

Firm Growth in Advanced Stage of Transition: Evidence from Slovak Industry

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1. Introduction

The focus of this article is on the process of individual firm growth on the adjustment path during the transition from a centrally planned to a market based economy. The empirical analysis of firm behavior is based on data covering all medium and large industrial firms from Slovak industry during the period of 1993 to 1996. At the beginning of 1993 major macroeconomic and institutional reforms were in place.¹ Firms were facing a relatively standard competitive environment, the economic model of Slovakia was converging to the model of a small open economy. Firms were exposed to competition from the world markets. 1993 was the beginning of the existence of the independent state, implying a shift of the general focus of the reform program. From 1993 to 1996 about 30 % percent of state ownership shifted to private hands. The economy started to recover showing signs of economic growth and unemployment declined, all this despite a general slowdown in the reform process.

While the economic environment during the period of analysis was still influenced by the process of privatization and restructuring, a number of industrial firms already operated within new corporate and ownership structures facing fairly competitive conditions. The discussion in transitional literature proposes hypothesis on the role of characteristics such as a firm's initial size, ownership, corporate structure, in determining its potential to grow. It is often assumed that private companies grow faster or that large companies are more likely to survive in the business. Ad hoc ex-

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¹ In the preceding years from 1990 to 1993 major macroeconomic and institutional reforms took place establishing the essential mechanisms of market economy. Industry, traditionally oriented towards heavy industry, was hit seriously having lost traditional buyers as the markets of the old system of Comecon (Council of Mutual and Economic Assistance) disappeared. Privatization was launched and from 1990 to 1992 10 % percent of the economy shifted from private to the public sector. This period is often referred to as the initial period of transition. The events of economic and institutional reforms during the initial period of transition included e.g.: in 1990: price liberalization, establishment of two-tier banking system, in 1991: adoption of competition and bankruptcy laws, launch of small-scale privatization and first wave of large-scale privatization; 1992: new government introducing changes into the general concept of reform and privatization, second wave of large-scale privatizations, 1993: foundation of independent Slovak Republic.

amination of aggregate statistics, indeed suggests such patterns that are then easily assumed to hold and become generally accepted. It is important to provide conceptual framework to analyze the effects within the premises of current economic analysis and find out whether we may confirm the presence of such effects on the firm growth process. In what follows we propose a standard econometric analysis of the firm growth relationship with emphasis on the particularities of panel data, adjusting for survival effect and providing the appropriate framework to analyze the presence of ownership/corporate structure effects.

Firm growth is a widely addressed issue in the context of market structure literature. Both theoretical and empirical works have focused on the analysis of determinants of a firm's growth in order to understand the behavior of firms and consequently the resulting market structure.² The transition from centrally planned to a market economy is yet another setting for analysis of the firm growth process. The process of transition implies that firms are on the adjustment path as opposed to an equilibrium state and we are thus not observing an equilibrium distribution of firms. The empirical evidence on the firm growth process provides useful framework for understanding the growth behavior of firms restructuring to adjust to new, competitive environment.

The main issues to be addressed by the empirical analysis of firm growth determinants may be formulated along these issues. Do we observe any specific pattern of firm growth – firm size relationship? Are there systematic effects of firm characteristics on its performance in terms of growth, or otherwise stated in constituting a firm's demand for labor? In particular, what is the role of firm characteristics such as ownership and corporate governance? Finally, we are interested in the role of market structure, whether we can see that firms in highly concentrated sectors have more space to grow as suggested by market structure literature. We analyze separately the character of the firm turnover process and the impact this process has on the sample selection in the firm growth analysis.

The structure of the article is as follows. In the following section we discuss the character of data used for estimated relationship, together with a brief review of the current literature on the issue. We then present the main ideas of our model together with treatment of the most important econometric problems related to the estimation. In section III we discuss the results of the survival analysis, which is a complementary analysis to the main growth relationship. The survival model though carries important information on the character of the turnover process of firms engaging in privatization and restructuring. Finally, in section IV, we discuss the main results and assess the determinants of firm growth relationship.

2. Data and Conceptual Framework

The empirical analysis is based on data of industrial firms in Slovakia during the period of transition from 1993 to 1996. Data was gathered by

² See (Sutton, 1997) for a review on the subject.

the Statistical Office of the Slovak Republic and is representative for Slovak industrial firms with at least 25 employees.³ It covers 80 % of both industrial employment and production in the given period. The industry itself⁴ represents more than about one third of the total employment and GDP.⁵

The structure of the industrial sector was at the beginning of the transition characterized by distorted factor and product prices, prevailing low value added production, firms facing soft budget constraints, further distorting managerial decision making within a state enterprise governance form. The state owned enterprises were typically large, as a result of the general tendency towards vertically integrated industrial firms within a central plan system. While the first years of transition, from 1990 to 1992, were devoted to the introduction of the reforms at a macroeconomic level, the following years the most important agenda was related to the process of privatization and restructuring. The structural change is explicitly implied by the implementation of the program of privatization and related events. The privatization itself was designed in 1990 but most industrial firms participated in large scale privatization, effectively launched in 1992 with first results in 1993. It is reasonable to believe that at the beginning of the analyzed period, in early 1993, many firms were in some stage of a privatization process. Some firms have changed owners and some started to engage in the restructuring process. The ownership structure of industrial firms changed during privatization. While in 1993 40 % of all firms in our data were private and 52 % state, in 1996 70 % are in private hands and only 16 % remained under state ownership. In terms of employment represented by these firms, the figures are less dramatic as state firms are the large ones and state firms in 1996 represent 35 % of employment and 39 % of output in our data. The Slovak industrial sector encountered a massive increase in the number of firms during the initial years from 1989 to 1992. The number of industrial firms with at least 25 employees from 1989 to 1992 rose ten times.⁶ Based on (Lizal – Singer – Svejnar, 1995, 2001), these increases are partially attributable to the process of breaking-up of the large state owned enterprises. Large industrial enterprises typically break up and result in a number of spin-offs. Due to the practice of vertical integration in the previous centrally planned systems, the spin-offs may operate in different segments of industry than their parent firm. The process of changes in the size structure continued also through 1993. From 1993 to 1996, the number of firms increased by half (46 %). The growth of firms

³ As of 1997, the data was modified to cover firms with at least 20 employees. This introduces discontinuity in the data and complicates the possibility of extending the analysis for following years.

