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Firm Growth and Survival in a Transition Country:

Micro Evidence from Slovenia

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Abstract

This paper investigates the determinants of firm survival and growth in Slovenia, a country in transition from a plan to a market economy. Firm growth (measured using employment) and firm survival (the probability of remaining in activity) are estimated using firm level data for the years 1994 to 1998. Both the OLS and the Heckman selection correction models are used to estimate a basic model of firm growth adjusted to analyse the specific context of transition. The performance of Slovenian firms that survived from 1994 until 1998 is studied using firm and industry pre-transition conditions so as to understand what type of firms best survived and performed in the transition process. Firm performance is assumed to be a function of several factors including initial firm size, ownership, firm innovation, trade orientation, capital intensity, firm financial constraints, firm costs and profitability, sunk costs or minimum efficiency scale, and market structure. Evidence suggests that, in Slovenia, during the first four years of transition, private and foreign owned firms, whose activity involved foreign trade, and potentially more capital intensive, grew the fastest. Small firms grew more than medium firms did, and also did large firms. Large firms or those with initial positive profits were more likely to remain in activity whilst firms with ill financial health, high costs, or involved in foreign trade were more likely to close down. This suggests that firms that are trading internationally are exposed to more competitive pressure and therefore are more likely to fail, however, once they survive they will also have a superior growth performance. It may also indicate that firms in Slovenia face hard budget constraints.

Key words: transition economies, Slovenia, manufacturing, firm growth and survival, firm ownership, firm trade orientation

JEL: P2, P3, L6

1. Introduction

In recent years a substantial theoretical literature has emerged on the process of economic restructuring in transition economies (*e.g.* Roland, 2000). The transition from plan to market implied a substantial reallocation of resources from declining firms to growing ones, from old sectors to new ones, from state firms to privatized ones. Although it has been documented that this reallocation and restructuring process can vary substantially across different emerging economies (*e.g.* Faggio and Konings, 2000; Haltiwanger and Vodopivec, 2000; Terrell and Sorm, 2000), little is known about what drives firm growth and market selection in transition countries. Many firms that entered the transition were characterized by over-manning levels, soft budget constraints, lack of innovation, and the production of low quality products. For many of them restructuring may not have been an option and survival in competitive markets may not have been feasible as suggested by Walsh and Whelan (2001). This paper is the first to investigate the determinants of firm survival and growth in a transition country, Slovenia, and thereby hopes to shed light on what drives the market selection process in transition countries where competition is just emerging and soft budget constraints often persist (*e.g.* EBRD, 1999).

Slovenia is a small open economy and a former republic of the Yugoslav Federation, from which it became independent in 1991. It has a population of two million inhabitants. Slovenia's macroeconomic stabilization program started in 1992 and as the other transition economies it also experienced a sharp decline in its GDP in the early transition years. However, its recovery started early on and it is one of the few countries that has now reached GDP levels which are higher than its pre-transition level. GDP per capita is more than 60% of the EU average, which puts the Slovenian economy closest to the EU. Privatization of state owned enterprises started mostly in 1995 after a

new law on privatization was adopted in November 1994 (EBRD, 1999). The year 1995 also witnesses the signing of the EU Association Agreements and EFTA Agrements.

We analyze the performance of Slovenian firms that survived the period spanning from 1994 to 1998. To this end we use firm level data covering virtually the whole population of manufacturing firms and allowing us to analyze firm growth after taking into account potential survival bias, which may be important in an emerging economy. We are able to test a number of theoretical arguments that may be relevant in explaining firm performance and selection in emerging economies. Apart from size and the ownership structure of firms, it has been suggested that the trade orientation may play an important role in explaining firm behavior. Walsh and Whelan (2001) showed that firms that were trading with Western Europe pre-transition had a superior growth performance compared to firms that did not do so. Furthermore, in transition countries firms often persist to have soft budget constraints, which affects the incentives of managers and hence may have an effect on survival and growth (Dewatripont and Maskin, 1995). In the context of investment decisions Lizal and Svejnar (2001) recently showed the importance of such soft budget constraints in the context of investment models. We will therefore test whether financial constraints matter in explaining firm survival and growth.

This paper is organized as follows. Section 2 introduces the data set used and the econometric approach. Section 3 presents the results and section 4 concludes the paper.

2. Data, Framework and Hypotheses

The data that we use are the company accounts of virtually all manufacturing firms that were available at the Slovenian Central Statistical Office[1] in 1994 and which we could trace through to 1998. In 1994 we have information on 2813 firms, 219 of

which did not survive till 1998. Table 1 compares total employment in our data set for the year 1998 with total employment reported in the Slovenian statistical yearbook for the whole manufacturing sector and for each 2-digit sector. We cover around 80% of the employment in manufacturing as a whole and more than that percentage in several 2-digit sectors.

We follow the existing literature in defining firm exit, *i.e.* if a firm that existed in 1994 disappears from the data set in a later year, we consider it as an exit. Table 2 shows the number of firms in each sector that survived and the number of firms that exit by 1998. The average exit rate is 7.6% although exit rates vary substantially across sectors with the highest in 'wearing apparel' registering a 19% exit rate on average. Note that there are two sectors where the exit rate is 0%, 'Tobacco products', which is characterized by a monopoly and 'Coke, refined petroleum and nuclear fuel', where there are three firms in activity. This suggests that there may be some sector characteristics such as the degree of competition or minimum efficient scale, which may affect firm survival.

The basic model that we shall estimate goes back to the growth of firms literature (*e.g.* Evans, 1987, Sutton, 1997) where firm growth was typically modeled as a function of initial size and age. The recent empirical literature shows that initial firm size and age are both negatively related to average firm growth, which is a rejection of Gibrat's law that firm growth and size are independent, but which is consistent with active and passive learning models (Jovanovic, 1982; Pakes and Ericson, 1989). In our data set we have no information on firm age. However, the focus here is not on testing learning models of growth, rather we want to use firm growth model to determine

[1] We thank Joze Damijan who kindly made this data set available for this research.

whether apart from initial size there are other factors, such as the ownership of the firm, that determines the growth trajectory of the firm and its survival.

