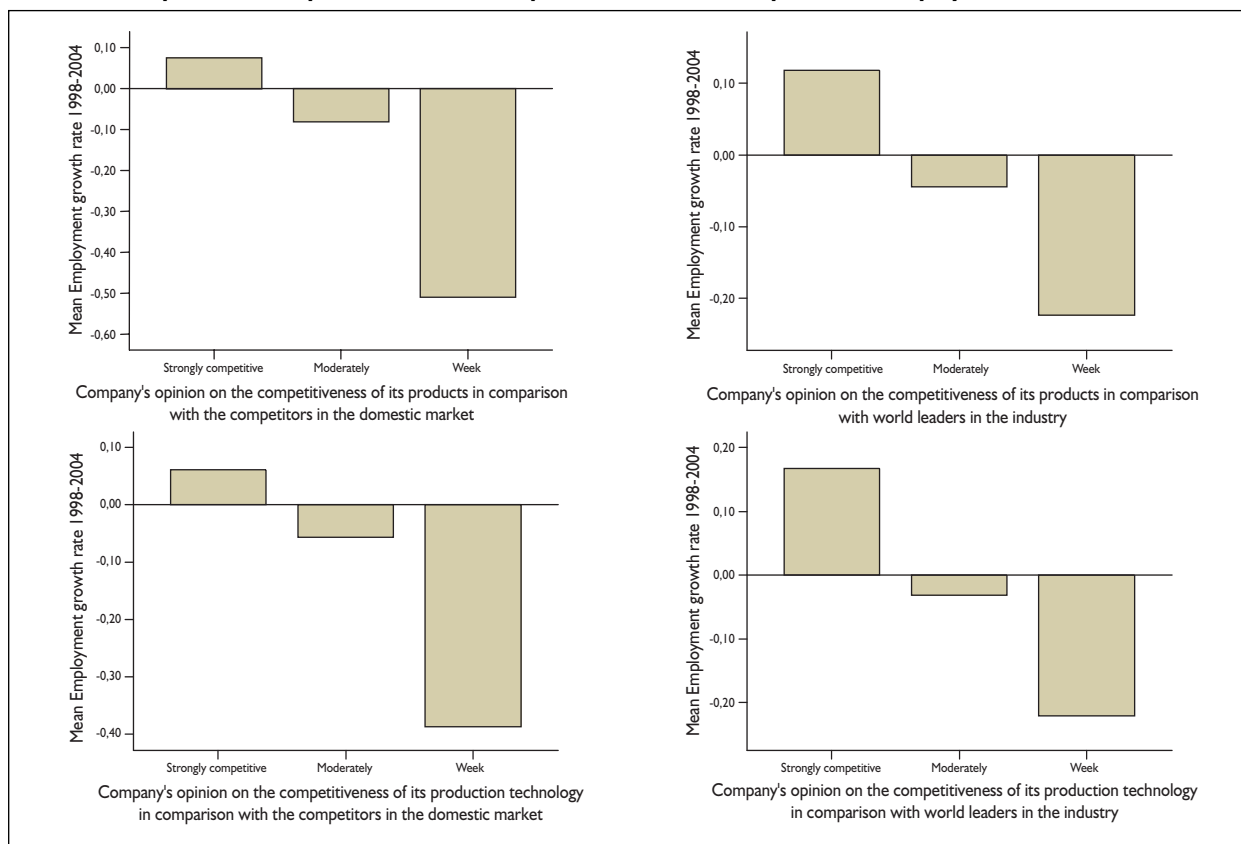
3.2.1. Changes in employment vs. competitiveness

The questionnaire made it possible to examine a company's competitiveness by several measures including its own opinion on its competitiveness, change in company's market share, innovativeness of company's products and technologies, and performance indicators based on the basic accounting data provided by each company³. In this subsection we focus on companies' own ratings and on the relative changes in market shares. We discuss the influence of innovations in the subsection on changes in technology.

a) Company's own opinion on its competitiveness

Companies were asked to rate the competitiveness of their products and technologies in a three-point scale, as compared to both domestic competitors and world leaders, which made in total four questions in the survey. Typically between 50 and 60 percent of companies described themselves as *moderately competitive*. The proportion between the number of firms that view themselves as *strongly competitive* and those which considered themselves *weak* depended on the specific question: in general more companies felt strong in comparison with domestic competitors than in comparison with world leaders and that applies both to products and technology.