⁴ excluding construction

⁵ For technical details on data and related data adjustments see chapter III in (Studená, 2003).

⁶ The number of firms rose from 158 in 1989 to 1059 firms in 1992, based on SOSR 1993–1997, information on the corresponding sample of industrial firms with at least 25 employees. The increases in the number of small and micro-firms are even more dramatic, e.g. the number of small industrial firms (<25 employees) rose between 1994 and 1995 by 27 % compared to 17 % entrance rate of medium and large firms (>=25 employees) – source: SOSR 1995, 1996 for small firms. The numbers of small firms are not available for previous years.

thus slowed considerably. This may be considered as an indication that the growth rate is converging to the rate corresponding to a standard developed market.⁷ The character of the process of industrial structure development may be further investigated through the firm growth relationship.

2.1 Model

The interest in firm growth has generated a broad strand of economic research mainly in the context of market structure oriented research. Since 1931 when Gibrat proposed his hypothesis that firm growth is independent from size both theoretical and empirical works attempted to explain or refuse validity of such relationship between firm growth and size.⁸ The recent empirical evidence on the validity of Gibrat's law implying firm growth is independent from size is diverse. Hall (1987) finds firm growth is independent from size only for large firms; Evans (1987a,b) finds that firm growth decreases with size. As from a firm's characteristics, Evans (1987a,b) reports firm growth decreases with age as well as Dunne et al. (1989). All mentioned authors/works deal with the robustness of results to the sample selection problem.⁹

Firm growth in the transition process is assessed theoretically in the context of the models of labor reallocation as these have implications for determinants of net employment creation (Aghion – Blanchard, 1994), (Brixiova, 1997), (Castanheira – Roland, 2000). The hypothesis of the superior behavior of privately owned firms in growth dynamics is empirically assessed in the firm growth analyses of transition economies. (Konings et al., 1996), (Konings, 1997), (Bilsen – Konings, 1998), (Faggio – Konings, 2001) cover mostly Central and Eastern European countries in transition and deal mainly with the role of firm characteristics in determining the firm growth. Special attention is paid to the role of private ownership as determinant of a superior firm behavior as reflected in the potential to grow.

When analyzing the general patterns of the firm growth determinants, the main issues may be summarized as i) the relationship between firm growth and its size (or validity of Gibrat's law); ii) relationship of firm growth to firm characteristics; iii) the determinants of the probability of a firm survival; iv) appropriateness of particular models. In what follows we present the main ideas of our model and the way we deal with the problems stated above.

The firm growth relationship may be in general stated (Evans, 1987a) as:

$$S_{i,t+d} = G[(S_{i,t}; X_{i,t})^d S_{i,t} e_t \quad (1)$$

⁷ See chapter II in (Studená, 2003).

⁸ For theoretical concepts see e.g., (Jovanovic, 1982), (Lucas, 1978, 1967), (Mansfield, 1962), for review on the subject see (Sutton, 1997).

⁹ Hall (1987) and Evans (1987a,b) estimate the growth equation together with the survival equation by maximum likelihood estimation. Dunne et al. (1989) use a different approach. They define size-age classes and obtain estimates of the distribution of growth rate conditional on the given size class. Thus they do not need any assumptions on the distribution or the functional form of the firm growth and size, age relationship.

where $S_{i,t}$ denotes the size of a firm i in time t , $X_{i,t}$ is a set of the firm's characteristics influencing the firm growth rate, e_t is the log-normally distributed error term and d is the length of the measurement period for the growth rate.¹⁰ After simple manipulation¹¹ we arrive at an estimable form to:

$$g_{i,t} = \ln S_{i,t-1} + \ln X_{i,t-1} + u_{t-1}^{12} \quad (2)$$

The major conceptual issues in the econometric part of our analysis are: i) the treatment of the sample selection problem, ii) the appropriate choice of estimation framework of fixed versus random effects model; iii) the modeling of a firm's characteristics effect and choice of a firm's characteristics.

Panel data is powerful data set under appropriate settings. In the context of the model used with panel data the choice between fixed versus random effects setting is essential.¹³ It has been shown (Hausman, 1978) that the two methods may result in significantly different results in estimated parameters when the time dimension is small and number of individuals is large.¹⁴ We are working with data on firms in a transition from a centrally planned economy to a market economy. All these firms started their operations after 1990 conditionally on a set of initial factors. These effects represent factors related to the history of previous activities in a centrally planned system and are at the same time firm specific and fixed. Thus the following behavior is conditional on initial factors. In this setting the fixed effects model is relevant.¹⁵

A problem arises in the case of dynamic specifications of panel data models, which imply inclusion of lagged values of the dependent variable as explanatory variables. Under such circumstances the usual least square methods do not lead to consistent estimates in case of fixed effects model.¹⁶

¹⁰ Brock and Evans (1986) tested semilog specification and found results similar to these for the log-log equation.

¹¹ Equation (1) implies model $\frac{\ln S_{i,t+d} - \ln S_{i,t}}{d} = \ln G(S_{i,t}; X_{i,t}) + u_t$, where u_t is normally distributed with zero mean and possible non-constant variance. Since we use annual growth rate measure, $d = 1$.