In particular, we seek to estimate the following general equation capturing firm growth:

$$avrgremp = \frac{\ln S_{it'} - \ln S_{it}}{d} = \alpha_0 + \alpha_1 \ln S_{it} + \alpha_2 \ln S_{it}^{\ 2} + \alpha_3 \ln S_{it}^{\ 3} + \beta' Z + u_{it} \qquad (1)$$

where u_{it} is a normally distributed error term, *S* stands for firm size, subscript *i* stands for firm *i*, subscipt *t* refers to the initial year (1994) and *t'* to the last year (1998) of the observations, *d* is the difference between the end and the first year of the analysis, and *Z* is a vector of other explanatory variables that affect firm growth. *Avrgremp* therefore stands for the four-year average employment growth of the firm and is the dependent variable.

Since, in equation (1), we focus on estimating the average growth of firms between 1998 and 1994 we capture only those firms that survived till 1998. This selection bias may potentially affect our results. We therefore estimate equation (1) correcting for survival bias using Heckman's selection models (the simple selection model using maximum likelihood and the two-step estimation procedure). This allows us to investigate not only the determinants of firm growth, but also the determinants of firm survival in a transition country.

In (1) we assume that initial size may be related to average growth in a non-linear way as in Evans (1987). We proxy size by the employment level in the firm and use the log of employment, employment squared and employment in its third power - *Lemp*, *Lempsq*, and *Lempcb*. Previous work (*e.g.* Hart and Oulton, 1996) shows that employment is widely used and that sales, assets, and employment do appear to follow similar distributions.

We are particularly interested in a number of other (transition-related) variables that may affect average firm growth, after controlling for size and potential selection bias. In particular we will focus on the following hypothesis and variables that we include in *Z*.

Ownership: It was generally believed that privatization would enhance economic performance as firms would move to profit maximizing strategies, being cut off from political influence and subsidies. Boycko (1996) and Frydman *et al.* (1999) for instance use firm level survey data to show that privatization has contributed to better firm performance. Konings (1997) demonstrates that especially "de novo" private firms, after controlling for size and age effects, have the highest growth rates. We include two ownership categories in our analysis, first we consider a dummy equal to 1 if the firm is a private domestic firm and 0 else (*Private*), second we include a dummy equal to 1 if the firm is a majority foreign owned one and 0 else (*Foreign*). The benchmark category thus refers to the state owned enterprises. The information on foreign ownership allows us to test whether foreign firms perform better than their domestic counterparts. It has been argued that foreign firms possess some superior technology and expertise which allows them to outperform domestic firms (Teece, 1977; Djankov and Hoekman, 1998) Furthermore, foreign owned firms operate in international competitive product markets which may induce higher efficiency. Estrin *et al.* (2001) find that firms with some foreign investment have higher total factor productivity than those without any foreign participation in transition countries. The ownership status of the firm refers to the year 1998 since in 1994 most companies were state owned. As mentioned, the privatization process took place mostly from 1995 onwards. By construction, in our data set a firm that was privatized during the period under study kept the same id number while changing the ownership category.

Trade Orientation of firms. Repkine and Walsh (1999) and Walsh and Whelan (2001) demonstrate that the trade orientation of firms matters considerably in explaining differences in firm level growth rates often as or more important than privatization. The argument is that firms that are trading on world markets are producing viable products at competitive prices, while firms that are producing for the domestic market do not always have the incentives to produce viable and high quality products pre-transition. This is a consequence of the Central Planner determining output targets and specified prices without any quality standards. With the transition to a market economy the restructuring of these firms was often not feasible and they were more likely to exit, compared to firms that were producing a viable product. We have information at the firm level on the fraction of the production of each firm that is sold in foreign markets versus the fraction that is sold in their domestic market. We use this fraction as an indicator of the degree of trade a particular firm is doing in the initial stages of transition, 1994 (*Forsh94*). This variable enables us to understand whether those firms used to competitive markets through foreign trade survived and/or grew faster than do those used only to the domestic market during the period of the analysis.

Firm capital intensity: We also wish to know if growth (and exit) was stronger (occurred more frequently) in capital intensive or labor intensive firms throughout the period. Thus, we compute initial capital intensity - *Kinten94* - as the ratio of total capital assets to sales revenues.

Firm R&D: We introduce a variable that acts as a proxy for the innovation capacity of each firm. Mansfield (1962) draws attention to the fact that firms that innovate more grow faster than similar sized firms do. A number of studies also show that that survival is positively associated with innovation (Mansfield, 1962; Audretsch,

1995; Sembeneli and Vannoni, 2000). We use the ratio of intangible assets to total fixed assets as a proxy of innovative capacity in 1994 (*Innov94*).

Financial Constraints of firms: In recent years a growing literature on the role of financial constraints on firm performance has emerged (*e.g.* Nickell and Nicolitsas, 1999) showing that financial constraints have a positive impact on firm performance. Tighter financial constraints increase the threat of bankruptcy and therefore give incentives to managers to increase their effort to improve firm performance. In the context of transition countries, however, soft budget constraints often persisted as documented by the EBRD (1999) and Lizal and Svejnar (2001). In the presence of soft budget constraints we would therefore expect that financial constraints have an effect on the probability of firm survival, or on firm performance. We proxy financial constraints by the ratio of long term debt over total assets in 1994 -*Finance94*.

Sector characteristics: We control for differences across sectors using sectoral dummies (at the 2-digit level of Nace industry classification) - *nacenumber*. Sectors may differ in terms of market concentration, import penetration, production technology, and consumer demand. We believe that these differences can be accounted for by inserting dummies in the estimated regression.

