Small Business Economics (2005) 24: 487-495
DOI 10.1007/s11187-005-6446-y

The Turnover of Firms and Industry Growth

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ABSTRACT. In a dynamic setting, every firm can be regarded as a "business experiment" with the objective to search and explore new business opportunities. It is suggested that the growth of an industry is enhanced by new-firm entry, since a positive correlation between the number of successes, i.e. fast-growing firms, and the number of business experiments is to be expected. Exit is necessary to sort out the firms that the market rejects. Hence, it is rather the entry and exit of firms that jointly should have a positive effect on growth, rather than the number of entries in isolation. This paper tests the hypothesis that a high turnover rate of firms has no, or a negative, effect on industry growth. The analysis is based on an extensive data set covering all Swedish IT firms that existed between 1994 and 1998. The turnover rate of firms is found to have a significantly positive effect on industry growth.

1. Introduction

An extensive literature has demonstrated the importance of new, small and fast-growing firms for economic performance. For example, it has been shown that they generate the majority of new jobs on net (e.g., Birch, 1979; Birch and Medoff, 1994; Loveman and Sengenberger, 1991; Kirchhoff, 1994; Acs, 1996; Acs et al., 1999; Audretsch, 2002). However, much less interest has been devoted to the relationship between firm *turnover* (here defined as the sum of entering and exiting firms in relation to the total number of firms in an industry), job generation and economic growth.[1] For instance, Fritsch (1996, p. 233) writes:[2]

> "The relationship between, entries, exits, turbulence, and subsequent economic growth has virtually remained empirically unexplored. One main reason for this paucity of studies is the lack of appropriate data. In particular, reliable data on entries and exits are available only in a few countries and often from very recent sources."

The issue of the effects of firm turnover is different from the one investigated in most earlier studies, and it needs to be explored further both theoretically and empirically. The question is whether the rate of entry and exit is important in itself.

One indication of its importance can be derived from Schumpeterian theory. According to Schumpeter (1934, p. 66), an innovation is defined as the introduction of a new combination into the economic system and the carrying out of this function defines the entrepreneur. Each innovation represents new knowledge, which implies that the economic actors' information about the value of the innovations is uncertain. Thus, each innovation, as well as each firm, may be regarded as a business experiment tested in the market.[3] One should, therefore, expect a positive correlation between the number of entering firms, or the number of business experiments, and the number of experiments that turn out to be successful, i.e., the number of fast-growing firms. Moreover, a number of studies suggest that new firms are more prone than established firms to introduce radically new innovations with large economic potential (e.g., Almeida and Kogut, 1997; Almeida, 1999).

The positive effects of firm entry can, however, be expected to be limited without exit. Exit is necessary to sort out the entrants that the market test rejects and, in general, to set resources free for expanding firms. For instance, Audretsch (1995) notes that gross entry and exit is more important than net entry in generating jobs, probably because a lot of the entries are aimed at a search for new opportunities. Hence, it is rather the entry and exit of firms jointly that should have

Final version accepted on July 29, 2003

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a positive effect on growth, rather than the number of entries in isolation.

This approach on the role of entry (and exit) differs from the traditional static view where new firms are perceived to *eliminate* positive profits from incumbent firms. The static view is more in line with the Walrasian theory where entering firms exhaust well-defined and exogenously given business opportunities, while the dynamic approach used here emphasizes new entry as an act of entrepreneurship *creating* profits and expanding the economic system.[4] The expansion takes place through – what Schumpeter (1942) called – a process of creative destruction, where new innovations challenges and replaces established structures – if successful. As discussed, new firms are expected to be instrumental for introducing radically new innovations into the economy and the exit of firms is expected to be instrumental to destroy obsolete combinations. Equivalently, a high turnover rate of firms is expected to speed up the search process for new business opportunities and the reallocation of resources from firms that are unsuccessful in identifying and commercializing new business opportunities to firms that are successful.

The basic idea in this paper follows this trait and suggests that the rate of business experimentation, measured as the turnover of firms, within an industry has a positive effect on the growth of that particular industry. More specifically, an econometric test of the hypothesis that the turnover of firms has no, or negative, effect on industry employment growth is carried out. The analysis is based on a comprehensive data set including all firms in the Swedish information technology (IT) industry between 1994 and 1998.

