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Stefan Schneck and Eva May-Strobl

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Herausgeber
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Maximilianstr. 20, 53111 Bonn
Telefon +49/(0)228 / 72997 - 0
Telefax +49/(0)228 / 72997 - 34

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The Economic Contribution of Start-Up Firms in Germany*

Stefan Schneck† Eva May-Strobl‡

April 28, 2014

This paper utilizes German tax data to present evidence about the direct and indirect effects of new firm formation. Cohort analysis is applied to investigate survival, sales, inputs, and value added of start-up firms. Most drop-outs occur in the early years. We show that start-up microenterprises increase economic vitality directly. Turnover and value added are in an approximate proportion of 3:1. With respect to the indirect effects of new firms, we find that one Euro of sales induce considerable indirect effects because 66 Cents are used to buy products and services from incumbents. For this reason, new firms substantially promote economic prosperity of incumbents. Sectoral differences are also indicated, with the manufacturing industry generating highest sales and relying on most inputs in the early periods.

JEL-Classification: L26, L29

Keywords: Entrepreneurship, direct effects, indirect effects, sales

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†Institut für Mittelstandsforschung (IfM) Bonn. Maximilianstraße 20, 53111 Bonn, Germany, e-mail: schneck@ifm-bonn.org.

‡Institut für Mittelstandsforschung (IfM) Bonn. Maximilianstraße 20, 53111 Bonn, Germany, e-mail: may@ifm-bonn.org.

1 Introduction

It is a highly stylized fact that entrepreneurial activity is central to economies, because start-ups contribute substantially to improvements and innovations in goods, processes, and applications (see, among others, Schumpeter, 1942; Baumol, 1968). For this reason, politicians try to foster entrepreneurial activity (e.g., German support programmes[1] or White House launches the "Startup America" Initiative[2]) to boost economic development and to reduce unemployment. In this line, Audretsch and Thurik (2000) conclude that an increase in the number of entrepreneurs lowers the rate of unemployment. Although the literature suggests rather weak employment effects of subsidized start-ups (Link and Scott, 2012; Caliendo et al., 2012), politicians might tend to overemphasize the direct employment effects of start-ups and discuss how to foster entrepreneurship.

Also the core literature about the economic contribution of entrepreneurship focuses on employment effects. Wong et al. (2005) show in their literature survey that newly formed businesses create a significant number of new jobs. Furthermore, the international literature frequently refers to "gazelles", which are defined as companies that experience a high rate of growth in a very short time (Cognetics, 2000). Studies on gazelles frequently refer to firm growth in terms of employment. Such firms are shown to be important because they generate a significant number of new jobs (Storey, 1994). However, the pure focus on fast-growing enterprises in terms of employment in the short run is myopic, as Fritsch and Weyh (2006) or Schindele and Weyh (2011) find that entrepreneurs in (West) Germany initially increase the number of employees, which is later followed by a decrease in the number of employees. Fritsch and Weyh (2006, p. 256) conclude that "strong employment growth of start-up cohorts is definitely not a general trend." The decline of employment in later years might not necessarily be due to reorganization and optimization of different

[1] April, 4 2014: http://www.existenzgruender.de/englisch/index.php
[2] April, 4 2014: http://www.whitehouse.gov/startup-america-fact-sheet

processes. In fact, Schindele and Weyh (2011) suggest that older firms face a comparatively high risk of failure.

In contrast to the papers listed above, we examine sales of new firms and the corresponding contribution to total sales in Germany. This determinant does not suffer medium- or long-term inferences, but is an adequate indicator of current economic prosperity introduced by newly founded firms. Our findings suggest that new firm formation has low impact on total sales in Germany. Each year, a maximum of one percent of total sales in Germany can be attributed to new firms although each eleventh firm is a start-up.

"In fact, despite the evidence, we still lack sufficiently firm evidence of positive spillovers from entrepreneurship" (Parker, 2005, p. 37). Here, we also consider indirect economic effects of new firm formation on incumbents. The seminal work of Acemoglu et al. (2006) shows that economies close to the technology frontier face higher relative demand for innovation (when compared to imitation) to foster growth. Their model proposes that entrepreneurs are more innovative than imitative, which is the main reason why economies at the technological frontier rely more on an innovation-based strategy, which are characterized by entrepreneurship and young firms. These innovative entrepreneurs in turn affect the established firms by creation of new products and the development of new markets. Aghion et al. (2009) present results on the effect of new entries into the market and the reaction of incumbents with respect to productivity and innovation. Indirect employment effects of new businesses on incumbents are addressed in Fritsch and Noseleit (2013b,a). Fritsch and Noseleit (2013a) suggest that competition between new businesses and incumbent enforce indirect employment effects. Fritsch and Noseleit (2013b) show that entrepreneurship stimulates incumbents' development and that indirect employment effects are quantitatively more important than the direct employment effects of new businesses. It is also shown that the indirect employment effects are likely to be positive in the period of entry of newcomers, but turn negative in the mid-term, and finally, become

positive again after a period of about five or six years. This paper contributes to the novel field of research on indirect effects of new entrants on incumbents. Specifically, we identify the monetary indirect effect of new firm formation on established firms. We show that a substantial part of sales in a new firm transfers to indirect effects. On average, 66 Cent of each Euro of sales in a new firm is used to buy products and services from incumbents.

This paper differs from the core literature about entrepreneurship by an examination of direct as well as indirect monetary effects. We examine highly reliable tax data from 2001 to 2009 to analyze the monetary impact of newly founded microenterprises in Germany. For this reason, our focus is on firms instead of the entrepreneur as individual.[3] We must omit very small enterprises because our sample is restricted to firms that exhibit sales of at least 16,617 Euro. We, thus, concentrate on firms that are suggested to secure one's livelihood. We show that newly founded microenterprises contribute considerable to economic development in Germany.

