Centre for
Economic and
Business Research

CEBR

Discussion Paper 2008-13

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2008-13

21-May-08

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Abstract

This paper analyses the importance of entrepreneurs for job creation and wage growth. Relying on unique data that covers all plants, firms and individuals in the Danish private sector, we are able to distil a number of different measures of entrepreneurial plants from the set of new plants, including measures that much more precisely capture the "truly new" or "entrepreneurial" plants than in previous studies. Using these data, we find that while new plants in general account for one third of the gross job creation in the economy, entrepreneurial plants are responsible for between 15% and 25% of this, and thus only account for up to 8% of total gross job creation in the economy. However, entrepreneurial plants seem to generate more additional jobs than other new plants in the years following entry. Finally, the jobs generated by entrepreneurial plants are to a large extent low-wage jobs, as they are not found to contribute to the growth in average wages. However, this insight varies across the different types of entrepreneurial plants.

Keywords: Job creation, entrepreneurial plants, wage growth
JEL: L26, J21, J31

[*] Acknowledgements: We thank the National Agency for Enterprise and Housing for financial support for this project. Sørensen also gratefully acknowledges financial support from Tuborgfondet. The usual disclaimer applies. Malchow-Møller: Centre for Economic and Business Research (CEBR), and School of Business & Economics, University of Southern Denmark, Porcelænshaven 16A, 2000 Frederiksberg, Denmark; nmm.cebr@cbs.dk. Schjerning: University of Copenhagen and Centre for Economic and Business Research (CEBR), Bispetorvet 1-3, DK-1455 Copenhagen K., Denmark; bertel.schjerning@econ.ku.dk. Sørensen: Department of Economics, Copenhagen Business School and Centre for Economic and Business Research (CEBR), Porcelænshaven 16A, 2000 Frederiksberg, Denmark; as.eco@cbs.dk.

1. Introduction

This paper analyses the importance of entrepreneurs for job creation and wage growth in the Danish private sector. Using a unique data set that combines information about plants with information about firm formation and ownership, we can distil a number of different measures of entrepreneurial plants among the total set of new plants. This in turn allows us to provide detailed measures of job creation by different types of entrepreneurs as well as their contribution to average wage growth.

Entrepreneurs are widely believed to play an important role for job creation and wage growth. Schumpeter originally used the term "creative destruction" to describe the process by which new and more productive firms – the entrepreneurs – replace old and less productive firms in the economy.

There has been substantial empirical work on the importance of *small* businesses in job creation; see, *e.g.*, Birch (1979, 1987); Davis *et al.* (1996a, 1996b); and Neumark *et al*. (2008). The main impression from these studies is that small firms play an important role for job creation. Birch (1987) thus found that firms with less than 20 employees account for 88% of overall US employment growth. Davis *et al.* (1996a, 1996b) later argued that Birch's findings had an upward bias in the contribution from small firms. Presenting a method without this problem, Davis *et al.* (1996b) found that plants with an average size less than 100 employees accounted for about one third of gross job creation in US manufacturing over the period 1973-1988. Using the method developed by Davis *et al.*, Neumark *et al.* (2008) studied the overall economy and found that plants with an average size of less than 100 employees accounted for 70% of gross job creation in the period 1992-2002, while plants with less than 20 employees in themselves accounted for almost 50%.

While the importance of small businesses is thus well-documented – and is often taken as evidence of the importance of entrepreneurs in job creation (see, *e.g.*, Parker, 2004) – the role of *new* businesses in job creation has received much less attention. This has to do with the difficulties involved in identifying the "truly new" firms. Several studies have thus analysed the role of *new plants* (new establishments) in job creation; see, *e.g.*, Dunne *et al.* (1989); Davis and Haltiwanger (1992); Davis *et al.* (1996a); Klette and Mathiassen (1996); Spletzer (2000) and Neumark *et al.* (2006). New plants, however, may belong to existing firms and do therefore not represent entrepreneurial job creation in the Schumpeterian sense of the word.

To our knowledge, the only other study that distinguishes new plants belonging to new firms from new plants belonging to existing firms is Neumark *et al.* (2006). They find that births of new firms are particularly important in job creation. Specifically, new plants account for 60-70% of gross job creation of which 2/3 is due to new firms. This implies that at least 40% of total gross job creation is accounted for by the birth of new firms.[1]

We shall argue that firms that are formally new need not be entrepreneurial.[2] An important objective of the present paper is therefore to identify different sets of plants (among the total set of

[1] At a more aggregate level, Audretsch and Fritsch (2002) and van Stel and Storey (2004) consider the relationship between start-up rates and employment changes across regions.

[2] See also Storey (1991) for an earlier discussion of the problems in identifying the "wholly new firms" among the set of new or entrant firms.

new plants) that can more appropriately be characterised as entrepreneurial. To the best of our knowledge, no study has previously analysed job creation by such *new entrepreneurial* plants.

We also address the quality of jobs created by entrepreneurial plants by analysing the contribution to average wage growth. In addition to evaluating the aggregate effect of new plants on the wage level, we are also able to separate out the relative importance of different types of entrepreneurs.

Related to this, Brixy, Kohaut and Schnabel (2007) have recently found that wages in newly founded establishments are 8 percent lower than in other establishments of similar size. Their study is based on a sample of around 800 newly founded firms in Germany. Moreover, Brown and Medoff (2003) have previously found that firms that have been in business for a long time pay higher wages. However, when controlling for worker characteristics, the difference is not significant. Wages are found to fall in the beginning of a firm's life and increase later. As for job creation, there is also a large literature considering the relationship with firm size, and here it is generally found that small firms pay lower wages than large firms; see, *e.g.*, Oi and Idson (1999).

Our study relies on a unique register dataset that covers the entire Danish private sector. It allows us to match *all* individuals with plants, and *all* plants with firms (the legal unit). Thus, firm level information about firm age and number of plants can be used at the plant level together with individual information on the owners of personally-owned firms (the self-employed). This implies that we can construct several different measures of entrepreneurial plants among the total set of new plants.

One set of measures take a firm approach, identifying the entrepreneurial plants from the age of the firm to which they belong. However, many firms that are formally new may in practice be little more than a renaming of the company or the result of organising existing or additional activities in different legal entities. To deal with this problem, Statistics Denmark has identified the subset of new firms which is considered as the "*truly" new firms*. A truly new firm is a firm that has been registered for VAT and has never been run (i) by another owner; (ii) under another form of ownership; (iii) under another firm; or (iv) by a personal owner who already runs other personally-owned firms. Using this information, we are able to get an improved measure of the entrepreneurial plants. On the other hand, this approach may not capture all relevant firms owned by self-employed individuals.