Based on previous evidence, we also include a number of variables in the selection model, which are not included in the growth model. Survival appears to be positively associated with initial firm profitability but negatively related to input costs (Mansfield, 1962; Gibson and Harris, 1996). Hence, we compute: initial production costs (materials and labour costs) normalised by sales revenues - *Totcost94* - and initial profitability - *Profit94* - measured as the ratio of net profits to sales revenues, and introduced them both in the survival equation. We further compute a variable that measures sunk costs of the industry as previous evidence suggests that firm survival is

positively associated with sunk costs. For a measure of exogenous sunk costs we use the logged values of the median tangible fixed assets of the industry in 1994 (*Lsunk94*). This can be interpreted as a measure of minimum efficient scale (MES). We would expect that a high minimum efficient scale is associated with a higher probability of firm survival. Finally, with the transition from plan to market price liberalization was introduced to achieve competitive markets. There exists a substantial literature on the relationship between increased competitive pressure and firm performance (*e.g.* Nickell, 1996; Brown and Earle, 2000), which suggests that increased competitive pressure leads to better firm performance. In transition economies little is known about the impact competitive pressure has on firm performance. Market structure proxies the extent of competitive pressure firms face and some studies have found that the probability of survival decreases with market concentration in the West (Audretsch and Mahmood, 1995). We define market structure as the herfindhal index at the 2-digit NACE classification level for the initial year of our data – *Herf94* - and check for the association between market concentration and firm survival in Slovenia.

Table 3 shows summary statistics of the variables that we use in our estimations. It can be seen that on average the growth rate of employment is 5%, although there are substantial differences between firms, given the large standard deviation. On average the size of Slovenian firms was about 65 workers in 1994 although the standard deviation suggests a wide variation around this number. Indeed, 50% of the firms have less than 10 workers. In our sample and in 1998 around 75% of all the firms were private and 16% were foreign owned firms so that 10% of the firms were state owned firms**.** The average fraction of production that is sold in foreign markets is almost 20%. About 50% of the firms reported trade shares different from 0. In other words, half of the firms in our sample were involved in some international trade. This suggests that

Slovenia is an open economy trading quite considerably in world markets. There is also quite a wide variation in terms of firm profitability, total costs, and financial health. Note that, on average, firms were loss-making.

3. Estimation and Results

Tables 4A, 4B, and 4C show the results for the growth equation estimated using the various model specifications. Table 4A reports the OLS estimations whereas tables 4B and 4C report the estimated growth equation correcting for selection bias (Heckman, 1976, 1979). The Heckman's simple selection model, presented in table 4B, estimates the survival and the growth equation jointly using MLE. The Heckman two-step efficient estimator procedure, reported in table 4C, consists of first estimating the survival equation, and then estimating the growth equation using the inverse Mill's ratio, computed using the first equation, as a regressor. We also check for heteroskedasticity by using robust regression analysis when estimating the growth equation. We use the White variance-covariance matrix correction (White, 1980). The Ramsey reset test tells us whether the model is well specified (Maddala, 1992).

The results are very similar across all model specifications. Version (1) and (2) of all estimation procedures show that size is negatively related to growth in a similar way to that found in studies for the West (*e.g.* Evans, 1987). According to version (3), (4), and (5) of the models growth is found to be associated with the initial size of the firm in a non-linear fashion. Evidence suggests that the relationship between growth, *Avgremp,* and size follows an inverse U-shaped pattern so that small firms grow faster than medium size firms but also very big enterprises grow faster than medium size ones (although the coefficient is rather small). The coefficient estimates for *Lemp94*, *Lemp94sq*, and *Lemp94cb* are around -0.08, 0.013, and -0.0008, and are statistically significant.

Evidence thus indicates that also for Slovenia and for the first four years of transition the Gibrat's law does not hold. Evans (1987) finds a similar non-linear relationship with his coefficient estimates following a similar pattern to ours but with higher magnitudes indicating that the growth of US firms is more strongly associated with size than the growth of Slovenia firms. Goos and Konings (1999), however, when looking at the growth rate of Belgian firms obtain coefficient estimates for *Lemp* and *Lempsq* of a similar magnitude to those of this study (although the authors also use the age of the firm in their regression analysis). A small country like Slovenia may be expected to have an association of a lower magnitude than that of the US and closer to that found for Belgium. Konings (1997) and Walsh and Whelan (2001) use a different estimation procedure and find a negative association between firms' growth rate and size for Bulgaria, Hungary, and Romania. These authors, however, do not check for a non-linear relationship.

Results also suggest that, for the period spanning from 1994 to 1998, the average growth rate of Slovenian firms, *Avgremp*, is positively related to *Private* and to *Foreign* ownership of firms. The coefficient estimates are respectively about 0.05 and 0.03 for our most preferred versions of the models - version (4) and (5), which appear to be well specified according to the Ramsey Reset test in the case of the OLS estimation. This means that Slovenian firms that were private in 1998 grew faster than their state owned counterparts did over that period. Firms whose capital is at least partly owned by foreign firms also performed better.

Moreover, as the positive and significant coefficient of *Forsh94* - about 0.03- suggests that firms whose activity involved trading abroad have also registered a larger growth rate than those trading only in the domestic market. This confirms the

hypothesis put forward by Walsh and Whelan (2001) that trade orientation may be an important factor in explaining firm growth.

There is some evidence that capital intensive firms also have witnessed a stronger rate of growth as given by the sign and significance of the coefficient estimate of *Kinten94* in version (1) and (2) of the models - about 0.003. However, once we take into account the non-linearity relationship of size the association becomes non-significant.

Innovation capacity proxied by the ratio of intangible assets to total assets does not appear to be associated with the average growth rate of Slovenian firms (*i.e.* the coefficient estimate of *Innov94* is not statistically significant). Also the financial health of the firms - *Finnac94* - does not appear to be related to growth.