2 Data

The consecutive analysis utilizes the German *Umsatzsteuerpanel*, which is provided by the Federal Statistical Office. It is based on the data from the *Umsatzsteuerstatistik (Voranmeldung)* of the Federal Statistical Office, which are surveyed from 1996 onwards. It contains annual information on all firms that submit a turnover tax pre-registration. Based on the cross-sectional data of the *Umsatzsteuerstatistik*, the Federal Statistical Office produces panel data -the *Umsatzsteuerpanel*- that also allow for longitudinal analysis. The panel structure relies on highly reliable identifiers such as the tax ID and the turnover tax identifier (Statistisches Bundesamt, 2009, p. 737). Further details are presented in Vogel and Dittrich (2008). The underlying data is restricted to the period from 2001 to

[3]Entrepreneurs, start-ups, new ventures, new firms, and new microenterprises are used interchangeably in the following.

2009. A further restriction is that the minimum yearly turnover must exceed 16,617 Euro, which implies that firms with lower turnover are not surveyed in the data.[4] Firms that are exempt from submitting this form are also missing. In addition, firms with mostly tax-free turnover are not surveyed. The data offer detailed information on turnover tax-related indicators and on sectors.[5] We consider the sectors "manufacturing industry", "distribution", "services for firms", and "other services" (see Schneck and May-Strobl, 2013).[6] The variables of main interest are *Lieferungen und Leistungen insgesamt* (turnover, sales) and *abziehbare Vorsteuer insgesamt* (deductible input tax, henceforth abbreviated as DIT).

In sum, our data set consists of only three variables (turnover, DIT, sector) and a unique firm-identifier in the time period from 2001 to 2009. New businesses are identified via our firm identifier in the data. Entrepreneurs are firms that are observable in year t, but not in the previous year $(t-1)$. For this reason, we cannot account for the year 2001 in our analysis, which reduces the observation period from 2002 to 2009.[7] Exits are defined in an analogous way to entries. If a firm is observed in period t, but not in the consecutive period $t+1$, we expect an exit of the firm. Information about exits in 2009 are not gathered via this procedure. It is possible, however, that firms are again observed in later years ($t+p$ with $p \geq 2$). We restrict our sample to firms that are observed either once or continuously over time. Firms with discontinuous observations over time (in either turnover or DIT) are dropped from the analysis. Such behavior might be due to business

[4] According to (Vogel and Dittrich, 2008, p. 664), this particular threshold is applied in the year 2001. In the year 2002, the threshold was equal to 16,620 Euro and amounted to 17,500 Euro from 2003 onwards.

[5] This secondary data source does not contain any further information, which might be the main reason for the scarce utilization of this data set in the economic literature.

[6] Precisely, we consider a time invariant variable that is based on the first response.

[7] Firms surveyed in the year 2001 could be start-ups or already established companies, because we were not able to observe them in the year 2000. For this reason, we exclude period 2001 from the consecutive analysis. This is a usual procedure for the analysis of panel data that consist of cross-sectional data. With respect to entrepreneurship, we cannot distinguish between firms that exist for one months or for twelve months because we only observe one annual record. Also note that we might consider some established firms, which are not surveyed in the data because of turnover below the above mentioned threshold values.

breaks or other reasons, such as part-time self-employment, which might lead to an annual turnover below the above mentioned thresholds. Note that an exit in our data set might not necessarily indicate business failure, but might be a due to a change in the legal form of the organization or a regional transfer of business. In such cases, the ID changes, and we incorrectly identify exits because of a change in the tax ID or the turnover tax identifier.

Table 1 shows how different definitions and restrictions affect the sample size. Our sample of newly founded enterprises with continuous profiles in turnover over time consists of 2,568,810 firms in total (sample 1). For calculation of value added, we need continuous profiles over time in DIT, which reduces the sample to 2,314,567 start-ups (sample 2).[8] Exclusion of the agriculture sector reduces the sample by 61,858 firms (sample 3). For our investigation, we only examine the cohorts between 2002 and 2008 because we cannot conclude about any failure or development of new ventures in 2009. This restriction reduces the sample to 1,987,369 firms. The restriction to microenterprises (see 2003/361/EC) with a maximum turnover of 2,000,000 Euro in the period of start-up ($\leq$ 2,000,000 Euro, leaving the number of employees unconsidered) leads to a reduction of 37,523 firms (sample 5). For this reason, it becomes obvious that most firms are characterized by small turnover in the year of start-up.

Insert Table 1 about here

The European Commission (see 2003/361/EC) suggests that microenterprises are businesses that employ less than ten employees ($\leq$ nine employees) and whose annual turnover and/or annual balance sheet total does not exceed two million Euro (turnover $\leq$ 2,000,000 Euro).[9] Restriction to less than ten employees reduces sample 5 by 34,733 firms to 1,915,113

[8] Continuous profile is defined as no missing values in firm-specific observations in DIT as well as turnover over time. If turnover is surveyed but DIT is missing in at least one period, then we drop this firm from our analysis.

[9] Note that start-ups might be identified in case of changes in the legal form of organization, regional transfer of business, or changes of holder (Treeck, 2004). For this reason, overestimation of entrepreneurs is possible. We expect that the restriction to microenterprises in the start-up period minimizes at least the impact of identifying changes in legal form as entrepreneurship.

start-ups in total (see sample 6).[10] In total, we consider 6,496,164 observations on 1,915,113 in our cohort analysis (see Table 2).