Chart I. Companies' own opinions on their competitiveness vs. developments in employment



³ Woodward et al. (2005) performed a factor analysis to determine the relevant factors of competitiveness. However they did not consider the (relative or absolute) changes in market shares, while some of the variables they did identify we do not interpret as factors of competitiveness (e.g. market share in static terms). What is more, their analysis was based on the entire pool of 227 firms.

As one can see Chart 1 in companies that felt more competitive are the ones that grew more (or declined less) in terms of employment. That applies to all four questions. It should be stressed that this pattern is also reiterated when each of the four industries is analysed separately. Average decline in employment of the poorly competitive group is deeper when considering domestic competitors (left charts) than world leaders (right charts). This is because all companies that felt weak compared to the world leaders, felt inferior compared to domestic competitors too. By implication, the “weak” groups represented in the left charts were the weakest firms in the pool showing also the biggest declines in employment.

b) Market shares

In the study we used the relative growth in market shares, just as in our branch-level analysis (2005). It is the relative growth in market share that matters for the employment growth rate, not the absolute change in market share. Take a market that is stagnant: in that case growth in market share equals growth in sales. We would expect the relative growth in sales and not the absolute growth to influence directly relative growth of employment.

We calculated the relative growth in market share in two ways. First, we took the advantage of the fact that companies were asked to estimate their market shares in 1998 and 2003 by choosing one of ten intervals: “0-10%”, “10%-20%” etc; they could also indicate zero. We assumed the market share of each company to be in the middle of the chosen interval or zero respectively. This way we were able to calculate the relative growth of market share for 140 firms that indicated positive market shares in 1998.

Second method of calculating market shares consisted in merging the survey data on company’s domestic sales with the data on the domestic demand in the 3-digit or 2-digit sectors from the industrial statistics. The details of data merging is explained in Annex . Since not all the companies in the survey provided data on sales for both 1998 and 2003, there are less observation for this estimate of market share (104).

Both measures of the relative growth in market share are positively correlated with employment growth rates and the correlation is significant at the 1% level (Table 3). Correlation with the sales-based measure is particularly strong. Also the bivariate correlation between both measures is positive and significant.

Table 3. Changes in market shares vs. changes in employment

		Employment growth rate	Growth rate of market share (based on company's estimates)	Growth rate of market share (based on the sales data)
Employment growth rate	Pearson Correlation	1	,228(**)	,502(**)
	Sig. (2-tailed)		,007	,000
	N	165	140	104
Growth rate of market share (based on company's estimates)	Pearson Correlation	,228(**)	1	,282(**)
	Sig. (2-tailed)	,007		,007
	N	140	140	90
Growth rate of market share (based on the sales data)	Pearson Correlation	,502(**)	,282(**)	1
	Sig. (2-tailed)	,000	,007	
	N	104	90	104

** Correlation is significant at the 0.01 level (2-tailed).

We conclude our investigation into the relationship between market shares and employment changes by saying that the finding from the industry-level studies is confirmed on the enterprise level: companies that improved their competitive position relatively to other companies, showed better employment growth rates (which might have still been negative, though).

3.2.2. Employment changes vs. changes in domestic demand

To remain consistent with industry-level studies we should mention domestic demand as a factor of changes in relative employment. Unfortunately, the survey does not make it possible to observe changes in demand. By merging the data from industrial statistics with survey data (see Annex) we obtained an – undoubtedly imperfect – measure of changes in domestic demand in constant prices. Correlation between this measure and relative growth in employment for the 165 companies in the survey is positive, yet weak and insignificant.

3.2.3. Changes in employment vs. technology

Influence of technological changes on structural changes on the enterprise-level can be two-fold. On one hand technological progress makes companies more competitive, which should result in their relative growth as observed above. On the other hand, if as a result of changes in technology capital is substituted for labour, then such firms could actually shrink in terms of their shares in total manufacturing employment. In this section we seek to examine the two effects by investigating the relationship between the growth rate of company employment and: innovation and R&D activities, investment intensity and changes in the share of technical staff.

a) Innovations and R&D activities

Companies were asked after the percentage of revenue from products older no more than two years in 1998 and 2003 and the percentage of the revenue from the items produced with technology older no more than two years in the same periods of time. Both measures for both years are positively and significantly correlated with employment growth rate, and the current percent of revenue earned from the new products shows strongest correlation (Table 4.)