The conclusions from previous studies on the effect on the turnover of firms on economic performance are ambiguous; some research has found a positive relationship (e.g., Davidsson et al., 1994a, b, 1996; Kirchhoff, 1994; Callejón and Segarra, 1999), while others have found no, or even a negative, relationship (e.g., Audretsch and Fritsch, 1996).

The paper proceeds as follows: The next section (Section 2) introduces the data and the econometric model. The following section (Section 3) presents the results. Section 4 concludes this paper with a comment upon the results.

2. Data and econometric model

The econometric analysis is based on data from the central register of firms and establishments (*Centrala företags- och arbetsställeregistret*, CFAR) compiled by Statistics Sweden (*Statistiska Centralbyrån*, SCB). Every firm in Sweden is obliged to register by law. Therefore, CFAR covers all firms active in Sweden. Hence, it covers firms of all sizes (from firms without any employees to firms with thousands of employees), legal forms (sole proprietorships, stock companies etc.) and industries (manufacturing as well as service). Furthermore, data are collected annually.[5]

Even though CFAR covers all firms, the register, however, contains quite limited information on each firm: the number of employees, date of "birth", date of "death", ownership (if the firm is privately owned or owned by the government) and if the firm belongs to an enterprise group or is independent. SCB has mainly used it as a population register when conducting surveys on firms. It would have been desirable to include data on other variables that can account for growth, for instance profitability and R&D investments. Another of SCB's register, Enterprises: Financial Accounts (*Företagen finansstatistken*; EFA), contains data on the firms' balance sheets and income statements. Hence, it includes data on several variables that would be of interest for this analysis. However, in 1994 only a smaller sample of firms is covered in EFA because of the costs to survey all firms. Moreover, data from EFA for the years 1997 and 1998 were not available for this study. Still, econometric analysis has been carried out using the data available from EFA. The results are similar to the ones obtained using only CFAR.[6] Because of reasons of parsimoniousness and to cover a longer time period the analysis in this paper, therefore, is solely based on CFAR. Hence, the model applied to test the effect from firm turnover on industrial growth is quite limited in terms of the number of variables included, while it is exhaustive concerning the number of included firms.

This paper uses the commonly employed definition of the IT industry applied by Statistics Sweden when classifying industries. According to this definition, the Swedish IT industry comprises

the following subindustries: manufacturing IT industry, industry that trades in IT equipment, telecommunications industry and data consulting and data service industry. These four broadly defined industries are, in turn, defined by a number of industries at a lower level of aggregation. In total, the Swedish IT industry comprises 26 industries at the 6-digit level in the SNI92 industry-classification system, the lowest level at which firms are classified in this system (see Table III in Section 3).[7]

SNI92 was employed in 1993 to make Swedish statistics correspond to the statistics of the European Union. Because of the change of industrial classification system it is difficult and costly to follow individual firms further back in time. Also, data on exits are not available for 1993. Therefore, the analysis begins in 1994. It ends in 1998; the last year data were available for this paper. In 1998, the Swedish IT industry encompassed about 27,000 firms.

In principle, the analysis could have been carried out on any industry. However, there are a few reasons why the IT industry is the focus of this paper. First, it is of particular interest considering the Schumpeterian theory that underlies this paper and which emphasizes creativity and innovations. The (recent) development of the information technology has been instrumental for the exploration of new knowledge fields, e.g. gene technology, encouraging novel innovations. It is also large (and during the 1990's exceptionally fast-growing), producing a generic technology inducing a transformation of production (and societies) in the whole world. Moreover, since the work of Coase, transactions costs, or information costs as Dahlman (1979) calls them, have come to be at the center of economic analysis. They have been shown to be large; e.g. Wallis and North (1986) estimate them to be close to half of the United States GDP. The information technology has a major impact on these costs (see Johansson 2001, chapter 3 for an elaboration of these arguments).[8]