Finally, a few coefficient estimates for sectoral dummies (computed at the 2-digit NACE classification) are statistically significant implying that average growth rates were different for different sectors. Specifically, average growth rates for the first four years of transition were lower for the following sectors: a) manufacture of textiles; b) manufacture of wearing apparel, dressing and dyeing of fur; c) tanning and dressing of leather, manufacture of luggage, handbags, saddler, harness and footwear; d) manufacture of wood and of products of wood and cork except furniture, straw articles and plaiting materials; e) pulp and paper; f) publishing, printing and reproduction of recorded media; g) rubber and plastic; h) radio, tv and communication equipment; i) other transport equipment; and j) manufacture of furniture.

In terms of the survival equation presented in table 5, we find that the probability of firm survival, given by the variable *Survival,* in Slovenia, increases with size of the firm (as expected). The coefficient estimate for *Lemp94* is positive - about 0.10 - and statistically significant. Initial profitability of the firm is also found to

increase the probability of a firm surviving in Slovenia: the estimated coefficient for *Profit94* is positive - about 0.11 - and significant as predicted by the existing literature. Input costs, measured by *Totcos94*, are negatively and significantly related to survival (also as expected): the coefficient estimated is around -0.18.

Interestingly, firm survival probability decreases with foreign trade involvement whereas the latter is positively related to average firm growth. The coefficient estimate for *Forsh94* is negative in the survival equation - 0.4 - but positive in the growth equation. A rationale is that the involvement in foreign trade by Slovenian firms makes them more prone to external and harder competition decreasing their probability of surviving. However, if they succeed, the fact that they trade abroad leads to a higher growth rate, perhaps a result of the fact that foreign competition is found to increase efficiency (Estrin *et al.*, 2001).

Also interesting is the negative and significant sign of the coefficient associate with the financial health of the firm, *Financ94*, about -0.5. This is in line with the financial literature and has the expected sign for the context where budget constraints are hard. Hence, one can say that in Slovenia, the firms with a financially ill health are more prone to exit the market just as in most market economies. The presence of soft budget constraints, common to socialist economies, appears to have been reduced in the Slovenian transition.

Finally, although bearing the expected sign (as suggested by previous studies) the coefficient estimates for sunk costs, *Lsunk94*, measuring the MES of the sector, and for market concentration, *Herf94*, are not statistically significant. Firm capital intensity, *Kinten94*, and innovation capacity, *innov94*, also do not appear to influence the probability of firm survival in the context of Slovenian transition.

The Heckman selection models estimate several measures of the correlation between the residuals of the two equations. As can be seen at the bottom of table 4B, the estimated *rho* (measuring the correlation between the two equations when in the context of the simple selection model) is not statistically different from zero as also indicated by the likelihood ratio test provided in the same table. The inverse Mill's ratio in the Heckman two-step estimation, represented by the *Mill's lambda* in table 4C, has an associated coefficient estimate that is not statistically significant confirming that selection bias is not a problem in our analysis.

Therefore, evidence suggests that in Slovenia and for the first four years of transition, private and foreign owned firms, whose activity involved foreign trade, grew the fastest. The growth rate was the highest for both small and large firms with the medium size firms growing the least. Finally, large firms and those with initial positive profitability were more likely to remain in activity whilst firms with ill financial health or involved in foreign trade were more likely to close down.

4. Summary and Conclusions

This paper is the first that studies firm growth and survival in a transition economy. We find that average exit rate for the period was 4% although exit rates varied substantially across sectors with wearing apparel registering the highest rate of exit, 19%, and other five sectors registering an exit rate of 10% and more. On average the growth rate of employment is 5%, although there are substantial differences between firms. About 50% of the firms reported positive international trade shares and the average fraction of production sold in foreign markets was almost 20%, which suggests that Slovenia is quite an open economy with a considerable international trade. There is also quite a wide variation in terms of firm size, profitability, total costs, and financial

health. The average size of the firms is 65 workers but 50% of the firms have less than 10 workers. Also, on average, firms were loss-making.

We estimate the growth equation using OLS but also Heckman's (1976, 1979) sample selection correction models so as to control for potential selection bias: the Heckman's simple selection model, which make use of maximum likelihood estimator, and the two-step efficient estimator. If selection bias is in place the OLS coefficient estimates are biased. We also check for heteroskedasticity by using robust regression analysis.

We find evidence that is consistent with predictions for market economies. Our main findings can be summarized as follows. Firm growth is negatively related to firm size in a non-linear way following an inverted U-pattern. Firm survival, on the contrary, is positively related to size. Furthermore, private and foreign firms have higher growth rates than state firms. It has been suggested that an important determinant of firm growth in transition countries is trade orientation of firms. We thus use a firm level proxy for the trade intensity of a firm and find that the higher the trade intensity the higher the growth rate of the firm on average. In contrast, firm survival is negatively related to trade orientation. This suggests that firms that are trading internationally are exposed to more competitive pressure and therefore are more likely to fail, however, once they survive they will also have a superior growth performance.

We find no evidence that innovative capacity matter in determining firm growth, or firm survival. We further find that firms that are financially constrained have lower chances of survival, which suggests that firms in Slovenia face hard budget constraints. Initial profitability and costs appear to be respectively negatively and positively related to firm survival in Slovenia, as previous literature would suggest.

A few issues are left for future research. It is our hope that better and more exhaustive information on the firm will become available thus enabling us to considered the effect of firm age and test the life-cycle theory of firm growth (Jovanovic, 1982), that is, whether growth is negatively related to the age of the firm. Possible interactions between age and size and ownership could then also be tested for the context of Slovenia. Also, we could test the positive influence of age on firm survival (Jovanovic, 1982; Evans, 1987). Moreover, we leave as future research the analysis of the relationship between human capital characteristics and firm survival or growth (Jovanovic, 1982; Nafziger and Terrel, 1996; Rizov and Mathijs, 2001). Our data were limited in terms of information on the human capital of the firms (*e.g.* education and experience of CEO or firm owner). It would also be pertinent to analyse the performance of privatised firms versus *de novo* firms. Changes in corporate governance (*i.e.* changes in ownership) might not have an immediate effect on firm performance and thus test whether some of the perverse incentives and inefficiency inherited from the planned economy remain.