Another set of measures therefore identify the entrepreneurial plants from the newly self-employed individuals. Apart from giving us a measure of the contribution of new self-employed to job creation – which is interesting in its own right given the large (political and academic) interest in the self-employed – this approach has the advantage of including among the entrepreneurial plants those firms that were founded several years ago, but only became active (in terms of employment) at a later stage.

The different measures of entrepreneurial plants not only allow us to get a more robust estimate of the contribution of entrepreneurs to job creation, they also allow us to compare the contributions of different types of entrepreneurs.

Equipped with these measures, we analyse the importance of entrepreneurship in gross job creation using the method developed by Davis and Haltiwanger (1992), and Davis *et al.* (1996a). As also the

"quality" of the jobs created is of interest, we subsequently assess the impact from entrepreneurship on the average wage level using a decomposition method from Foster *et al.* (2001).

We find that new plants account for around *one third* of overall gross job creation even though they only account for 4-5% of total employment. While half of these jobs are generated by new plants of new firms, using our measure of *truly* new firms, we find that entrepreneurial plants account for only about 15% of the gross job creation by new plants. If we also take the plants of newly self-employed into account, thereby including also formally older firms among the entrepreneurs, the share increases to around 25%. Thus, entrepreneurs are responsible for up to 8% of *total* gross job creation in the economy.

Even though jobs created by entrepreneurial plants do not exhibit higher persistence than jobs created by other new plants, we find some evidence that entrepreneurial plants create more additional jobs in the years following entry. Quantitatively, this may raise the contribution of entrepreneurs in total job creation by a few percentage points.

We also analyse the "quality" of jobs generated by entrepreneurship by decomposing the change in average wages into the contributions from continuing, exiting and entering plants. While exiting plants contribute significantly to wage growth – confirming Schumpeter's idea of the destruction of less productive firms – the effects of new plants are less clear. In general, these are found to account for between -10 and 10 percent of the increase in the average wage. Among these plants, plants of new self-employed have a strong negative contribution, while the plants of truly new firms are found neither to increase nor to decrease average wages. Thus, it seems fair to say that entrepreneurs generate low-wage jobs on average.

The rest of the paper is organised as follows. In Section 2, we describe the data and present the different measures of entrepreneurial plants applied in this paper. In Section 3, we analyse job creation focusing on the contribution to this process by the entrepreneurial plants. The contribution of entrepreneurial plants to the growth in the average wage is analysed in Section 4. Finally, Section 5 concludes.

2. Data and Definitions

This study draws on data from a number of Danish registers administered by Statistics Denmark. The registers cover the entire population of individuals, plants and firms in the Danish economy.

First, we use data from the Integrated Database for Labour Market Research (IDA). IDA contains detailed annual register-based data on all plants (establishments) and all individuals in Denmark. For example, for each plant, the number of employees, the total wage bill, and the industry classification are observed. With respect to the present study, the IDA database has three important characteristics. (i) It covers the entire population of plants and individuals. (ii) It is longitudinal making it possible to track individuals and plants from year to year. Thus, there is only natural attrition in the data set, *i.e.*, births, deaths and migration of individuals, and start-ups and closures of plants. The panel currently covers the period 1980-2005, and the occupational status of each individual is observed once a year (the last week of November). (iii) Workers are linked to plants, making it possible to identify all the employees of any plant in each year, as well as the owners of plants in personally-owned firms.

Second, plants in IDA can be linked to firms (the legal units) for the period 1995-2002. In this way, we can assign firm level information to each plant in the firm, including the age (registration date) of the firm from the Enterprise Statistics. Furthermore, this link allows us to obtain information about other plants within the same firm.

Third, we combine the information above with a special database on "truly" new firms, which has been developed by Statistics Denmark. In this database, all new firm registrations in the years 1993-2002 have been collected and subsequently been merged with additional information to eliminate registrations which do not reflect "truly" new firms (more about this below). This additional firm information can be merged onto the Enterprise Statistics and used at the plant level.

2.1 Plants

Our population of interest is the set of plants in the Danish private sector in the years 1994-2003. However, we exclude the primary sector as well as industries not subject to value-added taxes (VAT) such as the financial and educational sectors as the database on truly new firms does not cover these industries.[3]

The longitudinal identity of a plant is well defined in IDA. A plant is thus considered as continuing from one year to the next if (at least) one of the following criteria is fulfilled in two consecutive years: (i) same owner and same industry; (ii) same owner and same employees; (iii) same employees and same address; or (iv) same employees and same industry.[4] Hence, even in cases where the plant changes location or is taken over by a new owner, the plant is still considered as a continuing plant, thereby reducing the possibility of spuriously recording a plant death followed by a plant start-up.

Given the well-defined longitudinal identity of plants, they provide the most reliable basis for measuring the amount of jobs created and destructed in the economy. Thus, the measures of job creation, job destruction and average wages used in this paper are all constructed at the plant level. Finally, note that there must be employees for an establishment to figure as a plant in the data set. A self-employed individual without employees is therefore not considered as having a plant.

2.2 Entrepreneurial plants

The simplest way of measuring entrepreneurial job creation is to use total job creation by all new plants. However, as argued in the Introduction, this is likely to "exaggerate" the entrepreneurial activity. Thus, we use various approaches to distil different sets of entrepreneurial plants from the total set of new plants.

Several definitions of entrepreneurship are available from the literature. Often, entrepreneurs are simply measured as the number of *self-employed* or, perhaps more precisely, as the number of *new self-employed*; see Iversen *et al.* (2008). According to such a measure, the entrepreneurial plants would be those set up and owned by newly self-employed individuals. This measure, however, leaves out those entrepreneurs who form incorporated businesses as these individuals are not technically self-employed, according to the registers, but instead employees of their incorporated businesses. Only the owners of personally-owned firms are registered as self-employed.

[3] Note that we exclude all plants that belong to these industries in at least one year.
[4] By "same employees" is meant that at least 30% of the employees should be present in both years.

An alternative measure of entrepreneurship therefore takes a firm perspective, focusing on all new firms (the legal unit) – both incorporated and non-incorporated (personally-owned) in a given year. However, all firms which are new in a legal sense need not be new in any practical sense. Instead, they may, *e.g.*, reflect that existing or new activities are organised in new legal units for legal and/or tax reasons. As such, the plants of these firms are not necessarily "entrepreneurial". Furthermore, firms that are new in a practical sense, *i.e.*, entrepreneurial, in a given year may have been legally established many years earlier.