¹² where from (1) $g_{i,t} = \frac{\ln S_{i,t} - \ln S_{i,t-1}}{d}$

¹³ Hsiao (1986) summarizes the discussion on fixed versus random effects in a clear way. He characterizes the two models as conditional inference on the effects that are in the sample (fixed effects) or unconditional or marginal inference with respect to the population of all effects (random effects). The choice between conditional-likelihood function or the marginal-likelihood function depends on the context of the data, the manner in which it was gathered, and the environment from which it came.

¹⁴ This is the case of the data used for estimation.

¹⁵ The random effects are relevant in general if the effects of omitted variables may be summarized by a random variable. The fixed effects on the other hand may be understood as a model in which the inferences are made conditional on the effects that are in the sample. Considering the relevance of the random effects model, then initial conditions would be not be that important while the individual conditions would have random distribution. This does not apply in our case.

¹⁶ The bias is introduced from the fact that the disturbance terms are serially correlated, causing the lagged endogenous variable to be correlated with those disturbances.

Also the maximum likelihood estimator in the fixed-effect model is no longer consistent in a typical situation when the time dimension is small and the number of individuals is large (Anderson – Hsiao, 1982), (Nickell, 1981), (Sevestre – Trognon, 1992). The remedy for this problem is the usage of the instrumental variable method, which yields consistent estimates of the slope coefficients.¹⁷ There are other approaches¹⁸ and the particular choice of instruments depends on the setting of the model and circumstances of data. Our model does not explicitly include exogenous explanatory variables, but these may be used as instruments¹⁹ based on the existence of a general production function.

In order to assess the role of ownership and type of incorporation we estimate the growth model for sub-samples defined according to the respective ownership form and type of incorporation.²⁰ We can then test for the difference in the slope coefficients in the respective categories. We define 11 categories of different ownership forms and corporate structures.²¹ The combination of the two characteristics is based on the fact that they are interrelated. Especially the privatization projects explicitly implied certain groupings.²²

The sample selection problem is specific as many of the entries/exits are of a spurious character. The process of firm entry and exit is a caveat of virtually all studies based on large panel data. It is troublesome to follow a firm that drops out of data for other reasons than bankruptcy. Firms which drop out from/in data from other reasons leading to administrative change of their identifier in the data represent spurious exits/entries. Not distinguishing such spurious entries and exits in empirical analysis may lead to

¹⁷ Balestra and Nerlove (1966) proposed using two stage least square type of estimation using as a basis for instruments current and lagged values of exogenous explanatory variables. Finally not the instrumental variables themselves are used as instruments but their differences from their individual means.

¹⁸ Another approach is to write model in the first differences. Anderson and Hsiao (1982) propose using under this setting for instrumental variables either second lag of the endogenous variable (supposing the model contains first lag on the right hand side) and first differences between the exogenous explanatory variables. Another modification they propose instead of the second lag of endogenous variables to use the first differences, i.e. difference between second and third lag. Obviously here one has to sacrifice one time dimension. For other approaches see e.g. (Arrelano, 1989).

¹⁹ For instruments we are using the current and lagged value of sales, sectoral measure of market concentration and unemployment capturing the regional specific effects. We are using average values of variables from firms in the nearest industries, based on two-digit sectoral classification to account for idiosyncracies of the underlying production technology (Basu – Estrin – Svejnar, 1997), (Zellner – Kmenta – Dreze, 1966). To capture the change in the extent of the concentration of a given market defined by a sector, we use sectoral concentration as the instrumental variable. The concentration is measured here by the Herfindahl index. For further details see *Appendix*.

²⁰ The setting of the fixed effects model obviously does not allow the usage of category variables on the right-hand-side to analyze the effect of firm characteristics.

²¹ These categories are identical to those used by Lizal and Svejnar (2002) except that they use in addition also the category “other”.

²² E.g., one of the possible privatization projects (participating in the voucher privatization) would involve the transfer of the state enterprise to a joint stock company, while the ownership would remain state. After some period of time ownership would change from state to private depending on the entrance of the private investor.

misinterpretation of data. During a period of privatization, the problem may be particularly important unless accordingly adjusted for in the data. In our data the presence of spurious entries and exits is given by the run of privatization projects. Another way of ad hoc estimating the presence of spurious entries is to consider the possible number of green field companies, i.e., the “true” entries. The number of green field companies in industry is in the initial stages of transition typically related to the level of foreign investment in a respective country and varies among the transition economies. In Slovakia it remains low during the first two stages of transition and signals that the number of green field companies is also very low.²³ The credit constraints faced by domestic entrepreneurs also negatively influences the entrance of new firms on the domestic market. Entries in the data are thus connected with previously existing enterprises²⁴ and are rather a result of the privatization of a previously state owned enterprise or further changes of ownership and corporate governance structure.²⁵ Analogously the firms do not exit data because of bankruptcy²⁶ but because they are engaged in the process of privatization. Irrespective of the character of the process of entries and exits, the firm growth rate is observed conditionally on the fact that it remains in data. The probability of this event is modeled by a Probit model where the latent variable is a function of a firm’s characteristics. We are not modeling the probability of survival in the real sense, however, the model is suitable for adjusting the sample selection bias due to spurious entries and exits. This setting is known as a generalized Tobit model – (Tobin, 1958), for a review on the topic see (Amemiya, 1984). As a result of the estimation of the survival equation we obtain inverse Mill’s ratio. Including this variable into the estimated relationship for the firm growth adjusts for the presence of spurious entries and exits. The firm growth model may be thus formalized as follows.

$$\begin{aligned}
 g_{i,t} &= \beta x_{i,t} + \varepsilon_{i,t} && \text{if } z_{i,t}^* > 0 \\
 g_{i,t} &= \textit{not observed} && \text{if } z_{i,t}^* < 0
 \end{aligned}
 \tag{3}$$

²³ While in the first stage of transition the level of FDI is relatively low in all Visegrad countries with the exception of Hungary (where reforms started before 1990), in the advanced stage of transition it increases significantly in all countries except Slovakia. In 1998 Slovakia attained 9.8 % FDI that is the smallest figure out of the Visegrad countries and not even half of the average of the Visegrad countries. The Czech Republic accounted for 23.9 % FDI and the average of the Visegrad countries was 21.9 % (WIIW, 2000).