The econometric tests have been carried out in the following manner.[9] The dependent variable is industry employment growth and the main explanatory variable is the rate of firm turnover.[10] Several other explanatory variables are included as well, in particular the rate of entry and exit; see below. The following model is used to analyze the effects of firm turnover on industrial growth:

$$GROWTH_{i,t} = \beta_0 + \beta ENTRY \times ENTRY_{i,t} + \beta_{EXIT} \times EXIT_{i,t} + \beta_{TURNOVER} \times TURNOVER_{i,t} + \beta_{other} \times Z^{other}_{i,t-1} + u_{i,t}$$

where $GROWTH_{i,t}$ is a vector on the growth of IT industry i at time t. $ENTRY_{i,t}$, $EXIT_{i,t}$ and $TURNOVER_{i,t}$ are vectors on firm entry, exit and turnover in industry i at time t. $u_{i,t}$ is the error term. $Z^{other}_{i,t-1}$ represents a vector with other explanatory variables, including the average age of firms in each industry, the average size of the firms in each industry, the quadratic form of age and size, the share of employment due to enterprise groups and the share of employment due to governmentally owned firms. The null hypothesis that is tested is:

$$H_0: \beta_{TURNOVER} \geq 0.$$

The variables are defined as follows:

Dependent variable:

$GROWTH_{i,t}$: The change in the number of employees in industry i between time $t-1$ and t (per cent).[11]

Main explanatory variable:

$TURNOVER_{i,t}$: The turnover rate of firms in industry i at time t defined as the sum of the number of new firms and the number of exiting firms divided with the total number of firms in industry i at time t.

Other explanatory variables:

$ENTRY_{i,t}$: New firms as a share of all firms in industry i at time t (per cent). A firm is defined as new when it is registered for value-added tax employment *or* registered as an employer in CFAR.

$EXIT_{i,t}$: Firms that exited as a share of all firms in industry i at time t (per cent). A firm is defined as exiting when it is deregistered for value-added tax payments *and* deregistered as an employer.

$AGE_{i,t-1}$: The average age of the firms in industry i at time $t-1$. A firm established at time $t-1$ is defined as 1 year old, a firm established in time $t-2$ as 2 years old and so on.

TABLE I
Summary statistics

Variable	Description	Mean	Std. dev.
GROWTH	Growth of employees (in per cent)	44.28	336.40
ENTRY	The number of entering firms (per cent)	15.90	10.22
EXIT	The number of exits (per cent)	7.28	3.53
TURNOVER	The sum of entries and exits divided with the total sum of firms (per cent)	22.34	12.79
AGE	Average age of firms	6.27	2.06
SIZE	Average size of firms	26.02	59.11
AGE^2	The quadratic form of age	43.59	26.67
$SIZE^2$	The quadratic form of size	4144.81	15601.18
ENTG	The share of employment in enterprise groups (per cent)	65.01	26.89
OWNER	The share of employment in firms owned by the government (per cent)	13.01	24.59

Source: Statistics Sweden (CFAR) and own calculations.

$SIZE_{i,\,t-1}$: The average size (number of employees) of the firms in industry i at time $t - 1$.

$AGE^2_{i,\,t-1}$: The average age of the firms in industry i at time $t - 1$ raised to the second power.

$SIZE^2_{i,\,t-1}$: The average size (number of employees) of the firms in industry i at time $t - 1$ raised to the second power.

$ENTG_{i,\,t-1}$: The share of employment in firms belonging to an enterprise group in industry i at time $t - 1$ (per cent).

$OWNER_{i,\,t-1}$: The share of employment in firms owned by the government in industry i at time $t - 1$ (per cent).

The data set includes cross-sectional and time-series observations, i.e., the data set represents a panel, where each industry is regarded as an individual observation. The panel is balanced, i.e., there are observations on all industries all years. An F-test rejects poolability and a Hausman test rejects the assumption that the disturbances and explanatory variables are independent. A fixed-effect model is, therefore, applied in the analysis. The variables are summarized in Table I.

The correlation of the variables is presented in Table II. The correlation between *AGE* and AGE^2 is high, as is the correlation between *SIZE* and $SIZE^2$. *ENTRY* and *TURNOVER* also show a high correlation.