Thus, to provide the most comprehensive picture, we rely on four different measures of entrepreneurial plants. The first two definitions take an individual perspective focusing on self-employed individuals, while the latter two take a firm perspective. From these four subsets of new plants, we can also define a number of combinations to better proxy the set of entrepreneurial plants. We shall return to that below. Figure 1 illustrates the relationship between the four different measures.

Our first measure of entrepreneurial plants is defined as the set of new plants which are owned by *newly self-employed* individuals. We shall refer to these as "NSE plants". To be precise, an NSE plant is a new plant owned by a self-employed individual who was not self-employed (as his or her primary occupation) the year before. In other words, he or she was either wage employed, unemployed or non-employed in her primary occupation the year before.

Our second measure of entrepreneurial plants is defined as the set of new plants owned and operated by *new employers.* This measure is an extension of our first measure, as it also includes new plants owned by individuals who were self-employed without employees the year before. By construction, the set of NSE plants thus becomes a perfect subset of this latter set of plants, which we shall refer to as the set of "NE plants". See Figure 1 below.

To illustrate the difference between the two measures, consider the self-employed individual who has been running a small handicraft shop on his own for a number of years. If she – after 10 years – decides to hire an assistant, she will be setting up a new plant, and this plant will then be included in the set of NE plants in that year. However, as the owner was also self-employed the year before, the plant will not be included in the set of NSE plants.

Our third definition is simply the set of new plants set up by *new firms, i.e.*, firms which are new in a legal sense. This third set of plants is referred to as "NF plants". From the Enterprise Statistics, we know the starting (registration) date of each firm, which allows us to identify among the new plants those that also belong to new firms.[5] To operationalise this definition, we define NF plants as new plants belonging to firms founded either the same year or the year before. Thus, the plant of the small handicraft shop from the example above will not be included in this measure.

A potential critique of this third definition is that many firms that are new in a legal sense are not new in any practical or economic sense. They may instead be the results of restructures, take-overs etc. Statistics Denmark has therefore identified the subset of new firms, which is considered as the "*truly" new firms*. This provides us with our fourth definition of entrepreneurial plants, which we shall call the set of "TNF plants".

[5] van Stel and Storey (2004) have previously used new registrations for VAT as a measure of firm births.

Specifically, there are around 35,000-40,000 new firm registrations for VAT each year in Denmark (Statistics Denmark, 2002). From this population, the following new registrations are eliminated: registrations due to take-overs or reorganisations (*e.g.*, from personally-owned to incorporated firms), re-starters, and administrative registrations where firms register existing activities in a new legal entity. This leaves around 15,000-20,000 truly new firms each year (Statistics Denmark, 2002).

A truly new firm is thus a firm that has been registered for VAT in a given year, and has never been run (i) by another owner; (ii) under another form of ownership; (iii) under another firm; or (iv) by a personal owner who already runs other personally-owned firms (Statistics Denmark, 2002). Our TNF plants are therefore the subset of NF plants where the firm behind the plant is not only a new firm but can also be found in this database of truly new firms.

2.3 Discussion

The four different definitions of entrepreneurial plants (NSE, NE, NF, and TNF plants) and the relationship between these are illustrated in Figure 1 below. The figure also shows the number of plants in each category in 2001.

Out of 17,186 new plants in 2001, 4,767 belonged to new employers (NE plants). These are plants in personally-owned firms where the owner did not have employees the year before. In approximately half of the cases – 2,576 to be precise – the owner was not even self-employed the year before. These are our NSE plants. In other words, approximately half of the new plants set up by new employers are operated by individuals who were already running their own business the year before; just without employees.

Turning to the firm-based definitions of entrepreneurial plants, we can see that 6,781 of the new plants were set up by new legal entities, *i.e.*, firms founded within the same or the previous year. These are the NF plants. In approximately half of the cases (3,359), the firm was also considered a truly new firm. This provides a first illustration of the danger in setting new firms equal to entrepreneurial firms.

Note that we may perfectly well have entrepreneurial plants that meet the conditions for being NSE and NE plants, but not those for being NF and TNF plants, and the other way around. For example, consider an individual who has been part-time self-employed for some years and then decides to become full-time self-employed and hires employees. This plant will be included in the sets of NE and NSE plants, but not in the sets of NF and TNF plants as no new legal entity has been established. Similarly, new plants belonging to (truly) new incorporated firms, and hence are included in the sets of NF and TNF plants, do not figure among the plants of the new self-employed (NSE plants) or the plants of new employers (NE plants).

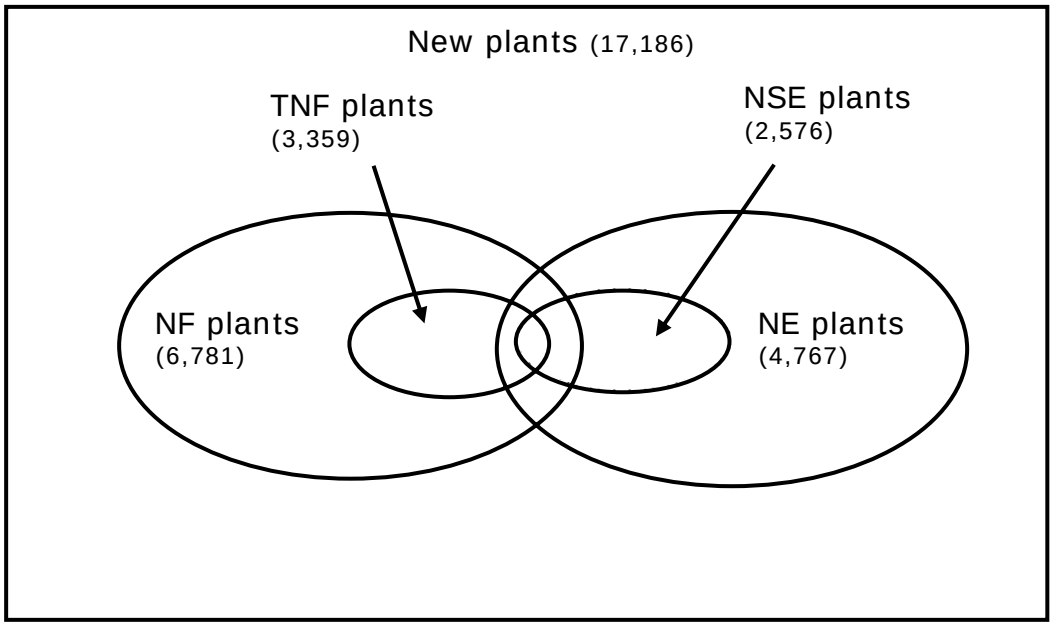

Figure 1: The four measures of entrepreneurial plants and the number of plants in each category (2001 numbers).