²⁴ The argument is based on the period of analysis and sample used. It would not hold for small firms and other economic sectors like e.g. services. In the case of industrial firms with more than 25 employees the empirical evidence strongly supports the conventional knowledge that important number of exits and entries of these firms are spurious and represent the changes related to engagement in the privatization process.

²⁵ Due to the relatively short span of time and character of the privatization process, such firms are more likely cases where organizational/administrative type of restructuring took place to some extent. This stage of firm restructuring is not necessarily connected with the introduction of new production or managerial systems that would alter significantly economic behavior of the entity.

²⁶ State firms being privatized cannot become bankrupt by law. The firms though engage in following stages of privatization after the ownership was changed to private and still may appear as spurious bankruptcies due to other reasons – see the discussion of spurious exits and entries in (Studená 2003, Chapter III).

The survival variable is z so that²⁷:

$$\begin{aligned} z_{i,t} &= 1 && \text{if } z_{i,t}^* > 0 \\ z_{i,t} &= 0 && \text{if } z_{i,t}^* < 0 \end{aligned} \quad (4)$$

The survival model is estimated as:

$$z_{i,t}^* = \gamma_0 + \gamma_1 \ln S_{i,t} + (\gamma_2 \ln S_{i,t-1})^2 + \gamma_3 \ln HCI_{s,t} + \gamma_4 \text{dummy_State Owned} + \gamma_5 \text{dummy_JointStockCpy} + \gamma_6 \text{dummy_CompanyLtd} + \gamma_7 \text{Cap}_{i,t} + u_{i,t} \quad (5)$$

The probability that a firm remains in data depends on its current size ($S_{i,t}$) quadrate of its lagged size ($S_{i,t-1}$). The degree of sectoral market concentration in sector s ($HCI_{s,t}$) captures not only the market power but also sector specific effects related to changes in sectoral structures. The effect of ownership and type of incorporation is captured by the dummy variables for the state ownership and corporate forms of a joint stock company and a limited liability company. Finally the level of capital ($Cap_{i,t}$) is used to account for firm specific probability of being chosen in the privatization project and consequent drop out from data.

The final form of the firm growth relationship²⁸ is defined as:

$$g_{i,t} = \beta_{0,i} + \beta_1 \ln S_{i,t-1} + \beta_2 (\ln S_{i,t-1})^2 + \beta_3 \ln HCI_{s,t} + \beta_4 iMills_{i,t} + u_{i,t} \quad (6)$$

where $g_{i,t}$ are annual firm level observations on the growth rate, $\beta_{0,i}$ are the individual firm specific fixed effects, HCI represents the degree of the sectoral concentration²⁹ and $iMills$ is the estimated inverse Mill's ratio. This variable is obtained from the survival model estimation.³⁰ Including the inverse Mill's ratio as an explanatory variable in the estimated growth relationship adjusts for the sample selection introduced by the survival effect. The empirical literature often examines the relationship between growth rate and age of the firm, e.g. (Evans, 1987a,b), i.e. $X_{i,t} = Age_{i,t}$. This approach is also used in applications on transition economies (Konings, 1997), (Bilsen – Konings, 1998), (Faggio – Konings, 2001). In case of a transition economy age does not carry the information relevant for the age of a firm in a market economy. It is more appropriate to think of the firms as

²⁷ where the related probabilities of a firm presence vs. exclusion from data are defined by:

$$P(z_{i,t} = 1) = \Phi(\gamma\omega_{i,t}), \quad P(z_{i,t} = 0) = 1 - \Phi(\gamma\omega_{i,t})$$

²⁸ See *Appendix* for the reported results of tests for the model specification.

²⁹ Measure of sectoral concentration, Herfindahl index is defined:

$$HCI_s = \sum_{i=1}^{n_s} \alpha_i^2; \quad \alpha_i = \frac{y_i}{Y}$$

where α_i is the market share of firm from sector s , defined as the share of its production y , on the total production Y , n_s is the number of firms in sector s .

³⁰

$$iMills_{i,t} = \frac{\phi(\gamma'\omega_{i,t})}{\Phi(\gamma'\omega_{i,t})}$$

being at the same starting point in 1990. Hence we assume that age is not a relevant indicator for explaining the firm growth relationship, as it would provide spurious results at this stage, and we do not include this variable in the estimated relationship.³¹

3. Survival Effect

The survival model is used to adjust the sample selection. The estimated parameters of the survival model at the same time reveal what was the pattern of changes leading to observed changes in the market structure. The turnover of firms is already visible from both aggregate figures and descriptive statistics based on our data (see *Appendix for tables A1–A3*). The size categories continue to develop and number of firms increases in firms with less than 25 employees. The number of large firms is stable and does not change considerably any more. Within the ownership structure obviously there is a continuing shift from state to private sector. The private firms are choosing between corporate governance of company with limited liability and joint stock company. How do these changes reflect in the firm turnover process and how is this process linked with observed market structure development?

The results of the estimation of survival model³² yield two straightforward results. Firstly, state owned firms are the most likely to drop out of data. State firms are dropping out of the sample as they engage in privatization. Being in the privatization process the state firms change not only ownership structure³³ but also type of incorporation. The firms may have considerably changed size structure, having broken up into two or more spin-offs, separating core production facilities from supportive ones. The spin-offs have new identity and the mother firm often changes identity too as it is not directly a successor of a previous state firm.