Table 4. Correlation between innovativeness and changes in employment

		Percentage of revenue from new products 1998	Percentage of revenue from new products 2003	Percentage of revenue from new technology 1998	Percentage of revenue from new technology 2003
Employment growth rate	Pearson Correlation	,294(**)	,393(**)	,338(**)	,347(**)
	Sig. (2-tailed)	,000	,000	,000	,000
	N	145	145	136	135

** Correlation is significant at the 0.01 level (2-tailed).

We strived to confirm this positive relationship by comparing the means of employment growth rates in two subpopulations of firms: those having an R&D unit and those without such a division (Table 5). The result is that the former do have on average a higher employment growth rate than the latter, however the difference is not statistically significant at the 5% level.

Table 5. R&D vs. changes in employment

Does company have a R&D unit	Employment growth rate		N
	Mean	Median	
Yes	1,45%	-10,94%	57
No	-8,81%	-18,08%	108
TOTAL	-5,27%	-16,92%	165

b) Investment efforts

While the positive relationship between innovativeness and employment growth rate could have been expected – because innovations enhance company’s competitiveness and we observed already that higher competitiveness was correlated with employment growth rates – the investment efforts of the companies could reflect the negative effect of technology on employment. That was why we checked if investments per person employed were negatively correlated with employment growth rates.

Since the four branches analysed in this study differ in their average capital intensity, for the investment-employment ratios we looked at the correlations within each industry separately. However the results are rather weak: only in the food industry we found a significant relationship between employment growth rate and investments per person employed in 1998, and this correlation was actually positive! It seems that in the food industry companies that were more capital-intensive in 1998 sacked relatively less people in the course of next five years. On the other hand, when we looked at the relationship between growth rate of investment per person employed and growth rate of employment we found all the correlations to be negative, yet only one of those was significant at the 5% level: the correlation for the pharmaceutical industry.

c) Technical staff

Results of the analysis of investment efforts being rather unsatisfactory, we turned to the data on changes in technical staff of the companies. We assumed the share technical workers in company’s employment at a given point of time to be an indicator of the technology-intensity of the production. This measure is sector- and firm size-sensitive, in particular smaller companies are more likely to show higher level of this indicator. Unfortunately the sample was not big enough to control for all these factors. On the other hand, we were interested in the growth rates of the technology-intensity and not in the absolute values and we could hope that growth rates were more comparable across different kinds of companies. Still, the results of the correlation analysis (Table 6) are to be interpreted with caution.

Table 6. Employment growth rates and different categories of staff

		Growth rate of technicians’ share in the staff	Growth rate of engineers’ share in the staff	Growth rate of R&D personnel share in the staff
Employment growth rate	Pearson Correlation	-,225(*)	-,233(*)	,308(*)
	Sig. (2-tailed)	,010	,015	,021
	N	129	109	56

* Correlation is significant at the 0.05 level (2-tailed).

The positive and significant correlation for the R&D personnel share does not come as a surprise in the view of previous findings. That the two other correlations are negative and significant, seems to reflect a change in technology that reduces companies’ employment growth rates.

Surely, in this particular context it probably means little more than that engineers and technicians were the last to sack⁴. Still, it might indicate a technological change within companies, but possibly not in the sense of technological progress, but in the sense of organisational changes that took a fuller account of the previously introduced technologies.

⁴ Arithmetically, growth rate of share of a particular category of workers in total staff is equivalent with comparing the growth rate of this category of staff with the growth rate of total employment.

3.2.4. Employment changes vs. changes in ownership

The industry level analysis presented in (Marczewski, Szczygielski 2006) proved that sectors entered early by foreign investors generally increased their share in employment in all the periods analysed in that paper (1995-2003, 1995-1998 and 1999-2003). When we look at the companies in our sample, the mean and median employment of growth rate in the companies who had foreign owners in 2003 was substantially lower than among the domestic owners (Table 7). However the number of foreign-owned companies is small and the difference is not statistically significant.

Table 7. Employment growth rate vs. foreign ownership

	Employment growth rate		N
	Mean	Median	
Domestic owner 2003	-3,33%	-16,19%	145
Foreign owner 2003	-19,32%	-30,47%	20
TOTAL	-5,27%	-16,92%	165

The survey made it possible to compare companies according to their ownership status and history. We divided the pool into four groups: state-owned firms, companies privatized in 1997 the latest (“early privatization”), companies privatized in 1998 or later, and finally firms that started as private businesses⁵.