Table 1 below contains the number of entrepreneurial plants according to each of the four definitions and various combinations of these for the years 1994-2003. Note that the NF plants and TNF plants, which are based on the Enterprise Statistics, can only be identified for the years 1996-2001. The table confirms the picture from Figure 1. Roughly speaking, the number of NF plants is twice as large as the number of TNF plants. Similarly, the number of NE plants is twice as high as the number of NSE plants.

It is evident that the different measures of entrepreneurial plants will provide rather different measures of the entrepreneurial activity. So which measure should we prefer?

The NE and NSE plants are interesting in their own right as much of the literature has focussed on the self-employed. However, as a measure of entrepreneurial plants, the NSE measure is probably to be preferred as the NE plants may belong to individuals who have been self-employed their entire life just without employees. On the other hand, if one can argue that a self-employed individual only becomes an entrepreneur when (s)he starts to hire employees, the NE plants would be the preferred measure.

The main problem in using the definitions based on the self-employed is that it leaves out all the incorporated firms which are likely to be the bigger firms and hence the more important ones in terms of job creation. This takes us to the firm-based definitions.

Obviously, the NF plants provide a far too optimistic picture of entrepreneurial activity. A TNF plant is much closer to what we would consider to be an entrepreneurial plant. These are plants of generically new firms. The only drawback is that this measure leaves out firms which were formally established several years prior to becoming active in terms of employment.

Based on this, our preferred measure of entrepreneurial plants is the TNF plants or the union of TNF plants and NSE plants. The latter set (TNF∪NSE) includes the new plants of truly new firms (from a legal perspective) as well as the new plants of newly self-employed individuals where the legal entity was established at an earlier date. According to Table 1, using the union of TNF and NSE plants yields around 4,000-5,000 entrepreneurial plants each year out of a total of 16,000-18,000 new plants.

Including also the new plants of new employers (the NE plants), raises the number of entrepreneurial plants by 2,000-2,500 per year. However, these plants may be owned by individuals who have been full-time self-employed for decades just without employees.

Table 1: Number of New Plants and New Entrepreneurial Plants According to the Four Definitions

	New Plants	NE Plants	NSE Plants	NF Plants	TNF Plants	NF∪NE Plants	TNF∪NE Plants	TNF∪NSE Plants	NF∩NE Plants	TNF∩NSE Plants
Year	Number of plants									
1994	17,937	5,754	2,840	-	-	-	-	-	-	-
1995	16,926	5,986	3,105	-	-	-	-	-	-	-
1996	16,795	5,719	2,957	4,168	1,840	7,569	6,482	3,900	2,318	897
1997	16,174	4,959	2,563	4,867	2,511	7,571	6,231	4,084	2,255	990
1998	16,342	5,485	2,917	4,712	2,397	8,177	6,717	4,413	2,020	901
1999	17,812	5,426	2,749	5,570	2,881	8,708	6,925	4,482	2,288	1,148
2000	18,055	5,208	2,890	6,856	3,466	9,407	7,205	5,179	2,657	1,177
2001	17,186	4,767	2,576	6,781	3,359	8,946	6,833	4,927	2,602	1,008
2002	16,705	4,356	2,313	-	-	-	-	-	-	-
2003	17,411	4,402	2,207	-	-	-	-	-	-	-

Note: The number of NF and TNF plants can only be identified for the years 1996-2001.

3. Entrepreneurship and Job Creation

In this section, we study the role of entrepreneurial plants in job creation. The methodology used is explained in Section 3.1. In Section 3.2, we consider the overall job creation and job destruction in the Danish economy. Section 3.3 then analyses the importance of entrepreneurship for gross job creation, exploiting the different definitions of entrepreneurial plants from above.

3.1 Methodology

We determine job creation and job destruction at the plant level by applying the method developed by Davis and Haltiwanger (1992) and Davis *et al.* (1996a). Albæk and Sørensen (1998) have previously analysed job creation and job destruction in the Danish Economy, but not the importance of plant age and entrepreneurial plants in this process.

The measures of job creation, C_{it}, and job destruction, D_{it}, at plant *i* between year's *t-1* and *t* are defined as follows:

$$C_{it} = \max\left(X_{it} - X_{it-1}, 0\right)$$
$$D_{it} = \max\left(X_{it-1} - X_{it}, 0\right) \quad (1)$$

where X_{it} is employment at plant i in year t measured as employment in the last week of November. The variable C_{it} is thus equal to the increase in the number of employees if an increase has occurred. If the number of employees has decreased, the variable is set to zero. Similarly, D_{it} equals the number of jobs lost if employment has decreased, and equals zero if employment has increased. Note that new plants have $X_{it-1} = 0$ by construction. Similarly, exiting plants have $X_{it} = 0$.

We also construct measures of the persistence of jobs created (and destructed). The k-year persistence measure of jobs created at plant i between year $t - 1$ and t is constructed as follows (see also Davis and Haltiwanger, 1992):

$$P_{kit}^{C} = \begin{cases} Max(X_{it} - X_{it-1}, 0) & if\ X_{it+k} \geq X_{it} \\ Max(X_{it+k} - X_{it-1}, 0) & if\ X_{it+k} < X_{it} \end{cases} \quad (2)$$

If the number of jobs at plant i increases or stays constant between years t and $t + k$, there is full persistence of the jobs created between $t - 1$ and t. On the other hand, the persistence measure equals the number of remaining jobs if the number of jobs decreases from t to $t + 1$. Thus, the persistence measure takes a value between 0 and C_{it}. The former is the case when all the jobs created between $t - 1$ and t have been destroyed, whereas the latter is the case when the employment level from period t has been maintained or increased. The persistence measure of jobs destructed is constructed in a similar way.

3.2 Job Creation and Job Destruction

In this section, we focus on the overall amount of job creation and job destruction in the Danish economy. Table 2 reports aggregate measures of annual job flows in the period 1994-2003. The key message conveyed by the table is that gross job flows are relatively large in magnitude. The amount of jobs created each year is between 12.8% and 17.0% of total employment, with job destruction amounting to between 10.9% and 15.2% in the period considered. For comparison, Davis *et al.* (1996a) report that the average job creation and destruction rates in US manufacturing were 9.1% and 10.2%, respectively, over the period 1973-1988. One explanation for this difference is, of course, that job turnover has increased between the two periods considered. Another explanation is that Danish plants on average are smaller than US plants and that therefore more job creation and destruction is registered in Denmark, while some of it nets out at the larger US plants.