Secondly, the probability of survival increases with firm size for small firms and decreases with size for larger firms. The market structure litera-

³¹ To understand the problem, it is important to take into account the population structure of firms. There is a number of de novo firms where age is appropriate. In data used here, the number of these firms is small and especially for the analyzed period it is negligible. In the case of all the remaining firms the information is ambiguous. The cases of the remaining firms are: state owned firms, privatized firms, spin-offs from state owned firms (privatized or not). In the case of privatized firms, there is a different extent of linkage with the previous state owned firm. Depending on the character of the production, in some firms there could have been introduced new methods of production together with complex restructuring of the production facilities. In some cases the privatized firm would just continue with its prior activities without considerable changes either because it is in a stand-by position until its new owners engage in the restructuring process or owners are not interested in investment into the firm and perceive the current activities as satisfactory.

³² See *Table A2* in *Appendix* for the results.

³³ Inspection of the data revealed that pure change of ownership does not imply change of identification number and firm is further observed with new ownership form. On the other hand, there are virtually no observations on the changes of type of corporate form, while the structure of firms in data with respect to corporate form changes significantly during the analyzed period. This implies that changes in corporate form is linked with changes in the identification of the firm in the sample.

ture actually reports opposite effects and thus this need some explanation. Large firms are less likely to drop out of sample as they have a large market share, on the other hand small firms are more likely to fail to remain on the market or to be absorbed by their competitors. In our data, the small firms are most likely newly privatized firms as opposed to large firms still being likely to enter the privatization process. From there the opposite type of size – survival relationship. The small firms are these that are already privatized, they behave as competitive firms and make efforts to increase their market share, hence to remain in the market. The second part of the effect is specifically linked to the run of the privatization process and explains the pattern of firm turnover linked to privatization. The large firms are most likely changing the structure within the privatization and restructuring so that there is no administrative continuity with the previous entity and the original firms seemingly drop out of the sample.

The probability of survival decreases also for firms incorporated as a limited liability companies followed by firms with a corporate structure of joint stock companies. These effects may be actually further capturing size effects as companies incorporated as a limited liability companies are smaller and their turnover is in general larger. Also during the respective period part of these companies changed corporate structure in favor of a joint stock company in order to look for investors in the stock market as the credit from financial institutions is by and large limited for small firms. Finally joint stock companies exiting are rather the further restructuring within the privatization process, than firms really exiting the market.

The significance of ownership and corporate form is thus in line with the process of privatization when the state owned companies drop out of data during privatization connected with the change of its identification number. It is likely that many of these dropouts reenter data as a new entity after the change of ownership. Obviously some state owned companies disappearing from the sample may represent exits though the experience from Slovak industry for the given period indicates that the share of these companies is rather small. Similarly the negative size effect for large firms is rather, than characteristics of large firms, a result related to the specifics of the privatization process.

4. Firm Growth

The survival analysis confirmed that the process of firm turnover among industrial large and medium firms is tightly linked with the process of privatization and restructuring. The firms engage in the process of ownership transfer and change of governance in relation with the setup of privatization process or resulting restructuring. Large firms continue to take part in de-fragmentation despite a major wave of spin-offs in the preceding years.

In this section we want to discuss the major results of the firm growth analysis. In the preceding sections we discussed the interest of this approach in the context of a transition economy. The main issues to be addressed by the empirical analysis of firm growth determinants may be formulated as follows. Do we observe any specific pattern of firm growth –

TABLE 1 Firm Growth. Fixed Effects IV Estimates of Firm Growth Equation

Slovak industry, > 24 employees, 1993–1996, unbalanced four-year panel 1993–1996
(Dependent variable is the logarithm of the annual growth rate of the employment level.)

Estimated coefficient	All firms	State/ SOE	State/ Joint stock Cpy.	Private/ Joint stock Cpy.	Private/ Ltd. company	Foreign/ Ltd. company	Cooperative/ Cooperate	Foreign/ Joint stock Cpy.	Private/ Individual	State/ Ltd. company	Mixed/ Joint stock Cpy.	Mixed/ Ltd. company
Log(Employment _{<i>t</i>-1})	-0,11	0,14	-1,89	1,70 ^b	-0,92 ^c	0,24	0,51	0,82	0,32	0,90 ^a	-0,01	-0,28
Standard error	0,35	0,48	1,61	0,69	0,53	0,36	0,34	0,66	0,28	0,31	0,41	0,33
[Log(Employment _{<i>t</i>-1})] ²	0,00	-0,04	0,17	-0,16 ^a	0,10	-0,03	-0,05	-0,12 ^c	-0,04	-0,11 ^a	0,01	0,01
Standard error	0,03	0,05	0,16	0,06	0,06	0,04	0,03	0,06	0,03	0,03	0,04	0,03
Log(HCI)	0,53	4,71 ^a	5,18 ^c	-2,39 ^a	-0,31	1,00 ^b	-0,98	-0,78	0,61 ^c	-0,89	-0,42	0,80
Standard error	0,40	1,67	2,81	0,88	0,64	0,44	0,75	1,69	0,36	0,72	2,07	0,95
Mills ratio	0,54 ^a	4,70 ^a	3,29 ^c	-0,91 ^b	0,20	0,38	-1,90 ^c	-1,06 ^c	0,17 ^b	-0,09	-0,66	0,62
Standard error	0,20	0,87	1,94	0,44	0,13	0,24	1,08	0,55	0,09	0,20	0,57	0,38
Adjusted R ²	0,24	0,31	0,18	0,39	-0,23	0,16	0,12	0,26	0,52	0,89	0,41	0,17
Number of observations	3682	473	247	800	1165	344	316	98	74	26	68	68
Number of firms	1718	243	109	333	590	185	111	40	38	16	29	32

Note: ^a, ^b, ^c – statistically significant at 1%, 5% and 10% test level, respectively

firm size relationship? Are there systematic effects of firm characteristics on its performance in terms of growth, or otherwise stated in constituting a firm's demand for labor? In particular, what is the role of specific ownership forms, or more specifically, do we find evidence for different patterns of growth behavior of private or foreign firms? How do different forms of governance influence a firm's decision making with respect to demand for labor? We are interested in the role of market structure, whether we can see that firms in highly concentrated sectors have more space to grow as suggested by the market structure literature. A somewhat methodological but none the less important question is whether the attention paid to the role of sample selection was appropriate. Finally, we shall see how the results of our analysis correspond to evidence from other transitional economies.