We drew the border between “early” and “late” privatization at the year 1997 not least because firms taken over before or in this year had the same owner at both points of time for which data on employment were submitted (1998, 2003), so it was that owner who was fully responsible for company’s policy reflected in the survey. We could not assume this for firms taken over in 1998 or later (theoretically we could have drawn the border line at 1998, but we thought it was better to observe the policy of the new owner at least one year after the takeover).

The ownership questions – if the company was started as a private business, if not then if it was privatized, and if it was, then when – proved to have been factors significantly differentiating employment growth rates. This is demonstrated in Table 8. The differences between “neighbour categories” B-C and C-D are significant at the 10% level. The differences between A and C is significant at 5% and so is the B-D difference.

Table 8. Employment growth vs. ownership status and history

	Ownership status and history	Mean employment growth rate	N
A	State-owned firms	-45,32%	13
B	Privatized in 1998 or later	-39,76%	12
C	Privatized before 1998	-12,26%	32
D	Started as private businesses	5,46%	108
	TOTAL	-5,27%	165

It would be tempting to conclude that companies that had earlier undergone restructuring performed better in the period under research. However this hypothesis needs a more in-depth examination. This will be done in the next section.

⁵ This classification was based on firm’s current ownership status and on the dates of its founding or last takeover. Thus, it was based on some simplifying assumptions. The category of firms called “privatized in 1997 the latest” contained companies that were founded before 1988 and taken over before or in 1997 and they were not state-owned in 2003. On the other hand companies “privatized in 1998 or later” were those founded before 1988 and not state-owned in 2003, but they experienced their last change of owner in or after 1998. Firms founded in or after 1988 and not state-owned in 2003 were considered to have been “private businesses” all along.

4. Early privatisation and foreign ownership and performance factors of the surveyed enterprises

To investigate influence of privatisation process and foreign direct investment on performance of the surveyed firms we took into account several enterprise characteristics. They included both output and input measures. The output is represented by the value of the enterprise revenues (*Revenues*). Labour input is characterised by average wages (*Average wage*) and the skill intensity of labour, measured by the share of white collar workers in employment (*Skilled labour share*). The value of revenues produced by each employee is treated as a measure of the enterprise productivity (*Productivity*) and gross value added (GVA) per employee – as a measure of the enterprise profitability (*GVA Labour*). All monetary values are measured in Polish zlotys and converted to 1998 constant prices using appropriate deflators⁶.

To determine whether early privatisation or foreign ownership has a significant impact on the above-defined five enterprise characteristics we have to control for other potentially important factors like relative enterprise size, industry and time. In the analysis we follow the approach introduced by Bernard and Wagner (1997) in their analysis of differences between exporters and non-exporters (see also Ruane and Sutherland 2005). Exploiting firm-level data, the early privatisation or foreign ownership premia are estimated using the following forms of regression

$$\ln V_{it} = a_0 + b_1 \text{Early Privatisation}_{it} + b_2 \text{Size}_{it} + b_3 \text{Industry}_{it} + b_4 \text{Year}_t + 0_{it}$$

$$\ln V_{it} = c_0 + d_1 \text{Foreign Ownership}_{it} + d_2 \text{Size}_{it} + d_3 \text{Industry}_{it} + d_4 \text{Year}_t + 0_{it}$$

where V_{it} is the performance characteristic of firm i in the year t . We seek to determine whether there is a premium between the two kinds of firm under consideration (in the first analysis we distinguish between firms started as private businesses or privatised early on one hand, and state-owned companies or firms privatised later on the other; in the second analysis we distinguish between foreign owned firms and non-foreign owned firms). The premia are expressed by dummy variables: *Early Privatisation* and *Foreign Ownership* to reflect the status of the enterprise. The dummy variable *Size* takes value of one when the number of employees is above the median employment level, zero otherwise. *Industry* is a group of sectoral dummy variables⁷ and *Year* is a dummy, which takes value of one for 1998 and zero for 2003.

We started with an initial sample of 220 enterprises from which we selected five sub-samples forming for each of the examined enterprise characteristics an appropriate balanced panel. We used random-effects panel data GLS regression technique to estimate the two above equations separately for each of the enterprise characteristics. Tables 9 and 10 report the results.