Table 2 also reveals that annual net creation is positive throughout the 1990s; a period of continued expansion in the Danish economy. Following 2001, the Danish economy enters a (light) recession and net creation becomes negative. In the following, we focus on 1999 and 2001 as two years where net job creation was close to zero. Furthermore, 2001 is the last year in which we have information on all the four measures of entrepreneurial plants, *cf.*, Table 2.

Table 2: Aggregate Job Flows, 1994-2003

	Number of employees (X)	Job creation (C)	Job destruction (D)	Net creation (C-D)	Job reallocation (C+D)
			Absolute numbers		
1994	1,185,129	201,210	139,787	61,423	340,997
1995	1,212,676	175,646	148,099	27,547	323,745
1996	1,224,905	161,263	149,034	12,229	310,297
1997	1,259,877	172,587	137,615	34,972	310,202
1998	1,291,029	171,261	140,109	31,152	311,370
1999	1,297,954	178,020	171,095	6,925	349,115
2000	1,323,496	191,871	166,329	25,542	358,200
2001	1,330,100	191,676	185,072	6,604	376,748
2002	1,301,903	169,767	197,964	-28,197	367,731
2003	1,272,173	162,655	192,385	-29,730	355,040
			Share of Employment		
1994	100	17.0	11.8	5.2	28.8
1995	100	14.5	12.2	2.3	26.7
1996	100	13.2	12.2	1.0	25.3
1997	100	13.7	10.9	2.8	24.6
1998	100	13.3	10.9	2.4	24.1
1999	100	13.7	13.2	0.5	26.9
2000	100	14.5	12.6	1.9	27.1
2001	100	14.4	13.9	0.5	28.3
2002	100	13.0	15.2	-2.2	28.2
2003	100	12.8	15.1	-2.3	27.9

Note: The number of jobs is measured as plant level employment in the last week of November. For non-continuing plants, employment is set to zero in the following year. For new plants, lagged employment is set to zero.

To consider the importance of plant age for job creation and destruction, the distributions of gross job creation and gross job destruction across plant age are shown in Table 3. The figures refer to the years 1999 and 2001.

The first column shows the number of plants in each age category that are alive in 1999 and 2001, respectively, while the second column shows the number of plants that closed down during the last year. Thus, around 12% of all plants close down between two years. For young plants, this percentage is much higher. More than one third of the plants created in 1998 (or 2000) had thus closed down in 1999 (or 2001).

From the fourth column, we can see that the employment share of young plants is substantial: In both years, more than 20 percent of the total number of jobs is located in plants aged 0-5 years. Moreover, these relatively young plants create a considerably larger amount of jobs (column 5): Around 55 percent of gross annual job creation can be attributed to plants younger than 5 years, and

more than 31 percent to new plants. Whether these new plants are also entrepreneurial cannot be seen from the table. We will return to this issue below.

Table 3: Aggregate Employment and Job Flows by Plant Age and Continuation Status, 1999 and 2001

	Number of plants (N)			Empl. (X)	Creation (C)	Destruction (D)			Net Creation (C-D)		
	Startups/ Continued	Shutdowns	Total	Startups/ Continued	Startups/ Continued	Startups/ Continued	Shutdowns	Total	Startups/ Continued	Shutdowns	Total
Plant age						1999					
New plants	17,812	0	17,812	56,187	56,187	0	0	0	56,187	0	56,187
1 year	10,382	5,960	16,342	48,982	14,693	6,497	6,671	13,168	8,196	-6,671	1,525
2 years	7,674	2,529	10,203	42,359	8,054	7,157	5,322	12,479	897	-5,322	-4,425
3 years	6,328	1,468	7,796	44,900	7,441	6,092	3,205	9,297	1,349	-3,205	-1,856
4 years	5,632	945	6,577	40,944	6,334	5,347	3,917	9,264	987	-3,917	-2,930
5 years	5,132	751	5,883	46,966	6,181	5,161	2,564	7,725	1,020	-2,564	-1,544
6 years	4,300	524	4,824	40,575	4,796	4,531	1,981	6,512	265	-1,981	-1,716
7 years	4,321	479	4,800	44,179	4,407	6,371	1,330	7,701	-1,964	-1,330	-3,294
8+ years	60,595	3,561	64,156	932,862	69,927	84,448	20,501	104,949	-14,521	-20,501	-35,022
Total	122,176	16,217	138,393	1,297,954	178,020	125,604	45,491	171,095	52,416	-45,491	6,925
						2001					
New plants	17,186	0	17,186	60,697	60,697	0	0	0	60,697	0	60,697
1 year	11,695	6,360	18,055	63,633	18,461	11,300	8,133	19,433	7,161	-8,133	-972
2 years	8,685	2,492	11,177	56,241	10,909	8,542	4,645	13,187	2,367	-4,645	-2,278
3 years	6,663	1,360	8,023	44,663	6,800	6,427	3,124	9,551	373	-3,124	-2,751
4 years	5,468	906	6,374	37,675	6,412	5,646	2,451	8,097	766	-2,451	-1,685
5 years	4,735	679	5,414	39,844	4,762	5,303	2,129	7,432	-541	-2,129	-2,670
6 years	4,442	531	4,973	37,649	4,971	5,056	1,822	6,878	-85	-1,822	-1,907
7 years	4,191	421	4,612	42,045	4,801	4,599	2,036	6,635	202	-2,036	-1,834
8+ years	61,441	3,759	65,200	947,653	73,863	91,949	21,910	113,859	-18,086	-21,910	-39,996
Total	124,506	16,508	141,014	1,330,100	191,676	138,822	46,250	185,072	52,854	-46,250	6,604

Note: The number of jobs is measured as plant level employment in the last week of November. For non-continuing plants, employment is set to zero in the following year. For new plants, lagged employment is set to zero.

Turning to job destruction (columns 6 to 8), the lion's share is accounted for by older plants, *i.e.*, plants of 8 years or older. However, also the very young plants contribute to job destruction – both through shutdowns (column 7) and in continuing plants (column 6). For the youngest plants, around half of the job destruction is due to plants closing down, while the share of job destruction due to shutdowns is only around 25 percent for older plants. By comparing columns 2 and 7, we can also see that young plants that close down are on average much smaller than older plants closing down.

If we exclude start-ups, which by construction have no job destruction in their first year, total net job creation (columns 9 to 11) thus becomes negative already after the first year. The only exception is for 1 year old plants in 1999 that have a slightly positive contribution. For the young plants, this is entirely due to plant closures, as continuing plants remain to have a positive contribution. For the older plants, both continuing and closing plants contribute negatively to net job creation.