4.1 Size Effect and Firm Characteristics

The answer to the first question with respect to the relationship between firm growth and its size is negative. In general, the pooled regression does not reveal a firm growth – firm size relationship (see *Table 1* for estimated coefficients). Hence the empirical results do not provide evidence for a systematic relationship between firm growth and firm size for medium and large industrial firms.

The next issue concerns the role of a firm's characteristics such as ownership form or corporate governance structure in determining the pattern of firm growth relationship. It must be stressed here, that the estimation

framework we use does not allow us to inquire whether firms with certain types of ownership or corporate governance outperform others in the pace of growth. However, it is possible to inquire about the character of the firm growth size relationship, i.e., whether in general the firm characteristics matter in the process of growth. This is the point of running individual regressions for particular ownership forms and types of corporate governance.

The regressions for some categories do reveal size effects. It is though noticeable that when inspecting the signs of coefficients of the labor and its quadratic term representing acceleration effect in case of larger firms, the results are qualitatively different. The explanation for this needs a closer look at the construction of individual regressions. There are eleven separate groups defined for specific ownership forms and corporate governance structure of firms.³⁴ Size effects are present in two out of three categories of private ownership, and one foreign ownership category.³⁵ There are two categories of firms incorporated as joint stock companies, one category of firms is in private ownership and one in foreign ownership. Foreign ownership is frequently considered as a special form of private ownership. Therefore it is plausible to look at both categories together. The privately and foreign owned joint stock companies exhibit inverse firm growth – size relationship.³⁶ This finding is consistent with existing evidence from developed economies that smaller firms grow faster than larger firms.³⁷ Jovanovic (1982) provides the theoretical framework for this, explaining the pattern of inverse firm growth size relationship. He proposed a selection mechanism, where firms have different levels of efficiency and this influences their survival probability as well as potential to grow. Firms do not know their efficiency level and learn about it after entering the market (from there a learning model). Only the efficient ones remain and outperform the others. This mechanism actually also well suits the scenario of private joint stock companies which are mostly privatized previously state owned firms. All firms actually “enter” the market as private joint stock companies after privatization. Their new owners have bid for them based on the expectation of their efficiency or possible returns. Based on non-existence of both of this type of ownership and corporate governance in preceding years, the firms are likely to lack or have incomplete information about their efficiency under the new structure. They are also similarly unfamiliar with the new market environment. In this situation, firms are in the same situation of not knowing their efficiencies unless starting to operate in the market within a new structure. The new structure of a firm is here understood

³⁴ See *Table 2 in Appendix* for definition of individual categories and distribution of firms within these categories.

³⁵ The size effect is also present in one category of public ownership. It contains twenty six publicly owned companies incorporated as limited liability companies. The number of firms is so small and the combination of corporate form and ownership so particular and unusual that we would hardly look for some meaningful interpretation.

³⁶ However, the coefficient for employment term for foreign owned joint stock companies is only significant at 30% significance level.

³⁷ Evidence also that small firms are less likely to survive. Due to different meaning of the survival model used here, comparison on this issue is not relevant.

as change in firm structure resulting from e.g.: ownership change, introduction of new corporate governance, combination of the preceding two, restructuring of production facilities usually following one of three preceding etc. Contrary to the mechanism in a developed economy, in case of a transition economy, the effect may only be temporary if it is related purely to uncertainty about the market environment and or uncertainty about a firm's efficiency in the new environment and/or within the new structure as explained above. The presence of a similar pattern of inverse firm growth – firm size relationship favors explanation within the Jovanovic learning mechanism. On the other hand, other private firms incorporated as limited liability companies do not support this type of behavior whereas they should be facing the same type of uncertainty. Specificity of effect for a type of governance, in this case, a joint stock company, signals that what we observe may still be the temporary effects of exogenous factors related to privatization. Joint stock companies were established in the very beginning of the privatization process prior to the transfer of ownership from the state. So large private joint stock companies may represent these firms in the initial stages of restructuring following privatization. These firms typically did not start to adjust employment stock before the final ownership change took place. Despite continuing privatization, increases in the number of firms incorporated as joint stock companies is already generated in the context of standard market development as we know it from developed economies. Many firms that entered the market as private firms incorporated as limited liability companies later transferred to joint stock companies mainly to obtain access to capital through public stock offerings. It is hard to distinguish the prevailing nature of the size effect at this point.

For private companies incorporated as limited liability companies we observe a negative relationship between firm growth and size. This is rather counterintuitive in terms of market structure development in standard market economies. We expected either firm growth irrespective of size or inverse firm growth firm size relationship, i.e., increasing growth for small companies that reflect the process of growth of entries catching up with existing large firms that are then growing at a slower rate. The negative relationship between firm growth and size means that after reaching some growth rate that is captured by the fixed effect the firm size decreases. In particular case the entries in industry in the underlying period reflect privatized firms that have mostly left their employment stock unchanged prior to realized changes in ownership. The fact that the sizes shrink in general in the category of privately owned firms incorporated as limited liability companies reflects therefore the adjustment of employment stock to competitive levels. In addition to that a share of firms with potential to grow change the corporate governance of a limited liability company to that of a joint stock company. More specifically, as seen in the survival analysis firms incorporated as limited liability companies are most likely to drop out from data. The firms drop out of data as a consequence of change in corporate governance in favor of joint stock firm structure in order to obtain access to capital. Very limited access to financial capital from financial institutions supports this factor. This explanation is consistent also with behavior of foreign firms incorporated as limited liability companies. There

we do not observe the contradictory relationship between firm growth and size. Foreign companies more likely contain entries of the “green field” type, and have access to financial capital via owners therefore they are not forced to look for means among investors in financial markets.