To calculate the value added of entrepreneurs (defined as entrants into the *Umsatzsteuer-panel*), we calculate our measure in analogy to the one applied in Brouwer et al. (2005). Specifically, we utilize information on the turnover and on the DIT of firm i in period t.

$$\text{value added}_{it} = \text{output}_{it} - \text{input}_{it} = \text{turnover}_{it} - \text{intermediate consumption}_{it} \tag{1}$$

with

$$\begin{aligned} \text{intermediate consumption}_{it} &= \frac{DIT_{it}}{I(\text{turnover tax rate})_t} \\ I(\text{turnover tax rate})_t &= 0.16 \text{ for t= [2001; 2006]} \\ I(\text{turnover tax rate})_t &= 0.19 \text{ for t= [2007; 2009]} \end{aligned} \tag{2}$$

Note that the German tax system considers a full turnover tax rate and a reduced turnover tax rate. The reduced turnover tax rate is mainly applied for groceries, print media, and art (also see *Umsatzsteuergesetz* §12). We are not able to separate the full tax rate from the reduced one with our data. For this reason, we assume the full turnover tax rate for all inputs and, thus, apply this rate for calculation of intermediate consumption in equation 2.[11]

[10] Information regarding employment in the firms is not surveyed in the original data. It is possible, however, to match information on the number of employees to the original data. For this purpose the *Unternehmensregister* (see Sturm and Tümmler, 2006) that contains information on the number of employees covered by social security is matched with the *Umsatzsteuerpanel* (see Vogel et al., 2009). The matching of the *Unternehmensregister* and the *Umsatzsteuerstatistik* is conducted via the unique tax identifier.

[11] Henceforth, the words input and intermediate consumption are used as synonyms.

3 Results

The number of observations by cohort and firm-specific age are presented in Table 2. We find no general trend towards more or less new firm formation in our data because in 2002 and in 2008 almost the same number of firms are founded. About one in five of all new microenterprises leave the sample after the start-up period. Four years after entering the market, about half of all firms remain in the sample.

Insert Table 2 about here

In Table 3, we show whether surviving firms differ in certain characteristics from the firms that drop out after the start-up period. At first, it might be hypothesized that entrepreneurs who fail early might be necessity entrepreneurs (Block and Sandner, 2009). Furthermore, some individuals might tend to send the signal to potential employers that they are not formally unemployed. These individuals are presumed to be more likely to search for new jobs instead of planning self-employment in the long run. For this reason, we expect that those firms invest less capital. Application of a t-test confirms this hypothesis. Workers who survive the initial period invest, on average, almost 63,000 Euro more to set up their business (see Table 3).

Insert Table 3 about here

Table 3 also adverts to differences in economic situation. The average turnover of surviving firms is significantly higher than in exiting firms. We explain this by necessity entrepreneurship and the individual propensity to look for a job in paid employment. Inputs are also lower in firms that leave the sample after one single year, which also might be viewed as a hint to necessity entrepreneurship. With respect to value added, we find the opposite. Firms that survive generate significantly less value added than do firms that are not observed one period later. This might be due to investments of entrepreneurs that

might pay off in the future. For this reason, opportunity entrepreneurship and long-term investments are indicated.

As survival is not the only adequate measure for success of entrepreneurs (Noll and Wießner, 2011), our cohort analysis turns the focus to turnover.[12] Table 4 presents descriptive statistics for turnover of microenterprises. An average newly founded microenterprise in our data generates turnover of more than 100,000 Euro, while the median suggests that half of all newly founded microenterprises achieve turnover between 39,743 and 46,013 Euro in their start-up period. In fact, more than 75% of all new ventures exhibit less than average turnover in the period of start-up, which suggests that the distribution is positively skewed. Superstar theory (Rosen, 1981) might provide an explanation for this pattern. A few entrepreneurial 'superstars' (less than 25% of the population) heavily influence mean turnover.[13]

Insert Table 4 about here

Table 4 reveals a positively skewed distribution for established firms (age$\geq$1). Turnover of firms below the third quartile is lower than the mean across all cohorts and firm age. The ninth percentile, in turn, always exceeds the mean of turnover across cohorts and age. With respect to heterogeneity in turnover across newly founded enterprises, cohorts 2002 and 2003 seem to consist of a heterogeneous group of entrepreneurs because their standard deviations are highest in the start-up period. New firms are also considerably unequal with respect to turnover. The ratio between the 95% and the 5% percentile exceeds 20 in the period of entry and is even higher in later years.

We also contribute to the literature on economic prosperity and, thus, present total turnover in Table 5. Newly founded microenterprises generate turnover between 27.6 and

[12]Note that survival is an indirect success measure in this particular data set because firms exceed a turnover-specific threshold. Detailed descriptions of entrepreneurial success, however, cannot be made.

[13]According to our definition, the highest possible turnover of newly founded microenterprises is 2,000,000 Euro in period 0.

31.3 billion Euro in the period of start-up. In the succeeding period, total turnover exceeds that in the start-up period, although only four in five firms survive. In fact, total turnover substantially grows in early years. Across cohorts, total turnover increases in most considered periods, while the number of firms decreases. An exception is cohort 2002, where total turnover decreases between age 1 and 2. Total turnover, again decreases for cohorts 2002 and 2004 between age 4 and 5. In the years 2008 and 2009, turnover decreases for all of the cohorts from 2002 to 2007. This might be explained by the global economic crisis and "the unprecedented fall in exports" (Stiglitz, 2009, p. 2), whereas Germany is being considered as export-oriented country. In this line Möller (2010) suggests that the export-orientated sectors were mainly affected. In total, the accumulated turnover across all cohorts and years amounts to 1,524 billion Euro.

Insert Table 5 about here

In order to assess the economic importance of new ventures, we need to show their importance in relation to total turnover of all firms in Germany that submit a turnover tax pre-registration. Table 6 shows that the contribution of newly founded microenterprises is comparatively small in relative terms. Less than one percent of total turnover is contributed by new ventures in their period of start-up, although each eleventh firm is a newly found enterprise. In 2009, all of the surviving newly found microenterprises of cohorts 2002 to 2008 accumulate only 6.4729% of total turnover. This shows that absolute contribution of newly found microenterprises in Euro seems considerable, but their contribution is comparatively low in relative terms. This is not surprising because, according to the Federal Statistical Office (Statistisches Bundesamt, 2011, p. 25), the 412 firms (0.0131% of all firms) with minimum turnover of one billion Euro contribute 31.1926% of total turnover in the year 2009. Application of the definition of microenterprises (without consideration of employment) reveals that 94.3298% of all firms exhibit a maximum turnover of 2,000,000 Euro in 2009 (also see Statistisches Bundesamt, 2011, p. 25). In contradiction, they con-

tribute only 13.6997% of total turnover, which strikingly illustrates that only few very large companies create significant turnover in Germany.