After estimating the core model, regressions were run on the change of the number of employees; ordinary least squares models, log-linear models and random effects-models were applied; standard techniques applied to correct for

TABLE II
Table of correlation

	GROWTH	*ENTRY*	*TURN-*OVER	*EXIT*	*AGE*	*SIZE*	AGE^2	$SIZE^2$	*ENTG*	OWNER
GROWTH	1.00									
ENTRY	0.066	1.00								
TURNOVER	0.058	0.86	1.00							
EXIT	–0.024	–0.034	0.24	1.00						
AGE	–0.20	–0.50	–0.50	–0.050	1.00					
SIZE	–0.060	–0.045	–0.050	–0.022	0.067	1.00				
AGE^2	–0.16	–0.48	–0.48	–0.042	0.99	0.099	1.00			
$SIZE^2$	–0.040	0.041	0.022	–0.014	0.051	0.96	0.083	1.00		
ENTG	–0.27	–0.20	–0.16	–0.39	0.059	0.42	0.065	0.32	1.00	
OWNER	–0.077	–0.26	0.051	–0.060	–0.34	0.45	–0.32	0.33	0.32	1.00

Source: Statistics Sweden (CFAR) and own calculations.

simultaneity bias were used; and adjustments for heteroscedasticity and autocorrelation and a number of other adjustments were made to test the robustness of the results. The results are robust.

3. Results

3.1. *Description*

Average employment growth in 1994 to 1998 varies a lot between the different industries (Table III). The industry for broadcasting stations (SNI92: 64202) shows the fastest average employment growth (more than 700 per cent), followed by the industry for the reproduction of computer media (SNI92: 22330) and stores for telecommunications equipment (SNI92: 52494), with an average employment growth of 147 and of 114 per cent, respectively. These three industries are small employers and comprise few firms. This, of course, is one major explanation for the high growth. They employ 641 (10), 73 (49) and 740 (172) employees on average respectively (the average number of firms in parentheses). There are a few industries that show negative average growth in employment. Employment fell the most, about one fifth on average, in companies renting

TABLE III
Average employment, average employment growth, average number of firms, and average gross entry and exit of firms, Swedish IT industry, 1994–98

SNI92 Industry Code	Industry	Employment	Growth (%)	Firms	Entry (%)	Exit (%)
Manufacturing IT industry						
30010	Office machinery	1,529	–1	63	4	4
30020	Computers etc.	3,232	–17	367	9	9
32100	Electronic components	4,749	21	253	14	6
32200	Television, radio transmitters, telephones etc.	29,038	6	118	12	8
32300	Television and radio receivers etc.	2,155	18	150	10	7
33200	Instruments for measuring etc.	11,638	9	455	12	5
33300	Industrial process control equipment	951	50	129	18	3
Trade in IT equipment industry						
22330	Industry for the reproduction of computer media	73	147	49	34	5
51142	Agents: Sale of computer equipment	264	4	132	17	10
51432	Wholesale: Radio and television goods	1,607	–5	431	6	10
51640	Wholesale: Office equipment	20,472	4	2,895	10	9
51653	Wholesale: Telecommunications equipment	6,051	5	1,102	9	6
52452	Retail: Radio and television stores	4,269	2	1,625	4	9
52493	Retail: Stores for computers, computer programs etc.	1,657	15	1,100	25	9
52494	Retail: Stores for telecommunications equipment	740	114	172	22	8
71330	Companies for renting office equipment etc.	522	–21	219	5	13
Telecommunications industry						
64201	Network stations	26,520	–6	201	21	9
64202	Broadcasting stations	641	736	10	7	7
64203	Cable television companies	585	–2	58	8	4
Data consulting and data services industry						
72100	Hardware consulting companies	1,871	21	813	26	7
72201	Software consulting companies	25,385	14	9,545	22	7
72202	Software supply companies	6,469	21	1,228	28	6
72300	Data processing companies	5,972	3	635	13	6
72400	Data base companies	1,008	4	84	29	9
72500	Repair shops for computing machinery	1,388	–4	304	17	9
72600	Other data service companies	482	14	206	25	5

Note: The numbers in the table are calculated as average employment etc. for the period 1994 to 1998.
Source: Statistics Sweden (CFAR) and own calculations.

office equipment (SNI92: 71330). It fell the second and third most in the industries for the manufacturing of computers (SNI92: 30020) and network stations (SNI92: 64201), 17 and 6 per cent, respectively.