4.2 Market Characteristics

The market structure characteristics are captured in the estimated relationship by the variable of sectoral concentration known as Herfindahl concentration ratio. The estimated coefficient for this variable is significant for most regressions. However the sign of coefficient varies across ownership and corporate governance categories. The market structure literature predicts the positive effect of high concentration on growth – positive sign of the coefficient. However we obtain a negative coefficient of market concentration for private companies incorporated as limited liability companies. This is one of the largest categories in terms of number of firms and share on industrial employment. At the same time for this category we observe a negative relationship between firm growth and firm size. Since the concentration ratio is sector specific, it is in this case further adjusting for the effect of large firms in highly concentrated sectors downsizing after privatization or otherwise stated, adjusting for distortions introduced by labor hoarding from the past.

Sample selection correction confirms that it is an important issue in the underlying analysis. The coefficient on the Mills ratio, the variable that adjusts for sample selection in the estimated relationship, is a significant variable both in the pooled regression as well as in most regressions in individual categories of firms.

Concluding on the pattern of the firm growth – firm size relationship, empirical analysis based on medium and large industrial firms did not provide evidence for any form of systematic relationship between firm size and firm growth. Neither was confirmed the general role of ownership or specific form of corporate governance in determining the character of firm growth – firm size relationship. The present effects are by and large related to particular events of privatization and related restructuring and in general to structural shifts adjusting for distortions inherited from past. On the other hand, the character of size effect revealed in regression for foreign and privately owned firms incorporated as joint stock companies do signal possible tendency for inverse relationship of firm growth and size.

4.3 Firm Growth and Transition to a Market Economy

Putting the results in the context of existing evidence for transitional economies we have found similar tendencies, though since we use different methodological settings the comparison is not straightforward. Empirical works analyzing firm growth in transition economies (see *Table 2*) find evidence for superior behavior of private firms in terms of firm growth with special emphasis on distinguishing the private ownership that represents the efficient sector of the economy as opposed to e.g. only technical privatized old companies prior to restructuring. As we have shown we have fo-

TABLE 2 Examples of Empirical Evidence on Firm Growth in Transition Economies

Study	Countries covered	Firm growth: g_{it} vs. size, ownership and other effects	Sample characteristics
(Konings et al., 1996) (Bilsen – Konings, 1998)	Poland 1988–1991 Bulgaria, Hungary, Romania 1991, 1994	$g_{it} \downarrow$ with size $g_{it} \uparrow$ higher for private firms g_{it} higher for de novo private firms	Industrial firms > 5 employees, continuing firms stratified samples robust regression Nobs: B(95), H(76), R(85)
(Faggio – Konings, 2001)	Bulgaria, Estonia, Poland, Slovenia 1993–1997 Romania 1994–1997	g_{it} depends on ownership: g_{it} lower for state firms g_{it} higher for foreign firms (P, H) $g_{it} \downarrow$ with initial size $g_{it} \uparrow$ with trade orientation in the early stage of transition	medium and large firms, manufacturing and non-manufacturing sector Nobs: B(4679), E(535), P(738), R(5203), S(1482)
This study	Slovakia 1993–1996	$g_{it} \uparrow$ with size for small private joint stock companies $g_{it} \downarrow$ with size for large private or foreign joint stock companies	medium and large firms, Slovak industry, Nobs (3682)

cused on analysis of different aspects of the firm growth firm size relationship within particular ownership and corporate governance form. We have found that small private and foreign joint stock companies grow faster while large firms grow slower. Unfortunately, at this point it is not possible to conclude on the character of the observed pattern. In particular, we cannot rule out the possibility that the observed pattern is related to the exogenous setting of the privatization. At this point the methodological approach is a question of interest. It is known that random effects versus fixed effects model specification yield qualitatively different results (Hausman, 1978). While we are using the fixed effects model specification, other studies are based on the random effects model. Thorough examination of the model choice implications in a cross-country estimation would probably be the appropriate setting to address the importance of model selection for the firm growth relationship.

5. Conclusions

The purpose of this article is to empirically investigate firm behavior in terms of the relationship between a firm's growth and its size. Among other possible determinants of firm growth we specifically focus on the role of ownership and corporate form and degree of market concentration.

Analyzing the survival process of firms, we found that the probability that a firm remains in data increases with size for small firms and decreases with size for large firms. This result is explained by the specific events related to privatization. While small firms represent newly privatized competitive firms, large firms are the only ones to engage in privatization. The large firms are thus likely to drop out of data due to events related to privatization and restructuring. The level of market concentration has

a positive effect on the probability of survival. In line with intuition, the ownership and corporate form play a role, when state owned companies are the most likely to drop out of data. The probability of dropping out increases for firms incorporated as joint stock companies and limited liability companies. Overall the survival model captures very well the process of firm turnover related to events taking place in a given period. The empirical analysis revealed that attention paid to the sample selection problem was appropriate as the coefficient for variable adjusting for sample selection is significant in all regressions. The market structure also plays an important role in the firm growth estimation, though it may capture sector specific effects at this point.