Insert Table 6 about here

In a next step, we examine the indirect effects of new business formation in Table 7. The Table presents the amount of money that is needed to set up and to carry on businesses. In most cases, we can reasonably expect that these products and services are bought from incumbents. In total, new business formation creates a total demand of 1,005 billion Euro at established firms. When compared to total sales, each Euro of sales at new or young firms in our sample is transformed to 66 Cent of products and services bought from other firms.

Insert Table 7 about here

Table 7 also refers to the share of total inputs with respect to total sales by cohort and age. Especially in the period of start-up, the need for products and services is relatively high. In fact, 85 to 95% of each Euro of sales is needed to set up the firm. In the consecutive periods, the need for inputs decreases to about 65 percent. Exits as well as the singular nature of some start-up investments might explain this decrease. Two years after the start-up, about 60 to 63 Cent of one Euro of sales is needed to buy products and services from other firms.

Table 8 turns the focus on value added, which also considers intermediate consumption (input) of new ventures. In the start-up period, total value added differs across cohorts. Cohort 2008 generates only 1.3 billion Euro, while cohort 2005 exhibits 4.1 billion Euro, although the number of newly founded enterprises is not basically different (see Table 2). The average value added by firm, thus, is substantially lower for cohort 2008. As already shown for turnover, the very early growth is substantial. Afterward, value added increases

until the age of four.[14] The total value added of cohort 2002, then, decreases from period five onwards, which might be attributed to new investments and increasing intermediate consumption. Again, we observe an effect of the severe global economic crisis in the years 2008/2009. Only cohort 2008 generates higher value added in this particular period. In total 519 billion Euro of value added are confronted with 1,524 billion Euro of turnover, which implies that about 34 Cent of each Euro of sales remain in the firm for salaries, investments, and risk management. These numbers also reveal that the average costs for inputs exceed average value added in all periods.

Insert Table 8 about here

Table 9 presents OLS regression results, which allow us to infer sectoral differences in the mid-term with respect to our key measures. Dummy variables for the years account for business cycle effects or other effects, which we cannot control for. Cohort dummy variables describe similarities in starting conditions, competitiveness, and further cohort-specific characteristics. Our main interest is in the sector and the age variables, which show the additional value added (turnover and inputs) by sector and for each additional year.[15] Based on the regression results, we present sectoral differences for cohort 2002 by age in Figures 1, 2, and 3.[16]

Insert Table 9 about here

Insert Figure 1 about here

[14] We just examine cohorts 2002 to 2004 because cohort 2005 might already be affected by the global economic crisis at the age of four.

[15] Linear firm-specific fixed-effects approaches might also be applied to control for unobserved heterogeneity. Here, we prefer linear regression because this procedure allows for the inclusion of time invariant variables, such as sector. In addition, note that logarithmic transformation of the dependent variable value added leads to a loss of observations because firms with negative value added must be excluded.

[16] The figures display the results for cohort 2002, but the pictures are similar for other cohorts. Positive cohort dummy variables lead to a parallel upward shift, while a negative coefficient leads to a downward shift of the sectoral lines. Dummy variables for the years remain unconsidered.

Figure 1 shows that sales are highest in the manufacturing industry in all periods. The second highest sales are achieved in the sector distribution, followed by firm-related services. In the period of entry, the average need for inputs is highest in the manufacturing industry, followed by the services for firms sector (see Figure 2). With increasing age, the need for inputs grows fastest in the distribution sector. Six years after the start-up, the average cost for inputs exceeds the one in the manufacturing industry. The distribution sector can thus be characterized as the sector with the highest increase in intermediate consumption. In the first five years after starting up, inputs as well as turnover are highest in the manufacturing industry. Inputs and turnover are lowest in the sector of other services in all periods.

Insert Figure 2 about here

With respect to value added, we show that the manufacturing industry and services for firms exhibit the lowest value added in the start-up period (see Figure 3). The growth of value added, however, is significantly higher in the manufacturing industry and in the services for firms when compared to distribution and other services. For this reason, mid-term value added is highest in the services for firms and in the manufacturing industry.

Insert Figure 3 about here

4 Summary and Conclusion

We utilize highly reliable census tax data to show relevant success measures of entrepreneurship in Germany. The analysis considers newly founded microenterprises from 2002 to 2008 that submitted a turnover tax pre-registration. The central variables presented here are 1) firm survival, 2) turnover, 3) inputs, and 4) value added. Furthermore, we distinguish between four sectors, namely, the manufacturing industry, distribution, services for firms, and other services.

The survival of firms in our data set is in line with other studies, because most drop-outs are identified in the early stages of the firm history (for Germany, see Fritsch et al., 2006; Rink et al., 2013). About 20% to 25% leave the sample immediately after the start-up period. The typical new venture seems to exit the sample after about four to five years. In fact, each second firm drops out of our sample within this period. We also show that the share of turnover of new business formation with respect to total turnover in Germany is fairly low although each eleventh firm in Germany is a newly founded one. In 2009 each third firm was a young firm that was founded between 2002 and 2009, but the share of turnover contributed by these firms amounted to less than 6.5%. This implies that the major part of *current* prosperity is not determined by new firms, but the replacement of old firms enforces modernization. For this reason, entrepreneurship can be expected to affect the *future* prosperity via modernization, competition, and improvements of products and services.