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Tables

Table 1: Comparison between sample employment and employment according to the Slovenian statistical yearbook at the

Nace2	No of firms	Sample Employment	Employment in the book	Sample Representation
15 and 16	282	15859	20688	0.77
17	161	12743	15492	0.82
18	265	13562	18502	0.73
19	66	6595	8240	0.80
20	351	7549	10940	0.69
21	76	5105	6687	0.76
22	565	7188	7649	0.94
23	4	87	330	0.26
24	131	13524	12192	1.11
25	308	7949	10812	0.74
26	159	9309	11097	0.84
27	63	7093	8614	0.82
28	826	16152	23219	0.70
29	343	16217	23292	0.70
30	72	653	796	0.82
31	242	11223	11445	0.98
32	138	5054	6020	0.84
33	167	6406	7242	0.88
34	61	6696	7592	0.88
35	24	2560	2701	0.95
36	369	9445	13095	0.72
37	32	400	714	0.56
Total		181369	227359	0.80

Table 2: Distribution of Firms and Exit Rates

Sector 2-digit Nace	Firms that survived	Firms that exited	Exit rate
15. Food and beverages	181	11	0.06
16. Tobacco products	1	0	0
17. Textiles	105	7	0.06
18. Wearing apparel	144	28	0.19
19. Tanning and dressing of leather, luggage	34	5	0.14
20. Wooed and wood products	170	16	0.09
21. Pulp and paper	44	3	0.07
22. Publishing, printing	303	30	0.10
23. Coke, refined petroleum and nuclear fuel	3	0	0
24. Chemicals	79	8	0.10
25. Rubber and plastic	176	10	0.05
26. Other non-metallic mineral products	97	10	0.10
27. Basic metals	32	2	0.06
28. Fabricated metal products	488	40	0.08
29. Machinery and equipment	216	22	0.10
30. Office machinery and computers	44	4	0.09
31. Electrical machinery and apparatus	152	12	0.07
32. Radio, TV and communication equipment	76	10	0.13
33. Medical, precision and optical instruments	120	4	0.03
34. Motor vehicles, trailers	40	2	0.05
35. Other transport equipment	17	1	0.05
36. Furniture	198	11	0.05
37. Recycling	22	1	0.04

Table 3: Descriptive statistics

Variable	Number Observations	Mean	Standard Deviation
Avgremp	2742	0.051	0.201
Emp94	2811	64.871	233.552
Lemp94	2848	1.920	1.976
Lemp94sq	2848	7.589	11.643
Lemp94cb	2848	36.405	71.630
Private	2848	0.745	0.436
Foreign	2848	0.172	0.377
Kinten94	2800	0.752	7.454
Innov94	2800	0.016	0.197
Forsh94	2694	0.198	0.296
Financ94	2809	0.066	0.173
Profit94	2800	-0.024	0.890
Totcos94	2800	1.146	8.603
Herf94	2811	0.074	0.075
Lsunk94	2848	8.108	0.610

Table 4A: Regression results for the estimation of average firm growth in Slovenia (**avgremp**) using OLS.

Avrgremp	**OLS (1)**		**OLS (2)**		**OLS (3)**		**OLS (4)**		**OLS (5)**	
	coef.	**st. dev.**	**coef.**	**st. dev.**	**coef.**	**st. dev.**	**coef.**	**st. dev.**	**coef.**	**st. dev.**
Lemp94	**-0.0351***	0.0031	**-0.0366***	0.0032	**-0.0786***	0.0111	**-0.0794***	0.0112	**-0.0807***	0.0113
Lemp94sq					**0.0133***	0.0045	**0.0127***	0.0046	**0.0131***	0.0046
Lemp94cb					**-0.0009****	0.0005	**-0.0008****	0.0005	**-0.0008****	0.0005
Private	**0.0384***	0.0167	**0.0388***	0.0168	**0.0549***	0.0174	**0.0552***	0.0175	**0.0536***	0.0176
Foreign	**0.0323***	0.0152	**0.0306***	0.0153	**0.0314***	0.0151	**0.0299***	0.0152	**0.0298***	0.0152
Kinten94	**0.0031****	0.0018	**0.0030****	0.0018	**0.0029**	0.0018	**0.0028**	0.0018	**0.0027**	0.0018
Innov94	**-0.0045**	0.0180	**-0.0065**	0.0180	**-0.0072**	0.0179	**-0.0093**	0.0179	**-0.0096**	0.0179
Forsh94	**0.0251****	0.0141	**0.0357***	0.0146	**0.0154**	0.0142	**0.0257****	0.0147	**0.0248****	0.0147
Financ94									**0.0276**	0.0272
Nace2_16			**-0.0807**	0.1844			**-0.1305**	0.1840	**-0.1310**	0.1840
Nace2_17			**-0.0390**	0.0238			**-0.0431****	0.0237	**-0.0425****	0.0237
Nace2_18			**-0.0734***	0.0220			**-0.0752***	0.0219	**-0.0746***	0.0219
Nace2_19			**-0.0892***	0.0357			**-0.0933***	0.0356	**-0.0925***	0.0356
Nace2_20			**-0.0502***	0.0206			**-0.0481***	0.0205	**-0.0469***	0.0205
Nace2_21			**-0.0584****	0.0313			**-0.0596****	0.0311	**-0.0585****	0.0311
nace2_22			**-0.0467***	0.0183			**-0.0466***	0.0183	**-0.0463***	0.0183
nace2_23			**-0.0181**	0.1071			**-0.0124**	0.1065	**-0.0131**	0.1066
nace2_24			**-0.0233**	0.0253			**-0.0282**	0.0252	**-0.0277**	0.0252
nace2_25			**-0.0504***	0.0205			**-0.0461***	0.0205	**-0.0450***	0.0205
nace2_26			**0.0102**	0.0238			**0.0109**	0.0237	**0.0112**	0.0237
nace2_27			**0.0290**	0.0356			**0.0254**	0.0355	**0.0256**	0.0355
nace2_28			**-0.0302****	0.0172			**-0.0282**	0.0171	**-0.0274**	0.0172
nace2_29			**-0.0333****	0.0195			**-0.0304**	0.0195	**-0.0298**	0.0195
nace2_30			**-0.0176**	0.0316			**-0.0052**	0.0315	**-0.0037**	0.0315
nace2_31			**-0.0195**	0.0213			**-0.0191**	0.0212	**-0.0177**	0.0213
nace2_32			**-0.0595***	0.0262			**-0.0588***	0.0261	**-0.0576****	0.0261
nace2_33			**-0.0413****	0.0228			**-0.0367**	0.0227	**-0.0351**	0.0229
nace2_34			**-0.0347**	0.0329			**-0.0352**	0.0328	**-0.0346**	0.0328
nace2_35			**-0.1128***	0.0471			**-0.1115***	0.0469	**-0.1093***	0.0470
nace2_36			**-0.0388****	0.0200			**-0.0410***	0.0199	**-0.0401***	0.0200
nace2_37			**-0.0478**	0.0457			**-0.0350**	0.0456	**-0.0339**	0.0456
cons	**0.0784***	0.0182	**0.1153***	0.0235	**0.0830***	0.0183	**0.1192***	0.0236	**0.1192***	0.0236
No observ.	**2568**		**2568**		**2568**		**2568**		**2568**	
F-test for joint significance	**F(6,2561)=67.59**	**Prob>F=0**	**F(28,2539)=15.76**	**Prob>F=0**	**F(8,2559)=54.72**	**Prob>F=0**	**F(30,2537)=15.85**	**Prob>F=0**	**F(31,2534)=15.85**	**Prob>F=0**
Adjust. R2	**0.135**		**0.139**		**0.143**		**0.148**		**0.148**	
Ramsey test for ommit vars	**F(3,2558)=11.32**	**Pr>F=0.00**	**F(3,2536)=9.32**	**Pr>F=0.00**	**F(3,2556)=2.42**	**Pr>F=0.07**	**F(3,2534)=2.7**	**Pr>F=0.05**	**F(3,2531)=3.02**	**Pr>F=0.03**