The analysis of firm growth – firm size relationship based on medium and large industrial firms did not provide evidence for any form of systematic relationship between firm size and firm growth. Neither was it confirmed that ownership form or specific type of corporate governance determine the character of firm growth – firm size relationship. We do observe firm growth – firm size effects for firms with particular forms of ownership and corporate structure. More specifically, privately and foreign owned small firms grow faster compared to larger ones. Carefully analyzing the character of these effects, we find that they are by and large related to particular events of privatization. On the other hand, private firms incorporated as limited liability companies exhibit a negative relationship between a firm's growth and its size. This counterintuitive result is explainable by the process of restructuring adjusting for distortions inherited from the past. While it is not possible to exclude that character of size effect revealed in regression for foreign and privately owned firms incorporated as joint stock companies is transitory, it is a question to be raised and confirmed by extending the analysis over the following years. When comparing the results with other transitional economies, we find similar patterns but conclude these are more likely to be transitory than represent true ownership or corporate governance effects.

APPENDIX

Estimation Details and Specification Tests

As already discussed the estimation results in the panel setting are very sensitive to the specification. We have run the Hausman specification test (Hausman, 1978) for the validity of random vs. fixed effects specification and we have rejected the null hypothesis that the random effects are valid. Indeed the estimated coefficients in the fixed effects and random effects model varied considerably also in magnitude as well as signs of the coefficients that underlines the importance of appropriate settings.

The second important issue is the presence of heteroscedasticity. We treat this problem using a robust regression yielding heteroscedastic-consistent standard errors.

Finally we have accounted for the problem of autocorrelation. This occurred in the setting with quarterly observations on annual growth rates. We had to reject

the hypothesis of no autocorrelation when testing for it. We tried to solve this problem using the first difference problem but this specification was not a remedy for autocorrelation in our data. Therefore we had to remain with annual observations only losing thus about two thirds of the number of observations. In this setting we could finally reject the presence of autocorrelation.

TABLE A1 Size Structure of Industry

Number of Firms					Employment				
no. of empl. in the firm	1993	1994	1995	1996	no. of empl. in the firm	1993	1994	1995	1996
	[%] of total					[%] of total			
25-99	38	42	47	50	25-99	5	7	8	9
100-249	29	28	27	26	100-249	11	13	14	14
250-499	17	15	13	12	250-499	14	15	14	15
500-999	8	7	6	5	500-999	13	14	13	12
>1000	9	8	7	6	>1000	55	52	51	50
Total	100	100	100	100	Total	100	100	100	100
Total number of firms	1 289	1 452	1 622	1 731	Total [no. of empl.]	522 837	509 902	519 767	507 892

TABLE A2 Ownership Structure of Industry

Number of Firms					Employment				
Ownership	1993	1994	1995	1996	Ownership	1993	1994	1995	1996
	[%] of total					[%] of total			
Foreign	8	12	14	14	Foreign	4	9	10	11
Private	40	60	65	70	Private	14	40	48	53
State	52	28	20	16	State	82	51	42	35
Total	100	100	100	100	Total	100	100	100	100
Total number of firms	1 289	1 452	1 621	1 731	Total [no. of empl.]	522 837	509 902	519 767	507 892

TABLE A3 Corporate Structure of Industry

Number of Firms					Employment				
Corporate structure	1993	1994	1995	1996	Corporate structure	1993	1994	1995	1996
	[%] of total					[%] of total			
Cooperative	9	8	7	7	Cooperative	4	4	4	4
Ltd. company	33	44	50	54	Ltd. company	14	19	23	25
Entrepreneur	3	2	2	2	Entrepreneur	1	1	1	1
Joint stock cpy.	29	29	31	32	Joint stock cpy.	38	47	53	60
State enterprise	26	17	10	5	State enterprise	43	29	20	10
Total	100	100	100	100	Total	100	100	100	100
Total number of firms	1 289	1 452	1 622	1 731	Total [no. of empl.]	522 837	509 902	519 767	507 892

TABLE A4 Distribution of Firms in Defined Ownership/Legal Form Categories

	Number of Firms											
	All firms	State/ SOE	State/ Joint stock Cpy.	Private/ Joint stock Cpy.	Private/ Ltd. company	Foreign/ Ltd. company	Cooperate/ Cooperate	Foreign/ Joint stock Cpy.	Private/ Individual	State/ Ltd. company	Mixed/ Joint stock Cpy.	Mixed/ Ltd. company
1993	1289	329	269	56	309	74	116	22	34	11	31	36
1996	1731	92	118	365	698	205	113	40	39	12	27	20

Note: Category of individual entrepreneurs with foreign ownership was not inspected individually as they are only 2 such entities, these were though included in the regression with all firms.

TABLE A5 Survival Equation

Dependent variable = 1 for firms that drop out of data, probit model estimates.

Slovak industry, > 24 employees, 1993–1996, unbalanced four-year pooled data 1993–1996.

	Estimated coefficient*	Standard error
Constant term	1.45	0.14
Log(Employment)	-0.32	0.05
Log(Employment)] ²	0.04	0.005
Log(HCI)	1.19	0.25
Level of fixed assets	-0.14	0.006
Ownership dummy variables:		
State	0.72	0.02
Corporate form dummy variables:		
Joint stock company	0.14	0.02
Ltd. company	0.30	0.03
Number of observations	14 517	

Note * All estimated coefficients are statistically significant at 1% test level.

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SUMMARY

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Firm Growth in Advanced Stages of Economic Transition: Evidence from Slovak Industry

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This article analyzes the reaction of firms to transition in adjusting firm size. The author offers an empirical analysis in the context of the firm-growth model with emphasis on the presence of ownership and corporate-structure effects.

There is no evidence for a general firm-growth/firm-size relationship. On the other hand, the author finds evidence that firm growth is a function of size for firms of a particular type. Specifically, there is an inverse growth-size relationship for privately owned joint-stock companies. Examining the character of these effects, the author concludes that their character is transitory: It corresponds to events related to exogenous settings of economic privatization and the economic restructuring process rather than tangible ownership or corporate-governance effects.