Our results on indirect monetary effects on incumbents suggest that start-up investments increase vitality of the incumbents. One Euro of sales at a newly founded firm is used to buy products and services from incumbents for about 85 to 95 Cent. This might explain why employment at incumbents is likely to increase in the period of entry of new firms (see Fritsch and Noseleit, 2013b). In later periods, the need for products and services from incumbents decreases to about 60 Cent per Euro of sales. In total, the average need for inputs amounts to 66% of current turnover, while 34% remain in the new firm. The average cost for inputs, thus, exceeds average value added across all cohorts in all periods. This might explain why indirect effects of new businesses are quantitatively more important than the direct employment effects of new businesses (Fritsch and Noseleit, 2013b).

Furthermore, "It has long been recognized that the entrepreneurial function is a vital component in the process of economic growth" (Baumol, 1968, p. 65) and "that by ignoring the entrepreneur we are prevented from accounting fully for a very substantial proportion

of our historic growth" (Baumol, 1968, p. 66). However, entrepreneurship is virtually nonexistent in theoretical mainstream economics (Johansson, 2004). We totally agree with Bianchi and Henrekson (2005) who claim that theoretical frameworks on entrepreneurship must be highly stylized, which does not allow for reliable theoretical models. Nevertheless, we hope that our results help to improve the understanding of the direct and indirect economic effects of entrepreneurship and that they help to set up theoretical models. Moreover, the finding that indirect effects of entrepreneurship seem to be quantitatively higher than the direct effects (also see Fritsch and Noseleit, 2013b) might be utilized as a stylized fact in future studies.

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Tables included in the text

Table 1: Considered samples and restrictions.

Sample	description and restrictions	number of start-ups (sectors)
1	Newly found firms between 2002 and 2009 with continuous profile over time in turnover	2,568,810 (5 sectors)
2	continuous profile over time in turnover and DIT	2,314,567 (5 sectors)
3	continuous profile over time in turnover and DIT	2,252,709 (4 sectors)
4	Newly found firms between 2002 and 2008	1,987,369 (4 sectors)
5	continuous profile over time in turnover and DIT turnover$\leq$ 2,000,000 Euro in $t = 0$	1,949,846 (4 sectors)
6	continuous profile over time in turnover and DIT turnover$\leq$ 2,000,000 Euro in $t = 0$ number of employees ≤ 9 in $t = 0$ in case of missing values in employment: replace missing $= 0$ in $t = 0$	1,915,113 (4 sectors)

DIT: deductible input tax (*abziehbare Vorsteuer insgesamt*).
5 sectors: manufacturing industry, distribution, services for firms, other services, and agriculture.
4 sectors: manufacturing industry, distribution, services for firms, and other services.

Table 2: Survival of firms and number of observations.

Age	cohort 2002	cohort 2003	cohort 2004	cohort 2005	cohort 2006	cohort 2007	cohort 2008
0	274,327	251,288	265,177	290,517	284,531	274,991	274,282
1	210,015	198,597	212,485	234,279	228,542	220,660	206,864
	(76.56%)	(79.03%)	(80.13%)	(80.64%)	(80.32%)	(80.24%)	(75.42%)
2	171,764	164,532	178,265	196,103	190,129	174,020	
	(62.61%)	(65.48%)	(67.22%)	(67.50%)	(66.82%)	(63.28%)	
3	148,446	143,957	155,252	170,383	157,714		
	(54.11%)	(57.29%)	(58.55%)	(58.65%)	(55.43%)		
4	132,934	128,530	138,353	146,470			
	(48.46%)	(51.15%)	(52.17%)	(50.42%)			
5	120,579	116,361	121,703				
	(43.95%)	(46.31%)	(45.90%)				
6	110,567	103,857					
	(40.30%)	(41.33%)					
7	99,690						
	(36.34%)						
Number of observations by cohort	1,268,322	1,107,122	1,071,235	1,037,752	860,916	669,671	481,146
Total number of observations				6,496,164			

(number of firms in period t)/(number of firms in period t_0) in parentheses.

Table 3: T-test for start-ups that do not survive the start-up period compared with firms that survive.

	firms		
	not surviving the start-up period	surviving the start-up period	Difference
Intermediate consumption	44,687.46	107,163.2	-62,475.77***
(total input)	(940.66)	(819.09)	
Turnover	64,552.13	116,599.00	-52,046.84***
	(224.12)	(169.93)	
Value Added	19,864.67	9,435.74	10,428.93***
	(927.29)	(805.18)	
Number of observations	403,671	1,511,442	

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4: Firm-specific descriptive statistics: Turnover.