We find that early privatisation is positively and significantly (at the 10% level, though) only for one of our measures of enterprise performance, after controlling for size, sector, time and enterprise-specific effects. On average early privatised firms generate higher gross value added per employee than non-early privatised or state-owned firms. However they do not differ significantly in terms of revenues⁸, productivity, average wage paid and share of skilled labour in total employment. Given our previous findings on employment changes we may argue

⁶ We used the Industrial Producer Price indices at the two or three-three-digit NACE level. See Annex for details.

⁷ With four manufacturing sectors distinguished three dummy variables were constructed.

⁸ In fact, while in 1998 the state-owned- and late-privatized category had on average higher revenues than the other group, this relation was reversed in 2003. Yet in both years the difference was statistically insignificant.

Table 9. Performance characteristics of early privatised firms vs. non-early privatised or state owned firms

	Revenues	Productivity	Average wage	Labour GVA	Skilled labour share
Early privatisation premium	-0.122 (0.255)	0.150 (0.210)	0.093 (0.169)	0.368* (0.193)	-0.001 (0.116)
Size	1.667*** (0.196)	0.291* (0.163)	0.356*** (0.128)	0.205 (0.148)	0.196** (0.082)
Observations	326	316	290	296	388
Enterprises	163	158	145	148	194
R ² overall	0.342	0.048	0.123	0.106	0.249
Chi2	101.16	8.63	22.29	20.37	72.70
Prob.>chi2	0.000	0,196	0,001	0.002	0.000

Note: ***, **, * statistically significant at the 1 and 5 or 10 per cent level respectively. Standard errors in parentheses.

that firms privatised later and state-owned firms achieved comparable productivity level to early privatised ones primarily due to their huge employment cuts.

Contrary to the above results we find a positive and significant premium of foreign ownership as regards the majority of enterprise performance measures (Table 10). It was not a case only in relation to a share of skilled labour in the enterprise employment.

Table 10. Performance characteristics of foreign-owned firms vs. domestic-owned firms

	Revenues	Productivity	Average wage	Labour GVA	Skilled labour share
Foreign ownership premium	1.311*** (0.218)	0.790*** (0.198)	0.652*** (0.154)	0.919*** (0.175)	-0.070 (0.111)
Size	1.640*** (0.170)	0.208 (0.150)	0.309*** (0.116)	0.078 (0.133)	0.203*** (0.078)
Observations	326	316	290	296	388
Enterprises	163	158	145	148	194
R ² overall	0.453	0.123	0.213	0.211	0.251
Chi2	157.65	24.83	42.53	47.09	73.24
Prob.>chi2	0.000	0,001	0,000	0,000	0.000

Note: ***, **, * statistically significant at the 1 and 5 or 10 per cent level respectively. Standard errors in parentheses.

It is worth to notice that foreign ownership was not necessarily a reason for the observed premia, as foreign investors could have been focused on acquiring firms with over-average performance characteristics. In that case, however, our analysis shows that foreign ownership was conducive to preserving the advantages of such companies.

5. Conclusions

In this paper we analysed the growth and performance factors of manufacturing companies from the automotive, electronic, pharmaceutical and food industry between 1998 and 2003, while taking advantage of the fact that the survey data from over 200 firms made it possible to examine factors usually not available from industry statistics. These included, in particular, data on the competitive performance, skill-intensity and technological level of the companies as well as institutional factors such as ownership (foreign or domestic) or

the moment of the last takeover. We showed that the change in employment was positively and significantly correlated with the competitive performance of the firms and with their innovativeness. Moreover companies that were taken over by the current owner in 1997 the latest experienced smaller cuts in employment than the ones which were taken over (i.e. probably privatized) later. Econometric analysis of premia on early privatization and foreign ownership showed that only the latter factor played a significant positive role. Foreign owned companies performed better in terms of their revenues, productivity and profitability and they paid higher wages than other firms. On the other hand, they had no advantage in terms of the share of skilled workers in employment.



Annex

Merging data from the company survey and from the industry statistics

In the questionnaire companies were asked after their NACE codes and, independently, ascribed to one of the four industries. When merging data on demand and on the prices and the survey data, we used the information the companies submitted with the exception of

- 1) Obvious mistakes (some companies pointed non-existing NACE codes);
- 2) Industries for which we lacked data (two cases)

In these cases, as well as in the case of companies that did not indicate their NACE codes, we used the data on demand or price index in the 2-digit industries, ascribing the following NACE codes to the industries: food and beverages – 15, automotive industry – 34, electronics – 32, pharmaceuticals – 244.

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