Notes: Coefficient estimates are in bold and are the first column of each estimation procedure. *denotes significance at the 5% critical level; **denotes significance at the 10% critical level. Benchmark of industry dummies is nace15.

Table 4B: Regression results for the estimation of average firm growth in Slovenia (**avgremp**) using the Heckman simple selection model.

Avrgremp	Heckman (1)		**Heckman (2)**		**Heckman (3)**		**Heckman (4)**		**Heckman (5)**	
	Coef.	**St. dev.**	**Coef.**	**st. dev.**	**Coef.**	**st. dev.**	**Coef.**	**st. dev.**	**Coef.**	**st. dev.**
Lemp94	**-0.0357***	0.0032	**-0.0371***	0.0032	**-0.0794***	0.0111	**-0.0802***	0.0111	**-0.0815***	0.0112
Lemp94sq					**0.0134***	0.0045	**0.0128***	0.0045	**0.0131***	0.0045
Lemp94cb					**-0.0009****	0.0005	**-0.0008****	0.0005	**-0.0008****	0.0005
Private	**0.0383***	0.0166	**0.0388***	0.0167	**0.0550***	0.0174	**0.0552***	0.0174	**0.0533***	0.0175
Foreign	**0.0322***	0.0152	**0.0305***	0.0152	**0.0313***	0.0151	**0.0298***	0.0152	**0.0296***	0.0152
Kinten94	**0.0031****	0.0018	**0.0031****	0.0018	**0.0029**	0.0018	**0.0029**	0.0018	**0.0028**	0.0018
Innov94	**-0.0036**	0.0181	**-0.0056**	0.0180	**-0.0063**	0.0180	**-0.0085**	0.0179	**-0.0086**	0.0179
Forsh94	**0.0279***	0.0145	**0.0382***	0.0149	**0.0181**	0.0145	**0.0282****	0.0149	**0.0276****	0.0148
Financ94									**0.0312**	0.0272
Nace2_16			**-0.0807**	0.1840			**-0.1308**	0.1835	**-0.1314**	0.1836
Nace2_17			**-0.0388**	0.0237			**-0.0429****	0.0236	**-0.0422****	0.0236
Nace2_18			**-0.0732***	0.0219			**-0.0750***	0.0218	**-0.0743***	0.0218
Nace2_19			**-0.0897***	0.0355			**-0.0938***	0.0354	**-0.0929***	0.0354
Nace2_20			**-0.0498***	0.0205			**-0.0477***	0.0204	**-0.0463***	0.0204
Nace2_21			**-0.0587****	0.0311			**-0.0599****	0.0309	**-0.0587****	0.0310
Nace2_22			**-0.0464***	0.0183			**-0.0463***	0.0182	**-0.0458***	0.0182
Nace2_23			**-0.0166**	0.1067			**-0.0110**	0.1061	**-0.0115**	0.1062
Nace2_24			**-0.0236**	0.0252			**-0.0285**	0.0250	**-0.0280**	0.0250
Nace2_25			**-0.0510***	0.0205			**-0.0467***	0.0204	**-0.0455***	0.0204
Nace2_26			**0.0101**	0.0237			**0.0108**	0.0235	**0.0111**	0.0235
Nace2_27			**0.0286**	0.0354			**0.0250**	0.0353	**0.0251**	0.0353
Nace2_28			**-0.0296****	0.0171			**-0.0276**	0.0171	**-0.0266**	0.0171
Nace2_29			**-0.0333****	0.0195			**-0.0304**	0.0194	**-0.0297**	0.0194
Nace2_30			**-0.0176**	0.0314			**-0.0051**	0.0313	**-0.0035**	0.0313
Nace2_31			**-0.0192**	0.0212			**-0.0188**	0.0211	**-0.0172**	0.0211
Nace2_32			**-0.0595***	0.0261			**-0.0589***	0.0259	**-0.0574***	0.0260
Nace2_33			**-0.0404****	0.0228			**-0.0356**	0.0227	**-0.0352**	0.0227
Nace2_34			**-0.0363**	0.0329			**-0.0367**	0.0327	**-0.0364**	0.0327
Nace2_35			**-0.1134***	0.0469			**-0.1121***	0.0467	**-0.1097***	0.0467
Nace2_36			**-0.0384****	0.0199			**-0.0405***	0.0198	**-0.0394***	0.0199
Nace2_37			**-0.0483**	0.0455			**-0.0354**	0.0453	**-0.0343**	0.0453
_cons	**0.0822***	0.0186	**0.1186***	0.0237	**0.0868***	0.0187	**0.1225***	0.0238	**0.1227***	0.0237
Rho	**-0.2178**	0.2378	**-0.2023**	0.2480	**-0.2182**	0.2174	**-0.2039**	0.2252	**-0.2317**	0.1897
No observations	**2656**		**2656**		**2656**		**2656**		**2656**	
Wald test for joint signific.	**Chi2(6)=388.6**	**P>chi2=0**	**chi2(28)=423.8**	**P>chi2=0**	**chi2(8)=423.5**	**P>chi2=0**	**chi2(30)=463.3**	**P>chi2=0**	**chi2(31)=471.3**	**P>chi2=0**
LR for independence of eqs.	**chi2(1)=0.27**	**P>chi2=0.6**	**chi2(1)=0.26**	**P>chi2=0.6**	**chi2(1)=0.36**	**P>chi2=0.5**	**chi2(1)=0.35**	**P>chi2=0.5**	**chi2(1)=0.62**	**P>chi2=0.4**
Log-likelihood	**330.20**		**347.17**		**344.36**		**362.11**		**362.77**	