Firm average gross entry is high in many industries. More than one third of the industries report gross entry rates exceeding 20 per cent per year on average. The industry for the reproduction of computer media (SNI92: 22330) reports an average gross entry rate of about one third, and data base companies (SNI92: 72400) and software supply companies (SNI92: 72202) 29 and 28 per cent, respectively. The industries for the manufacturing of office machinery (SNI92: 30010) and radio and television stores (SNI92: 52493) report the lowest average gross entry rate (4 per cent).

The average exit rates are much smaller than the average gross entry rates. The highest average exit rates are observed in companies that rent office equipment etc. (SNI92: 71330), agents involved in the sale of computer equipment (SNI92: 51142) and wholesale of radio and television goods (SNI92: 51432); 13, 10 and 10 per cent, respectively. The average exit rates in the other industries are less than 10 per cent. The lowest average exit rate (3 per cent) is reported in the industry for the manufacturing of industrial process control equipment (SNI92: 33300).

New-firm formation has been surprisingly active in many industries, and it is much higher than reported in, for instance, Reynolds et al. (1994). It has been impossible to determine from the statistics why this is so. One plausible reason is that there are few firms in some industries. In these, small changes in the number of firms give raise to large relative changes. Another reason could be that the IT industry was "booming" during the studied time period and that new-firm formation and the business cycle are correlated (this can also explain the low exit rates). The thresholds for entering firms in terms of real capital requirements etc. are also extremely low in many of these industries. Many of the high-entry industries, furthermore, carry out typically outsourcable activities, thus offering incentives for employees to earn more from selling the services to their former employer and to other customers in their own companies. The underlying knowledge conditions of the IT industry may have been conducive to an entrepreneurial regime during this period, which would have favored new-firm formation (Nelson and Winter, 1982; Audretsch and Fritsch, 2002). Aggregate data, also, show a spectacularly large increase in the total number of firms in the IT industry (Johansson, 2001, Chapter 4). High entry rates are in accordance with that fact.

3.2. *Regression results*

The regressions are run on combinations of two of the explanatory variables ENTRY, EXIT and TURNOVER. It is impossible to run regressions including all these three variables because of perfect multicollinearity. The other explanatory variables are included in all regressions. In total, six regressions are run; see Table IV.

The rate of firm turnover has a positive effect, significant at the 1 per cent level, in all three regressions where it is included. In line with our expectations, we can, therefore, reject the hypothesis that the rate of firm turnover has no, or a negative, effect on industry employment growth.[12]

The entry rate of firms shows a positive effect (significant at the 1 per cent level) in two out of three regressions. This is what is to be expected, since entry adds employment to an industry. It shows, however, a negative effect (also significant at the 1 per cent level) when run together with the turnover rate of firms. This is not in line with expectations and is probably caused by the high multicollinearity between these two variables.

The rate of firm exits shows a significantly negative effect (at the 1 per cent level) in all regressions where it is included. In the case of exit it is difficult to tell whether this is an expected result or not; its effect can be positive, negative or neutral. In the short run, exit will have a negative effect on growth since firms are closed down. In the long run exit is supposed to have a positive effect on growth since it sets resources free to be reallocated and used in more efficient business ventures.[13]

The average age of firms in different industries shows a negative effect on industrial growth. The effect is insignificant in one of the regressions (Regression 4). It is significant at the 1 per cent level in Regression 5, at the 5 per cent level in Regressions 2, 3 and 6, and at the 10 per cent level