Age	mean	std. dev.	p1	p5	p10	p25	p50 (median)	p75	p90	p95	p99
						Cohort 2002					
0	114,173.40	207,412.1	16,899	18,021	19,631	26,000	45,258	101,731	252,947	454,399	1,183,332
1	225,633.69	1,636,252.8	18,277	21,301	25,276	39,100	77,611	182,480	449,771	783,805	2,055,595
2	272,855.58	3,535,091.3	18,598	22,483	27,329	43,236	87,616	209,049	515,552	910,907	2,482,177
3	321,362.71	4,793,418.9	18,979	23,800	29,336	47,571	97,949	236,492	592,685	1,043,312	2,968,040
4	385,599.06	4,712,528.1	19,246	24,654	30,931	51,305	107,479	266,800	676,785	1,210,522	3,651,260
5	420,154.48	4,941,554.8	19,429	25,100	31,761	53,280	113,257	282,870	726,753	1,303,039	4,127,500
6	457,554.15	5,332,034.9	19,540	25,800	32,889	56,029	120,948	305,475	786,431	1,417,659	4,603,818
7	457,771.71	5,172,073.4	19,633	26,253	33,650	57,539	123,480	310,102	795,246	1,415,461	4,521,056
						Cohort 2003					
0	113,772.50	205,692.5	17,799	19,038	20,724	27,161	46,013	101,027	249,039	448,838	1,166,052
1	213,168.20	945,645.4	18,404	21,784	25,901	39,580	77,044	178,455	436,095	766,118	2,018,640
2	266,736.17	1,578,323.5	18,839	23,328	28,416	45,048	90,000	213,000	524,052	920,281	2,557,463
3	313,959.64	1,769,848.5	19,104	24,340	30,225	49,345	100,820	243,077	618,627	1,090,896	3,137,023
4	360,074.00	2,157,184.9	19,324	24,950	31,412	52,022	108,092	264,963	676,404	1,215,449	3,694,059
5	404,101.12	2,578,165.8	19,506	25,840	32,840	55,100	115,934	287,790	738,232	1,343,616	4,192,085
6	413,290.99	2,936,459.4	19,744	26,297	33,588	56,668	119,732	296,454	751,369	1,347,192	4,135,743
						Cohort 2004					
0	104,185.04	192,779.6	17,774	18,910	20,491	26,353	43,103	90,768	220,066	396,176	1,099,937
1	208,065.36	1,078,226.6	18,404	21,695	25,610	38,465	72,162	165,082	411,213	727,173	2,036,271
2	266,544.23	1,881,869.1	18,727	23,100	28,012	43,589	84,878	200,318	505,876	906,081	2,618,173
3	311,902.74	2,379,251.0	18,942	23,999	29,518	47,013	93,829	224,165	572,896	1,040,281	3,138,711
4	367,270.06	4,714,803.3	19,171	24,784	31,017	50,200	102,418	249,876	643,764	1,161,122	3,658,165
5	386,698.62	5,212,158.2	19,344	25,346	31,888	52,112	107,186	261,054	661,465	1,179,096	3,684,756
						Cohort 2005					
0	101,564.25	191,759.1	17,757	18,836	20,319	25,828	41,500	86,092	213,066	386,501	1,089,526
1	204,268.07	2,709,464.2	18,303	21,333	24,970	36,658	67,350	154,951	392,452	714,025	2,032,850
2	250,740.37	3,239,145.6	18,618	22,459	26,800	40,523	77,426	180,992	462,452	841,332	2,470,954
3	291,489.01	2,956,142.6	18,863	23,455	28,460	44,300	86,556	206,126	529,978	966,495	2,948,089
4	302,579.25	2,049,192.6	19,011	24,047	29,654	46,597	92,080	220,404	562,569	1,013,875	3,109,678
						Cohort 2006					
0	100,857.86	192,991.3	17,746	18,771	20,168	25,421	40,392	84,126	209,220	390,599	1,101,571
1	204,560.44	1,261,940.3	18,241	20,975	24,240	35,181	65,244	151,406	392,975	722,983	2,098,712
2	255,771.14	1,824,984.7	18,496	22,154	26,250	39,608	75,931	180,625	476,293	874,261	2,544,644
3	283,568.83	2,445,538.0	18,716	22,930	27,596	42,595	83,565	202,069	525,555	958,776	2,764,476
						Cohort 2007					
0	104,047.39	198,671.8	17,744	18,751	20,161	25,409	40,597	86,081	221,254	410,684	1,134,870
1	236,761.48	8,553,605.9	18,211	20,903	24,245	35,387	66,645	159,135	424,697	770,460	2,205,621
2	290,546.06	9,676,731.9	18,465	21,864	25,947	39,245	77,028	188,593	496,953	892,087	2,487,316
						Cohort 2008					
0	101,855.00	195,997.4	17,732	18,660	20,000	25,025	39,743	83,851	214,482	401,810	1,112,832
1	202,144.68	1,150,122.6	18,139	20,640	23,863	34,558	64,850	153,613	400,441	732,751	2,009,161

Number of observations: See Table 2.

Table 5: Total turnover.

Age	cohort 2002	cohort 2003	cohort 2004	cohort 2005	cohort 2006	cohort 2007	cohort 2008
0	31,320,846,336	28,589,664,256	27,627,476,992	29,506,140,160	28,697,188,352	28,612,096,000	27,936,991,232
1	47,386,460,160	42,334,564,352	44,210,765,824	47,855,718,400	46,750,654,464	52,243,787,776	41,816,457,216
	(1.5129)	(1.4808)	(1.6002)	(1.6219)	(1.6291)	(1.8259)	(1.4968)
2	46,866,767,872	43,886,637,056	47,515,508,736	49,170,939,904	48,629,510,144	50,560,823,296	
	(0.9890)	(1.0367)	(1.0747)	(1.0275)	(1.0402)	(0.9678)	
3	47,705,010,176	45,196,689,408	48,423,522,304	49,664,774,144	44,722,774,016		
	(1.0179)	(1.0299)	(1.0191)	(1.0100)	(0.9197)		
4	51,259,224,064	46,280,310,784	50,812,915,712	44,318,781,440			
	(1.0745)	(1.0240)	(1.0493)	(0.8924)			
5	50,661,806,080	47,021,608,960	47,062,380,544				
	(0.9883)	(1.0160)	(0.9262)				
6	50,590,388,224	42,923,163,648					
	(0.9986)	(0.9128)					
7	45,635,260,416						
	(0.9021)						
Total	371,425,763,328	296,232,638,464	265,652,570,112	220,516,354,048	168,800,126,976	131,416,707,072	69,753,448,448

(turnover in period t)/(turnover in period t-1) in parentheses.
Number of observations: See Table 2.

Table 6: Contribution of entrepreneurs to total turnover in Germany.