Notes: Coefficient estimates are in bold and are the first column of each estimation procedure. *denotes significance at the 5% critical level; **denotes significance at the 10% critical level. Benchmark of industry dummies is nace15.

Table 4C: Regression results for the estimation of average firm growth in Slovenia (**avgremp**) using the Heckman two-step model.

Avrgremp	**Heckman (1)**		**Heckman (2)**		**Heckman (3)**		**Heckman (4)**		**Heckman (5)**	
	Two-step		**Two-step**		**Two-step**		**Two-step**		**Two-step**	
	Coef.	**St. dev.**	**Coef.**	**St. dev.**	**Coef.**	**St. dev.**	**Coef.**	**St. dev.**	**Coef.**	**St. dev.**
Lemp94	**-0.0364***	0.0037	**-0.0384***	0.0038	**-0.0808***	0.0113	**-0.0821***	0.0114	**-0.0865***	0.0180
Lemp94sq					**0.0134***	0.0045	**0.0129***	0.0046	**0.0135****	0.0071
Lemp94cb					**-0.0009****	0.0005	**-0.0008****	0.0005	**-0.0008**	0.0007
Private	**0.0383***	0.0167	**0.0388***	0.0168	**0.0551***	0.0175	**0.0553***	0.0176	**0.0521****	0.0274
Foreign	**0.0323***	0.0152	**0.0304***	0.0154	**0.0314***	0.0153	**0.0296***	0.0154	**0.0292**	0.0239
Kinten94	**0.0032****	0.0019	**0.0032****	0.0019	**0.0030**	0.0019	**0.0031**	0.0019	**0.0030**	0.0030
Innov94	**-0.0025**	0.0185	**-0.0033**	0.0188	**-0.0044**	0.0186	**-0.0054**	0.0190	**-0.0023**	0.0299
Forsh94	**0.0310****	0.0170	**0.0447***	0.0181	**0.0233**	0.0171	**0.0368***	0.0182	**0.0450**	0.0292
Financ94									**0.0539**	0.0478
Nace2_16			**-0.0813**	0.1897			**-0.1319**	0.1927	**-0.1342**	0.3037
Nace2_17			**-0.0388**	0.0238			**-0.0428****	0.0237	**-0.0414**	0.0367
Nace2_18			**-0.0730***	0.0222			**-0.0747***	0.0223	**-0.0732***	0.0347
Nace2_19			**-0.0907***	0.0358			**-0.0952***	0.0358	**-0.0952****	0.0556
Nace2_20			**-0.0489***	0.0207			**-0.0464***	0.0206	**-0.0427**	0.0321
Nace2_21			**-0.0595****	0.0313			**-0.0610****	0.0313	**-0.0600**	0.0485
Nace2_22			**-0.0453***	0.0185			**-0.0449***	0.0185	**-0.0426**	0.0288
Nace2_23			**-0.0150**	0.1090			**-0.0086**	0.1097	**-0.0066**	0.1717
Nace2_24			**-0.0241**	0.0254			**-0.0293**	0.0254	**-0.0292**	0.0393
Nace2_25			**-0.0525***	0.0208			**-0.0487***	0.0209	**-0.0487**	0.0325
Nace2_26			**0.0100**	0.0238			**0.0106**	0.0238	**0.0109**	0.0369
Nace2_27			**0.0275**	0.0358			**0.0236**	0.0358	**0.0222**	0.0556
Nace2_28			**-0.0285**	0.0174			**-0.0260**	0.0174	**-0.0226**	0.0273
Nace2_29			**-0.0337****	0.0196			**-0.0309**	0.0196	**-0.0302**	0.0303
Nace2_30			**-0.0176**	0.0315			**-0.0051**	0.0315	**-0.0023**	0.0488
Nace2_31			**-0.0186**	0.0214			**-0.0179**	0.0214	**-0.0142**	0.0333
Nace2_32			**-0.0601***	0.0263			**-0.0596***	0.0263	**-0.0579**	0.0409
Nace2_33			**-0.0406****	0.0230			**-0.0358**	0.0231	**-0.0354**	0.0358
Nace2_34			**-0.0403**	0.0341			**-0.0422**	0.0343	**-0.0472**	0.0539
Nace2_35			**-0.1150***	0.0472			**-0.1143***	0.0471	**-0.1124**	0.0730
Nace2_36			**-0.0373****	0.0202			**-0.0391****	0.0201	**-0.0357**	0.0314
Nace2_37			**-0.0492**	0.0459			**-0.0366**	0.0459	**-0.0360**	0.0712
cons	**0.0864***	0.0219	**0.1265***	0.0267	**0.0938***	0.0222	**0.1332***	0.0270	**0.1448***	0.0431
Mill's lambda	**-0.0875**	0.1368	**-0.1300**	0.1475	**-0.1184**	0.1364	**-0.1625**	0.1467	**-0.3018**	0.2572
No observations	**2656**		**2656**		**2656**		**2656**		**2656**	
Wald test for joint signific.	**chi2(10)=293.02**	**Pr>chi2=0**	**chi2(32)=323.51**	**Pr>chi2=0**	**chi2(12)=320.02**	**Pr>chi2=0**	**chi2(34)=350.2**	**Pr>chi2=0**	**chi2(36)=159.02**	**Pr>chi2=0**