TABLE IV
Regression results

Dependent variable	Regression 1 *GROWTH*	Regression 2 *GROWTH*	Regression 3 *GROWTH*	Regression 4 *GROWTH*	Regression 5 *GROWTH*	Regression 6 *GROWTH*
ENTRY	–	–23.65***	–	9.35***	–	9.18***
		(–3.61)		(3.90)		(4.06)
EXIT	–	–	–32.83***	–	–24.18***	–23.65***
			(–4.77)	(–3.43)	(–3.61)	
TURNOVER	5.84***	32.84***	9.19***	–	–	–
	(2.38)	(4.77)	(4.06)			
AGE	–151.26*	–192.99**	–192.99**	–131.82	–183.86***	–192.99**
	(–1.29)	(–1.81)	(–1.81)	(–1.18)	(–2.53)	(–1.81)
SIZE	–29.22***	–28.31***	–28.32***	–29.20***	–27.80***	–28.31***
	(–6.95)	(–7.45)	(–7.45)	(–7.26)	(–6.79)	(–7.44)
AGE^2	14.50*	13.90**	13.90**	12.39*	20.37***	13.90**
	(1.62)	(1.72)	(1.72)	(1.44)	(2.38)	(1.72)
$SIZE^2$	0.062***	0.058***	0.058***	0.061***	0.058***	0.058***
	(6.57)	(6.73)	(6.73)	(6.73)	(6.33)	(6.73)
ENTG	–1.05	–1.01	–1.01	–0.63	–2.35**	–1.01
	(–0.70)	(–0.74)	(–0.74)	(–0.44)	(–1.66)	(–0.74)
OWNER	–4.14***	–4.78***	–4.78***	–4.67***	–3.46**	–4.78***
	(–3.93)	(–2.94)	(–2.94)	(–2.71)	(–2.01)	(–2.94)
CONSTANT	855.85**	1307.96***	1307.96***	798.94**	1792.42***	1307.96***
	(2.25)	(3.67)	(3.67)	(2.30)	(4.95)	(3.67)
R^2	0.67	0.73	0.76	0.70	0.69	0.73
F-value	28.25	33.11	37.81	32.00	30.60	33.11
Number of observations	130	130	130	130	130	130

Note: ***, **, * signifies that the coefficient is significant at the 1 per cent, 5 per cent and 10 per cent level respectively. *t*-values in parentheses.
Source: Statistics Sweden (CFAR) and own calculations.

in Regression 1. AGE^2 has a positive effect on growth. The effect is significant in all regressions.

The average size of firms has a significantly negative effect, at the 1 per cent level, on growth in all regressions. Also, the effect of $SIZE^2$ is highly significantly positive (at the 1 per cent significance level) in all regressions. The results on age and size are in line with a number of theoretical arguments and empirical studies (e.g., Geroski, 1995; Caves, 1998).

The share of employment in enterprise groups shows a negative effect on industry employment growth in all regressions.

The share of employment in firms owned by the government also shows a negative effect. Notably, the effect is significant at the 1 per cent level in five out of sixth regressions. In the sixth, it is significant at the 5 per cent level.

The results on the employment share of firms owned by the government and the employment share in enterprise groups, showing a negative effect on growth, are supported by several studies in the literature. For instance, firms owned by the government can be expected to be more bureaucratic and less flexible than privately owned firms (e.g., Moe, 1997; Wintrobe, 1997). Similar arguments can be made for expecting firms in enterprise groups to grow more slowly than independent firms.

The R^2 is high: varying between 0.67 (Regression 1) and 0.76 (Regression 3).

4. Comments

This paper offers econometric tests of the hypothesis that the turnover rate of firms has no, or a

negative, effect on industry employment growth. This hypothesis is not accepted. On the contrary, the analysis shows that the turnover rate of firms has a positive effect on employment growth.

The results are interesting considering the economic performance of different countries and have a bearing on economic policy. New firm formation and economic performance differ between countries. At the same time, countries have chosen different economic policies towards new and small firms, some more favorable than others. The result in this paper is in line with other research results that suggest that economic policies that do not put any hindrance on new firm formations and firm exits will enhance economic performance.

Acknowledgements

I am grateful for comments on previous drafts of this paper made by: David Audretsch, Niclas Berggren, Anita Du Rietz, Gunnar Eliasson, Mickael Salabasis, Roger Svensson, participants at the ninth biennial conference of the International Joseph A. Schumpeter Society in Gainesville, Florida and two anonymous reviewers. Financial support from Torsten och Ragnar Söderbergs stiftelser is gratefully acknowledged.