Year	2002	2003	2004	2005	2006	2007	2008	2009
Total Turnover (in 1,000 Euros) of all firms	4,252,562,279	4,248,073,736	4,347,506,204	4,567,396,650	4,930,000,205	5,148,264,718	5,412,240,352	4,897,937,982
Total number of firms	2,926,570	2,915,482	2,957,173	3,036,758	3,099,493	3,140,509	3,186,878	3,135,542
				Contribution of entrepreneurs to total turnover				
Cohort 2002	0.7365%	1.1155%	1.0780%	1.0445%	1.0397%	0.9841%	0.9347%	0.9317%
	(9.3737%)	(7.2034%)	(5.8084%)	(4.8883%)	(4.2889%)	(3.8395%)	(3.4694%)	(3.1794%)
Cohort 2003		0.6730%	0.9738%	0.9609%	0.9168%	0.8989%	0.8688%	0.8764%
		(8.6191%)	(6.7158%)	(5.4180%)	(4.6445%)	(4.0926%)	(3.6513%)	(3.3123%)
Cohort 2004			0.6355%	0.9680%	0.9638%	0.9406%	0.9389%	0.9609%
			(8.9672%)	(6.9971%)	(5.7514%)	(4.9435%)	(4.3413%)	(3.8814%)
Cohort 2005				0.6460%	0.9707%	0.9551%	0.9176%	0.9048%
				(9.5667%)	(7.5586%)	(6.2443%)	(5.3464%)	(4.6713%)
Cohort 2006					0.5821%	0.9081%	0.8985%	0.9131%
					(9.1799%)	(7.2772%)	(5.9660%)	(5.0299%)
Cohort 2007						0.5558%	0.9653%	1.0323%
						(8.7563%)	(6.9240%)	(5.5499%)
Cohort 2008							0.5162%	0.8538%
							(8.6066%)	(6.5974%)

Percentage of total turnover by newly founded firms compared to all firms.
In parentheses: Percentage of newly founded firms compared to number of all firms.
Total turnover of entrepreneurs is presented in Table 5.
The number of entrepreneurs is shown in Table 2.
Sources: (July 16, 2013)
`http://www.ifm-bonn.org/fileadmin/data/redaktion/statistik/unternehmensgroessenstatistik/dokumente/Ums_KMU_2000-2010.pdf`
`http://www.ifm-bonn.org/fileadmin/data/redaktion/statistik/unternehmensgroessenstatistik/dokumente/Unt_KMU_2000-2010.pdf`
Thanks to Brigitte Günterberg for detailed information related to turnover of all firms.

Table 7: Total inputs.

Age	cohort 2002	cohort 2003	cohort 2004	cohort 2005	cohort 2006	cohort 2007	cohort 2008
0	27,622,200,064	25,162,733,824	23,498,370,304	25,310,043,648	25,899,797,760	25,841,633,536	26,675,256,960
	(88.2)	(88.0)	(85.1)	(85.8)	(90.3)	(90.3)	(95.5)
1	30,834,766,848	28,297,298,944	28,327,242,752	31,261,973,504	30,187,169,792	33,879,173,120	27,286,966,272
	(65.1)	(66.8)	(64.1)	(65.3)	(64.6)	(64.8)	(65.3)
2	29,945,292,800	27,022,373,888	29,340,286,976	30,201,427,968	30,600,521,728	31,987,959,808	
	(63.9)	(61.6)	(61.7)	(61.4)	(62.9)	(63.3)	
3	29,436,936,192	27,937,122,304	29,694,457,856	30,003,857,408	27,085,705,216		
	(61.7)	(61.8)	(61.3)	(60.4)	(60.6)		
4	31,157,276,672	28,599,842,816	31,451,875,328	26,040,784,896			
	(60.8)	(61.8)	(61.9)	(58.8)			
5	31,674,263,552	29,334,159,360	28,302,788,608				
	(62.5)	(62.4)	(60.1)				
6	31,618,740,224	25,971,822,592					
	(62.5)	(60.5)					
7	27,494,080,512						
	(60.2)						
Total	239,783,556,864	192,325,353,728	170,615,021,824	142,818,087,424	113,773,194,496	91,708,766,464	53,962,223,232

(total input in period t)/(total turnover in period t)*100 in parentheses.
Number of observations: See Table 2.

Table 8: Total value added.

Age	cohort 2002	cohort 2003	cohort 2004	cohort 2005	cohort 2006	cohort 2007	cohort 2008
0	3,698,646,272	3,426,930,432	4,129,106,688	4,196,096,512	2,797,390,592	2,770,462,464	1,261,734,272
1	16,551,693,312	14,037,265,408	15,883,523,072	16,593,744,896	16,563,484,672	18,364,614,656	14,529,490,944
	(4.4751)	(4.0962)	(3.8467)	(3.9546)	(5.9210)	(6.6287)	(11.5155)
2	16,921,475,072	16,864,263,168	18,175,221,760	18,969,511,936	18,028,988,416	18,572,863,488	
	(1.0223)	(1.2014)	(1.1443)	(1.1432)	(1.0885)	(1.0113)	
3	18,268,073,984	17,259,567,104	18,729,064,448	19,660,916,736	17,637,068,800		
	(1.0796)	(1.0234)	(1.0305)	(1.0364)	(0.9783)		
4	20,101,947,392	17,680,467,968	19,361,040,384	18,277,996,544			
	(1.1004)	(1.0244)	(1.0337)	(0.9297)			
5	18,987,542,528	17,687,449,600	18,759,591,936				
	(0.9446)	(1.0004)	(0.9689)				
6	18,971,648,000	16,951,341,056					
	(0.9992)	(0.9584)					
7	18,141,179,904						
	(0.9562)						
Total	131,642,206,464	103,907,284,736	95,037,548,288	77,698,266,624	55,026,932,480	39,707,940,608	15,791,225,216

(value added in period t)/(value added in period t-1) in parentheses.
Number of observations: See Table 2.

Table 9: Linear regression analysis.