Hence, at the aggregate level, new plants are responsible for approximately one third of gross job creation each year. Furthermore, it is primarily new plants that contributed to employment growth in 1999 and 2001, while both young and older plants, on average, contribute negatively to net creation of jobs. However, if we exclude the effects of shut-downs on net job creation, the average net contribution from a plant remains positive for the first 4-6 years a plant is alive.

For comparison, Davis and Haltiwanger (1992) found that plant openings were responsible for 20% of gross job creation in US manufacturing sector, while Neumark *et al.* (2006) find that new plants are responsible for around 60% of gross job creation in the US when considering the entire economy.

3.3 Job Creation by Entrepreneurial Plants

From Table 3, we saw that new plants account for around one third of gross job creation as well as most of the net job creation in the economy. The important question is now: What is the share of job creation in new plants that can be attributed to entrepreneurial plants? To determine this, we apply the different definitions of entrepreneurial plants discussed in Section 2.

Table 4 splits up the new plants and their contributions to job creation on the four measures of entrepreneurial plants (as well as combinations thereof). We can see that new plants of new firms (NF plants) are responsible for approximately half of the job creation by new plants. However, using the measure of truly new firms (TNF plants), the share drops to around 15-17%. Newly self-employed, on the other hand, are responsible for around 10-13% of job creation (NSE plants). This share increases to 18-24% if we also include plants run be individuals who were self-employed without employees the year before (NE plants)

Table 4 : Job Creation in Entrepreneurial Plants, 1999 and 2001

	1999			2001		
	Number of plants (N)	Job creation (C)	Jobs per plant	Number of plants (N)	Job creation (C)	Jobs per plant
			Absolute numbers			
All new plants	17,812	56,187	3.2	17,186	60,697	3.5
NE plants	5,426	13,630	2.5	4,767	10,758	2.3
NSE plants	2,749	7,503	2.7	2,576	6,364	2.5
NF plants	5,570	27,570	4.9	6,781	31,887	4.7
TNF plants	2,881	8,759	3.0	3,359	10,388	3.1
NF∪NE plants	8,708	34,492	4.0	8,946	35,715	4.0
TNF∪NE plants	6,925	18,878	2.7	6,833	18,060	2.6
TNF∪NSE plants	4,482	13,202	2.9	4,927	14,279	2.9
NSE∩TNF plants	1,148	3,060	2.7	1,008	2,473	2.5
			Share of total			
All new plants	100.0	100.0		100.0	100.0	
NE plants	30.5	24.3		27.7	17.7	
NSE plants	15.4	13.4		15.0	10.5	
NF plants	31.3	49.1		39.5	52.5	
TNF plants	16.2	15.6		19.5	17.1	
NF∪NE plants	48.9	61.4		52.1	58.8	
TNF∪NE plants	38.9	33.6		39.8	29.8	
TNF∪NSE plants	25.2	23.5		28.7	23.5	
NSE∩TNF plants	6.4	5.4		5.9	4.1	

Note: The number of jobs is measured as plant level employment in the last week of November.

Using the union of TNF and NSE plants as the measure of entrepreneurial plants, entrepreneurial job creation amounts to slightly less than 25% of the job creation by new plants. This share can be increased to 30-34% if we instead of the NSE plants use the broader measure of job creation by new employers; the NE plants. We take this as the most optimistic estimate on the importance of entrepreneurial job creation, but as previously argued many of the NE plants are unlikely to be truly entrepreneurial.

For comparison, Neumark *et al.* (2006) find that around 2/3 of the jobs created by new plants in the US economy are due to new firms. This in turn implies that around 40% of the total gross job creation is accounted for by the birth of new firms in their study.

From Table 4, it is also evident that jobs per plant vary relatively much over the four definitions. New plants in new firms (NF plants) generate 4.7-4.9 jobs per plant in the year of establishment, whereas new employers (NE) generate less than 2.5 jobs per new plant. This should be compared to the number of jobs per new plant in general, which equals 3.2-3.5.

In sum, using one of our preferred measures of entrepreneurial plants (TNF plants or the union of TNF and NSE plants), we conclude that entrepreneurs are responsible for between 15% and 25% of the job creation by new plants and hence between 5% and 8% of total job creation. Using all new plants of technically new firms (the NF plants) as the measure of entrepreneurial job creation would, however, exaggerate the importance of entrepreneurs in this process.

Table 4 only gives the contribution of the entrepreneurial plants to job creation in their entry year. Another aspect relevant for the understanding of job creation by entrepreneurial plants is how persistent these jobs are. Are they destructed more or less quickly than jobs created at non-entrepreneurial new plants and older plants? On the one hand, it is expected that successful entrepreneurial plants grow faster, which reduces the risk that jobs created in the first year are eliminated in the next couple of years. On the other hand, entrepreneurial plants may be much more vulnerable to failure than other new and older plants.

The upper part of Table 5 displays persistence measures of the jobs created and the jobs destructed in 1999 by new and older plants. There are several things to note from the table. First, the persistence of jobs created at new plants is generally higher than the persistence of jobs created at older plants. Second, among the different measures of entrepreneurial plants, persistence is highest on NF and TNF plants that have persistence rates that correspond to those for new plants in general. Persistence rates of jobs created by new self-employed (NSE plants) and new employers (NE plants) are somewhat lower.

Persistence measures of job destruction are generally somewhat higher. However, this is to be expected since some of the destructed jobs reflect plant exits where the jobs by definition remain destructed. Furthermore, the persistence rates of job destruction are slightly higher for younger plants. This reflects that these have a higher risk of exiting.

The persistence measures only capture what happens to the jobs that were created in the first year not the amount of additional jobs created in the following years. To throw some light on this latter aspect, the lower part of Table 5 presents the total employment at the new plants in the years

following entry, as well as the total employment in the firm (the legal unit), *i.e.*, including employment at other plants in the same firm.