Notes: Coefficient estimates are in bold and are the first column of each estimation procedure. *denotes significance at the 5% critical level; **denotes significance at the 10% critical level. Benchmark of industry dummies is nace15.

Table 5: Regression results for the probability of firm survival in Slovenia (**survival**) estimated when using both the Heckman simple selection and the two-step estimation procedures.

Survival	**Heckman (1)**		**Heckman (2)**		**Heckman (3)**		**Heckman (4)**		**Heckman (5)**		**Heckman**	
	Simple selection		**Simple selection**		**Simple selection**		**Simple selection**		**Simple selection**		**Two-step**	
	Coef.	**St. dev**	**Coef.**	**St. dev**	**Coef.**	**St. dev**	**Coef.**	**St. dev**	**Coef.**	**St. dev**	**Coef.**	**St. dev**
Lemp94	**0.0961***	0.0315	**0.0979***	0.0310	**0.0976***	0.0312	**0.0993***	0.0308	**0.0985***	0.0308	**0.1013***	0.0302
Kinten94	**0.0178**	0.0271	**0.0176**	0.0267	**0.0181**	0.0271	**0.0178**	0.0267	**0.0184**	0.0269	**0.0148**	0.0251
Innov94	**-0.1136**	0.1580	**-0.1115**	0.1575	**-0.1129**	0.1579	**-0.1108**	0.1574	**-0.1117**	0.1572	**-0.1045**	0.1570
Forsh94	**-0.4278***	0.1663	**-0.4342***	0.1654	**-0.4244***	0.1659	**-0.4307***	0.1652	**-0.4277***	0.1650	**-0.4413***	0.1639
Profit94	**0.1147****	0.0633	**0.1137****	0.0634	**0.1160****	0.0634	**0.1150****	0.0635	**0.1155****	0.0632	**0.1104****	0.0654
Totcos94	**-0.1865***	0.0743	**-0.1868***	0.0748	**-0.1879***	0.0746	**-0.1882***	0.0750	**-0.1893***	0.0743	**-0.1784***	0.0770
Financ94	**-0.5087***	0.2074	**-0.5125***	0.2072	**-0.5040***	0.2070	**-0.5077***	0.2068	**-0.5204***	0.2086	**-0.5173***	0.2068
Herf94	**0.7803**	0.8717	**0.9429**	0.8717	**0.7867**	0.8712	**0.9430**	0.8710	**0.9535**	0.8709	**0.8938**	0.8643
Lsunk94	**0.1043**	0.0999	**0.0842**	0.1003	**0.1048**	0.1000	**0.0844**	0.1001	**0.0833**	0.1001	**0.0893**	0.0996
cons	**1.0783**	0.7776	**1.2285**	0.7834	**1.0721**	0.7786	**1.2244**	0.7815	**1.2348**	0.7809	**1.1817**	0.7779

Notes: Coefficient estimates are in bold and are the first column of each estimation procedure. *denotes significance at the 5% critical level; **denotes significance at the 10% critical level.

Appendix

The Heckman selection model assumes that there is an underlying regression equation (in our case explaining the average growth of the firm) of the type:

$$y_j = x_j\beta + u_{1j} \qquad \text{regression. eq.}$$

(A1)

where the dependent variable is not always observed. Indeed, the dependent variable for observation *j* is only observed if

$$z_j\gamma + u_{2j} > 0 \qquad \text{selection eq.}$$

(A2)

that in our case means that firm growth is observed only if the firm is still is business. It is further assumed that u_{1j} and u_{2j} are normally distributed with mean zero and variance σ and 1, respectively. However, they may be potentially correlated, with correlation ρ. If this is the case, $\rho \uparrow 0$, standard regression techniques applied to equation (A1), or to equation (1) in the main text, yield biased results.

One way around it consists of estimating jointly, using maximum likelihood techniques, the probability of survival and the growth equation. A measure of the correlation of the residuals from the two equations is then computed as a way of identifying the presence of selection bias. This measure can be ρ as defined above (and the one presented on the tables) or $\lambda=\rho\sigma$. A similar method, the Heckman's two-step estimator, consists of first estimating the probability of survival using all the firms in the sample, and then estimating the growth equation using as an additional regressor the inverse Mill's ratio (the Mill's lambda on the tables). This is computed using the survival

equation and all the sample firms as $m_j = \frac{\phi(z_j\hat{\gamma})}{\Phi(z_j\hat{\gamma})}$. This procedure yields consistent estimates. A statistically significant coefficient estimate of the inverse Mill's ratio confirms the existence of selection bias.