Variables	(1) turnover	(2) intermediate consumption	(3) value added
Manufacturing industry	36,991.38***	51,459.46***	-14,468.07***
	(3,377.97)	(2,551.07)	(1,699.84)
Distribution		reference category	
Services for firms	-130.78	13,564.05***	-13,694.83***
	(4,151.37)	(2,949.43)	(2,303.66)
Other services	-56,553.26***	-51,830.05***	-4,723.21***
	(2,195.35)	(2,013.21)	(1,090.54)
Age of firm	64,198.83***	40,218.78***	23,980.05***
	(1,169.11)	(972.62)	(489.19)
Age of firm * manufacturing	1,027.70	-9,646.72***	10,674.41***
	(2,715.80)	(1,799.03)	(1,133.03)
Age of firm * distribution		reference category	
Age of firm * services for firms	-4,520.75*	-18,593.51***	14,072.76***
	(1,796.27)	(1,403.63)	(744.43)
Age of firm * other services	-30,306.40***	-24,875.47***	-5,430.92***
	(1,874.52)	(1,576.52)	(783.39)
Cohort 2002		reference category	
Cohort 2003	-10,885.62**	-7,957.88**	-2,927.74
	(3,962.14)	(2,835.25)	(1,896.64)
Cohort 2004	-6,665.71	-10,757.35**	4,091.64*
	(4,663.02)	(3,371.76)	(2,061.09)
Cohort 2005	-19,653.28***	-22,576.81***	2,923.53
	(4,157.98)	(3,183.93)	(2,125.93)
Cohort 2006	-9,252.57*	-15,782.68***	6,530.11**
	(3,795.93)	(3,119.25)	(2,146.21)
Cohort 2007	20,595.85*	3,547.99	17,047.86***
	(10,237.67)	(6,773.36)	(4,963.02)
Cohort 2008	-3,041.35	-7,848.78*	4,807.43
	(3,572.00)	(3,668.05)	(3,216.42)
Dummy for period 2002		reference category	
Dummy for period 2003	29,811.39***	11,693.73***	18117.67***
	(2,813.56)	(2,986.62)	(2454.94)
Dummy for period 2004	26,480.93***	10,413.96**	16066.97***
	(4,166.18)	(3,264.95)	(2488.19)
Dummy for period 2005	29,154.64***	11,585.72***	17568.92***
	(4,406.08)	(3,071.10)	(2619.68)
Dummy for period 2006	29,947.35***	15,747.08***	14200.27***
	(4,259.86)	(3,201.78)	(2295.66)
Dummy for period 2007	17,226.24**	10,213.56**	7012.68**
	(5,283.07)	(3,841.87)	(2334.08)
Dummy for period 2008	18,816.63**	14,683.68***	4132.96
	(5,988.22)	(4,112.68)	(2742.70)
Constant	116,354.40***	95,724.99***	20,629.44***
	(1,545.35)	(2,360.77)	(2,180.10)
R^2	0.0012	0.0009	0.0011
Number of observations		6,496,164	

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Figures included in the text

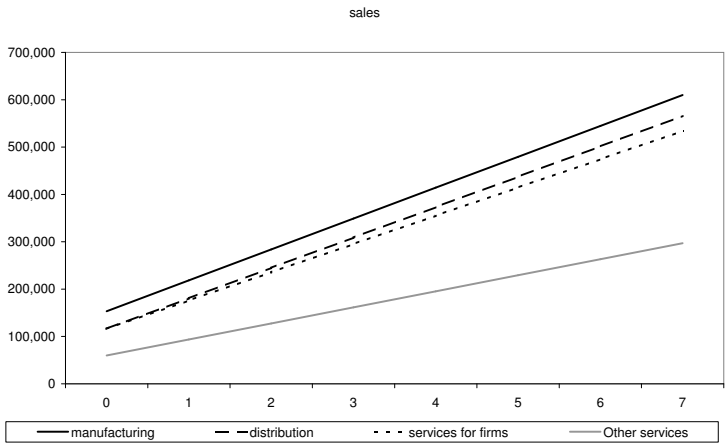

Figure 1: Average turnover by age and sector for cohort 2002.
Note: Calculations based on coefficients presented in Table 9 (Specification (1)). Annual dummy variables remain unconsidered.

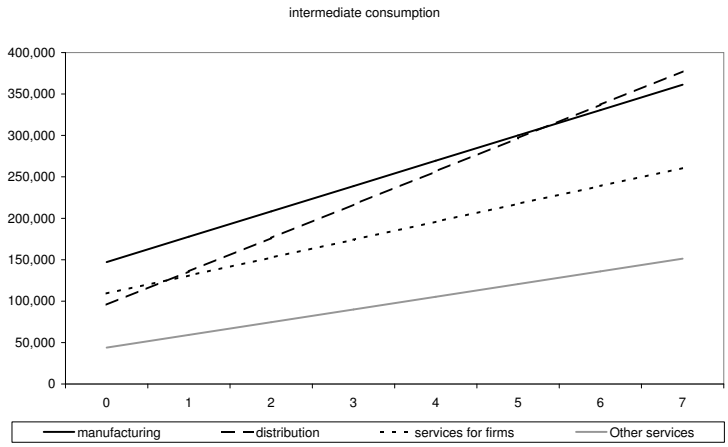

Figure 2: Average input by age and sector for cohort 2002.
Note: Calculations based on coefficients presented in Table 9 (Specification (2)). Annual dummy variables remain unconsidered.

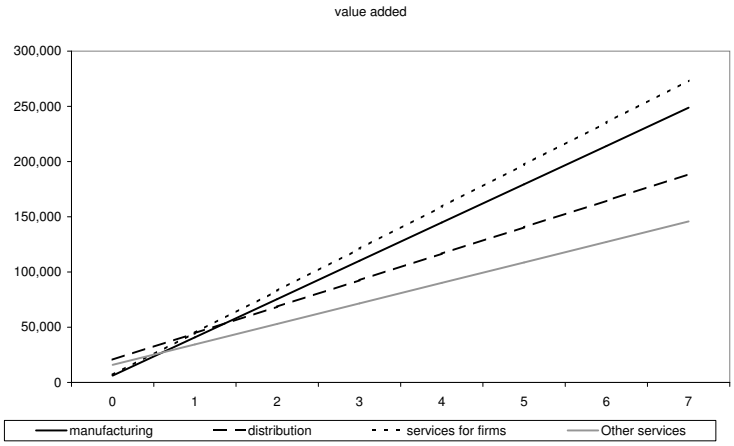

Figure 3: Average value added by age and sector for cohort 2002.
Note: Calculations based on coefficients presented in Table 9 (Specification (3)). Annual dummy variables remain unconsidered.