Table 5: Persistence Measures and Employment in the Years Following Entry, 1999

	Job creation (C)	Job destruct. (D)	One-Year persistence		Two-year persistence		Three-year persistence		Four-year persistence	
			Creation (P_1^C)	Destruct. (P_1^D)	Creation (P_2^C)	Destruct. (P_2^D)	Creation (P_3^C)	Destruct. (P_3^D)	Creation (P_4^C)	Destruct. (P_4^D)
Plant age	*Absolute numbers*		*Share of intial job-creation (destruction)*							
All new plants	56,187	-	73	-	60	-	51	-	44	-
1 year	14,693	13,168	69	91	53	89	42	88	34	87
2 years	8,054	12,479	64	90	49	87	40	86	34	85
3 years	7,441	6,512	60	87	47	82	38	80	32	79
4 years	6,334	7,701	61	84	45	72	37	66	30	63
5 years	6,181	5,998	53	84	42	76	31	73	25	72
6 years	4,796	5,700	61	84	41	77	31	75	27	73
7 years	4,407	4,637	59	86	44	78	37	76	30	74
8 years	4,237	5,623	66	79	50	73	40	71	31	69
9 years	4,007	3,738	66	81	50	74	35	68	27	67
10 years	4,036	3,990	66	81	46	75	32	71	26	70
11+ years	57,647	69,461	65	83	49	76	38	73	31	71
Total	178,020	171,095	67	85	52	78	42	76	35	74
All new plants	56,187	-	73	-	60	-	51	-	44	-
NE plants	13,630	-	67	-	52	-	41	-	35	-
NSE plants	7,503	-	69	-	53	-	43	-	37	-
NF plants	27,570	-	75	-	63	-	54	-	47	-
TNF plants	8,759	-	73	-	57	-	45	-	39	-
NF∪NE plants	34,492	-	73	-	60	-	51	-	44	-
TNF∪NE plants	18,878	-	69	-	54	-	43	-	37	-
TNF∪NSE plants	13,202	-	71	-	55	-	44	-	38	-
NSE∩TNF plants	3,060	-	70	-	53	-	43	-	36	-

	Employment in the years following entry									
	Entry year		One-year ahead		Two-year ahead		Three-year ahead		Four-year ahead	
	Plant empl.	Firm empl.	Plant	Firm	Plant	Firm	Plant	Firm	Plant	Firm
All new plants	56,187	216,206	100	74	96	76	84	-	77	-
NE plants	13,630	13,631	94	97	85	88	77	-	74	-
NSE plants	7,503	7,503	99	102	91	95	83	-	78	-
NF plants	27,570	56,656	107	92	106	91	91	-	84	-
TNF plants	8,759	8,779	120	122	123	124	95	-	89	-
NF∪NE plants	34,492	63,579	104	92	101	90	87	-	81	-
TNF∪NE plants	18,878	18,899	105	107	101	103	84	-	79	-
TNF∪NSE plants	13,202	13,222	112	114	112	114	90	-	84	-
NSE∩TNF plants	3,060	3,060	102	108	93	97	88	-	85	-

Note: See section 3.1 for a definition of the persistence measures. Employment in the years following entry is calculated in percent of employment in the entry year. Firm employment can only be tracked until 2001.

First, note that for the set of all new plants, total firm employment is four times higher than plant employment in the initial year, reflecting that many of the new plants are established by existing firms. Second, firm employment also significantly exceeds plant employment for the NF plants (by a factor 2), which reflects that these firms also have older plants, which have been acquired from other firms. This is a strong indication that many of the NF plants are not plants of *truly* new firms. Instead, the (technically) new firm is likely to be a result of changes in the legal structure of existing firms. This result thus confirms that using NF plants as a measure of entrepreneurial plants would be inappropriate.

Third, while new plants are on average 23 percent smaller in terms of jobs after 4 years, TNF plants are only 11 percent smaller. After two years, these entrepreneurial plants are in fact considerably bigger (23%) than in their start-up year. This points to a somewhat better performance of entrepreneurial plants than other new plants in generating jobs in the years following their entry. Quantitatively, however, this may add at most a few percentage points to the results for job creation by entrepreneurial plants from Table 4.[6]

Fourth, plants of new self-employed (NSE plants) and plants of new employers (NE plants) have a poorer performance in this respect. Four years after entry, they retain only around 75% of the jobs from the entry year. This corresponds to the performance of all new plants in general.

4. Entrepreneurship and Average Wages

Creative destruction may not only impact on jobs by replacing old jobs at exiting plants with new jobs at entering plants. Schumpeter's hypothesis was that it would also create more productive jobs. Thus, the process of creative destruction may also be expected to affect the average wage level in the economy. If the old jobs that disappear earn a lower wage than the new ones that enter, this will raise the average wage level in the economy.

In this section, we analyse the importance of entrepreneurship for average wage increases in the Danish economy using a decomposition technique suggested by Foster *et al.* (2001) and used by Bartelsman *et al.* (2004). This method decomposes the average wage increase into parts that can be ascribed to continuing, exiting and entering plants, respectively. The decomposition is presented in Section 4.1, while the results of the decomposition are presented in Section 4.2.

4.1 Decomposition Technique

We adapt a slightly modified version of the decomposition technique from Foster *et al.* (2001). Formally, define W_t as the average wage in year *t:*

$$W_t = \sum_{i=1}^{n_t} \theta_{it} w_{it} \tag{3}$$

where w_{ijt} is the wage rate at plant *i* in year *t*, and θ_{it} is the share of plant *i* in total employment in year *t*. Now, the change in W_t between two years ($t - k$ and t) can be decomposed as follows:

$$\begin{aligned} \Delta W_{t-k} = & \sum_{i \in C} \overline{\theta}_i \Delta w_{it} + \sum_{i \in C} \Delta \theta_{it} (\overline{w}_i - \overline{W}) \\ & + \sum_{i \in N} \theta_{it} (w_{it} - W_{t-k}) - \sum_{i \in X} \theta_{it-k} (w_{it-k} - W_{t-k}) \end{aligned} \tag{4}$$

where C is the set of continuing plants, *i.e.*, plants alive in both $t - k$ and t, N is the set of entering plants, *i.e.*, plants alive only in the last year t, and X is the set of exiting plants, *i.e.*, plants alive only in the first year $t - k$. A bar above a variable indicates the average value over years t and $t - k$, *e.g.*, $\overline{w}_i = (w_{it} + w_{it-k}) / 2$.

[6] For example, adding 23% to job creation by TNF plants in 1999 while reducing job creation by new plants by four percent (as suggested by the two-year ahead measures in the lower part of Table 5) can raise the share of TNF plants in job creation by new plants from the 15.6% reported in Table 4 to 20%. This in turn could raise their share in total job creation by 1-2 percentage points.

The first two terms on the right hand side in (4) represent the part of the wage change which is due to continuing plants. The first term is the so-called "within-plant effect". It is the contribution to the growth in average wages from continuing plants increasing their wages. It is calculated as the changes in wages of continuing plants, $\Delta w_{it} = w_{it} - w_{it-k}$, weighted by their average shares in the economy $\overline{\theta}_i$. The second term is the "between-plant effect", which gives the increase in average wages that stems from continuing plants expanding or contracting their share in employment. It is calculated as the change in the market share of plant *i* times the difference between this plant's average wage and the economy-wide average wage. Thus, if plants that pay higher wages than the average expand, then the average wage goes up. As our interest is in the effect of entering (and exiting) plants, we shall only report the sum of these two terms in what follows.