Notes

[1] Note that the literature uses several definitions of firm turnover, whereof this is one. Also note that firm turnover, as defined in this paper, sometimes goes under other names, for example firm turbulence.

[2] Fritsch's definition of turbulence is equivalent to the definition of turnover in this paper. See, for example, Kirchhoff (1994) and Baldwin (1995) for a discussion of, among other things, the measurement of entry and exit in different databases used in research.

[3] Therefore, Eliasson (1996) denotes the economy as experimentally organized.

[4] In a later phase, however, the entrepreneurs are followed by imitators eroding the entrepreneurial profit.

[5] The statistics in other countries are seldom of this quality. Usually, the statistics have problems with covering new and small firms, some legal forms like sole proprietorships and firms in the service industry. Moreover, registrations of firms on a annual basis are seldom done internationally. Hence, in an international perspective, Swedish data are appropriate to study the effects of firm turnover on, e.g., employment growth.

[6] It should be noted that EFA does not show R&D investments separately. To my knowledge, there are no R&D data compiled and available for the years and industries analyzed in this paper.

[7] SNI92 ("Standard för svensk näringsgrensindelning", established 1992) is the Swedish equivalent of the NACE (Nomenclature Générale Activités Economiques dans les Communautés Européennes) classification system used in the European Union.

[8] The analysis of the IT industry could, of course, be combined and compared with an analysis of, for instance, the traditional manufacturing industry. This would help to clarify the impact of factors idiosyncratic for the IT industry during the studied period when the IT industry was booming and characterized by vivid entry and few exits. Such an analysis, however, is quite extensive and beyond the scope of this paper. Moreover, it is beyond the budget constraints of this study, since (additional) data are quite expensive. This is, however, an interesting question for future research to address.

[9] Indeed, the analysis is based on the population of IT firms, but the risk for measurement errors etc. that generate uncertainty in the estimations can nevertheless motivate the carrying out of traditional significance tests.

[10] The literature discusses the appropriateness of different measurements of growth. However, no unambiguous conclusion has been reached; the variables chosen depends on the problem at hand and the availability of data. In this paper employment is utilized, first because employment is an interesting variable to study considering the purpose of this paper, and second, because other variables suggested as alternative measurements of growth, e.g. sales, are not available in CFAR.

[11] Shrinking of an industry is treated as negative growth.

[12] It has been suggested that the positive effect of TURNOVER to a large extent reflects the positive effect of ENTRY, since TURNOVER and ENTRY are highly correlated, since ENTRY has a significantly positive effect and since EXIT has a significantly negative effect on GROWTH. In response, the effect of TURNOVER alongside the effect of net entry, defined as ENTRY-EXIT, have been estimated. TURNOVER is still positive and significant. A number of other specifications have also been run, for example, regressions with an explanatory variable defined as the product of ENTRY and EXIT. The results are robust.

[13] A longer time period than the one covered in this analysis is probably required for this effect to show up.

References

Acs, Zoltan (ed.), 1996, *Small Firms and Economic Growth: Volume I and II*, Cheltenham: Edward Elgar.

Acs, Zoltan, Bo Carlsson and Charlie Karlsson, 1999, *Entrepreneurship, Small and Medium-Seized Enterprises and the Macroeconomy*, Cambridge: Cambridge Universit Press.

Almeida Paul, 1999, 'Semiconductor Startups and the Exploration of New Technological Territory', in Zoltan Acs (ed.), *Are Small Firms Important? Their Role and Impact*, Dordrecht: Kluwer Academic Publishers, pp. 39–50.