The third term is the "entry effect". It gives the contribution by entering plants and is calculated as the share of each entering plant times the difference between this plant's wage rate and the economy's wage rate. So, if entering plants pay higher wages than existing plants, they have a positive contribution to average wage growth. It is this term which has our main interest.

The fourth term is the "exit effect", which gives the contribution by exiting plants to wage changes. It is calculated as the initial share of the exiting plant times the gap in wages between this plant and the economy average. If the plant pays lower wages than the average, its exit contributes to a higher average wage rate in the economy.

Finally, we use our four different measures of entrepreneurial plants to analyse the importance of these for the "entry effect". More precisely, are entrepreneurial plants responsible for a particularly large share of the entry effect?

4.2 Results

We measure the average wage at plant *i* in year *t* as the wage bill in year *t* divided by the number of employees in year *t*.[7] This average wage is then deflated by the consumer price index. Table 6 reports the results from a decomposition of changes in the average wage for the private sector over 3-year periods. Thus, the first column gives the increase in the average wage (measured in 2002 prices) between 1996 and 1999.

It shows very clearly that most (80-90%) of the observed increases can be ascribed to within and between plant wage increases. Moreover, plant exits have systematically positive contributions, suggesting that exiting plants are low-wage plants. The results for entering plants are more mixed, being positive in some years and negative in other years. In general, however, the effect does not seem to be "significantly" different from zero.

Turning to the entrepreneurial plants, we observe that plants owned by new employers and new self-employed have particularly negative contributions to average wage growth, while the contribution of new plants in new firms (NF plants) seems to be positive on average. As the NE and NSE plants also accounted for much less job creation than plants owned by new firms, these must be very low-wage plants. This is confirmed by results not displayed, which show that average wage rates in NE and NSE plants are only around 3/4 of wage rates in NF and TNF plants. Thus, new self-employed do not create high-wage jobs.

[7] In this section, employment is measured as the number of fulltime equivalent workers.

Table 6: Decomposition of the Increase in Average Wages, 1996-2003

	1999	2000	2001	2002	2003
Wage Increase in DKK (from *t-3* to *t*)	10,611	10,553	8,895	6,943	6,097
	Shares of total wage increase between t-3 and t				
Within and between effects	89	84	81	88	78
Exit effect	17	11	7	18	33
Entry effect	-6	5	12	-6	-11
Entry effect by:					
NE plants	-13.0	-14.6	-18.3	-23.4	-28.8
NSE plants	-6.8	-7.9	-10.4	-13.5	-15.8
NF plants	1.9	9.7	18.9		
TNF plants	-2.6	-1.2	0.4		
NF∪NE plants	-2.5	6.1	15.8		
TNF∪NE plants	-10.2	-9.4	-9.7		
TNF∪NSE plants	-5.2	-4.1	-3.3		
NSE∩TNF plants	-2.6	-3.1	-4.6		

Note: Wages are measured in 2002 prices. The aggregate consumption price index was used as price deflator. Average wages are weighted by plant size (number of employees).

Turning to our preferred measures of entrepreneurial plants, the TNF plants or the union of TNF and NSE plants, these do not seem to contribute (positively or negatively) to the increase in average wages. Based on this, we may conclude that Schumpeter was at least partly right in the case of Denmark: Old and less productive firms are replaced by new and more productive firms – although not more productive than existing firms; at least not in the first couple of years.

An obvious limitation of the above decomposition is, of course, that we do not control for worker characteristics in computing the average wages. Thus, it might actually be the case that entrepreneurial plants contribute to average wage growth if they hire, *e.g.*, less educated (or less experienced) workers than other plants. In that case, a zero contribution to the average wage translates into a positive contribution to the education-specific wage.

5. Conclusion

The purpose of this paper was to analyse the importance of entrepreneurs for job creation and average wage growth. To do this, we applied a unique dataset for the Danish economy that allowed us to define four different measures of entrepreneurial plants and combinations thereof. The measures allowed us not only to provide a better picture of the role of entrepreneurial plants than previous studies relying mostly on information about small firms, but also to compare the importance of different types of entrepreneurs such as new self-employed and truly new firms.

First, we argued that either the new plants of truly new firms (the TNF plants) or the union of these plants with the plants of new self-employed (the NSE plants) were our preferred measure of entrepreneurial plants. However, the plants of new self-employed (NSE plants) and even the plants

of new employers (NE plants) were also interesting in their own right, as much of the entrepreneurship literature has focussed on the self-employed.

Second, we found that while new plants in general are responsible for around 1/3 of total gross job creation, the entrepreneurial plants account for between 15% and 25% of this, and hence between 5% and 8% of the total gross job creation, depending on the measure applied. The new self-employed in themselves, however, account for 10-13% of the gross job creation by new plants. Extending the measure of new self-employed to include also those who were previously self-employed without employees increases this share to between 17% and 24%. The most optimistic picture of entrepreneurial job creation – combining the contributions of truly new firms and the broadest set of new self-employed – is that they account for around 30% of the job creation by new plants and thus around 10% of the overall job creation in the economy.

Third, we also argued that using new firms as the measure of entrepreneurs is likely to exaggerate the importance of entrepreneurial activity considerably. While new plants of formally new firms account for around half of the job creation by new plants, many of these firms are unlikely to be truly entrepreneurial firms, but instead the result of changes in the legal set-up of a firm. This is most clearly illustrated by the fact that the new plants in these "new" firms account only for around half of the total employment in these firms, indicating the presence of a number of older plants as well.

Fourth, even though jobs created by entrepreneurial plants do not exhibit higher persistence than jobs created by other new plants, we find some evidence that entrepreneurial plants create more additional jobs in the years following entry than other new plants. Quantitatively, this may raise the contribution of entrepreneurs in total job creation by 1-2 percentage points.

Fifth, we also decomposed the change in the average wage level to analyse the importance of entrepreneurs for wage growth. While the exit of low-wage plants adds considerably to the growth in average wages, the evidence for entering plants is more mixed. Plants of new self-employed and new employers have a clear negative effect on the average wage level, revealing that these create mostly low-wage jobs. However, entrepreneurial plants – according to our preferred measure of this – do not seem to decrease (or increase) the average wage level.

In sum, while entrepreneurship may be responsible for up to 25% of job creation by new plants and up to 8% of overall job creation, entrepreneurship does not seem to be responsible for changes in the average wage level – at least not in the short run.

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