Almeida Paul and Bruce Kogut, 1997, 'The Exploration of

Technological Diversity and Geographical Localization in Innovation', *Small Business Economics* **9**(1), 21–31.
Audretsch, David, 1995, *Innovation and Industry Evolution*, Cambridge: MIT Press.
Audretsch, David, 2002, 'The Dynamic Role of Small Firms: Evidence from the U.S.', *Small Business Economics* **18**(1–3), 13–40.
Audretsch, David and Michael Fritsch, 1996, 'Creative Destruction: Turbulence and Economic Growth in Germany', in Ernst Helmstädter and Mark Perlman (eds.), *Behavioral Norms, Technological Progress, and Economic Dynamics: Studies in Schumpeterian Economics*, Ann Arbor: The University of Michigan Press, pp. 137–150.
Audretsch, David and Michael Fritsch, 2002, 'Growth Regimes over Time and Space', *Regional Studies* **36**(2), 113–124.
Baldwin, John, 1995, *The Dynamics of Industrial Competition: A North American Perspective*, Cambridge: Cambridge University Press.
Birch, David, 1979, 'The Job Generation Process', *MIT Program on Neighbourhood and Regional Change* (March), Cambridge: MIT.
Birch, David and James Medoff, 1994, 'Gazelles', in Lewis Solmon and Alec Levenson (eds.), *Labour Markets, Employment Policy and Job Creation*, Boulder and London: Westview Press.
Callejón, Maria and Segarra Agusti, 1999, 'Business Dynamics and Efficiency in Industries and Regions: The Case of Spain', *Small Business Economics* **13**(4), 253–271.
Caves, Richard, 1998, 'Industrial Organization and New Findings on the Turnover and Mobility of Firms', *Journal of Economic Literature* **36**(4), 1947–1982.
Dahlman, Carl, 1979, 'The Problem of Externality', *Journal of Law and Economics* **22**(1), 141–162.
Davidsson, Per, Leif Lindmark and Christer Olofsson, 1994a, *Dynamiken i svenskt näringsliv*, Lund: Studentlitteratur.
Davidsson, Per, Leif Lindmark and Christer Olofsson, 1994b, 'New Firm Formation and Regional Development in Sweden', *Regional Studies* **28**(4), 395–410.
Davidsson, Per, Lindmark, Leif and Christer Olofsson, 1996, *Näringslivsdynamik under 90-talet*, Stockholm: NUTEK.
Eliasson, Gunnar, 1996, *Firm Objectives, Controls and Organizations. The Use of Information and the Transfer of Knowledge within the Firm*, Dordrecht: Kluwer Academic Publishers.
Fritsch, Michael, 1996, 'Turbulence and Growth in West Germany: A Comparison of Evidence by Regions and Industries', *Review of Industrial Organization* **11**(2), 231–251.
Geroski, Paul, 1995, 'What Do We Know About Entry?', *International Journal of Industrial Organization* **13**(4), 421–440.
Johansson, Dan, 2001, *The Dynamics of Firm and Industry Growth: The Swedish Computing and Communications Industry*, Doctoral Thesis in Industrial Economics, Stockholm: Royal Institute of Technology.
Kirchhoff, Bruce, 1994, *Entrepreneurship and Dynamic Capitalism*, London: Praeger.
Loveman, Gary and Werner Sengenberger, 1991, 'The Re-Emergence of Small-Scale Production. An International Comparison', *Small Business Economics* **3**(1), 1–37.
Moe, Terry, 1997, 'The Positive Theory of Public Bureaucracy', in Dennis Mueller, (ed.), *Perspectives on Public Choice: A Handbook*, Cambridge: Cambridge University Press, pp. 455–480.
Nelson, Richard and Sidney Winter, 1982, *An Evolutionary Theory of Economic Change*, Cambridge: Cambridge University Press.
Reynolds, Paul, David Storey and Paul Westhead, 1994, 'Cross National Comparison of the Variation in the Firm Formation Rates', Regional Studies **28**(4), 443–456.
Schumpeter, Joseph, 1934/1912/1911, *The Theory of Economic Development*, London: Transaction Publishers.
Schumpeter, Joseph, 1942, *Capitalism, Socialism and Democracy*, New York: Harper & Row.
Wallis, John and Douglass North, 1986, 'Measuring the Transaction Sector in the American American Economy', in Stanley Engerman and Robert Gallman (eds.), *Long Term Factors in American Economic Growth*, Chicago: Chicago University Press, pp. 95–148.
Wintrobe, Ronald, 1997, 'Modern Bureaucratic Theory', in Dennis Mueller (ed.), *Perspective on Public Choice: A Handbook*, Cambridge: Cambridge University Press, pp. 429–454.