

Start-ups revisited

Are all start-ups true start-ups?

By

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Abstract: The usual measure of start-ups counts the number of newly registered firms and concludes that these are the start-ups of a country. A careful study of these firms shows, however, that a large number of them had existed before their apparent start-up. Thus, the true number of start-ups is only a fraction of all newly registered firms. Furthermore, it is found that these pre-existing start-ups have almost twice as many employees because they have had time to become more mature. Mixing the two groups make a new firm way more successful than a true start-up. The survival of true start-ups is found to be about half of other start-ups. The main reason for their apparent start-up status is change in ownership and organizational changes. The paper has clear policy implications because it shows a much higher vulnerability of true startups than previously believed and calls for much more focus on the true start-ups and their needs if the political desire is to promote them.

Introduction

There is a general agreement in the literature on job creation that start-ups are very important in all economies. Not only do they contribute with new jobs, they are also contributing with innovations and new ideas and thus representing the power of renewal in the society. Thus, it is generally believed that start-ups are contributing to the growth of productivity by inventions that provide new solutions and create new products. Thus, Bartelsman and Doms, 2000, find that almost 25% of within-industry gains in industry TFP originates from new entrants in the manufacturing sector. And Decker, Haltiwanger, Jarmin and Miranda, 2014 points at the essential role of business start-ups for the total job creation in the US. Startups are simply making up for the destruction of jobs in closing firms. They also conclude that the rate of business startups has been reduced over the period 1980 to 2010.

However, start-ups are also known for having a short life on average. Only few make it, mostly because it is very difficult to transform a business idea into a business plan and to carry the plan out

¹ Philip Koksby Hass has been an excellent RA on the data work for this paper. Rikke Ibsen has constructed the time consistent firm ID's. Simon Janssen has commented on an earlier version. All errors are mine.

with all the challenges from customers, competitors, banks, tax- and other authorities together with the general pushes from business cycles and other events. Even if they are able to survive this barrage of difficulties on their way it is only a small fraction of the surviving firms that become so large that they meet the next set of challenges of a growing firm. And some firms are never expected to grow big.

A recent paper, Akcigit and Ates, 2019 looks at reasons for the declining business dynamism in the U.S. and elsewhere in the Western World. One of the signs of the declining business dynamism is that the entry rate of new businesses has decreased among other reasons as a slowed down productivity growth, lower labor share and higher market concentration. There seems to be agreement that U.S startup rate has been trending down since 1979, see also Karahan, Pugsley and Sahin, 2019.

All of the mentioned papers are based on U.S. register information on firms and based on firms that have just got a new employer registration number or similar registration. Another source could be surveys where firms are asked about age/ year of start. However, both methods are open to a possibility that the firm in question may have been in existence before under a different registration number. That will represent a bias in our understanding of what a newly started firm is.

In this paper we will revisit the statistics of Start-ups. Denmark provides good and detailed statistics on persons and firms so it is a good place to analyze the process and the outcomes. At the same time there is no reason to believe that Denmark is different from other developed countries. In the World Bank ranking of the “ease of doing business” Denmark gets 85 points and is number 4 after Hong Kong and ahead of the US, which get 84 points. In the work on start-ups we have become aware of an important issue with respect to defining a new firm. General statistics from most statistical agencies count the number of new employer registration numbers. We have done the same, but tracing them backwards, we found that a large number of firms already existed in another form. Or expressed in another way, a substantial number of new firms are actually built on the “basement” of an existing firm.

Data

In this paper we have used Danish register data to identify and follow newly started firms. A newly started firm is usually defined as a firm that has just got an employer registration number (ERN).

Therefore, a new firm is likewise defined as a firm with an ERN that did not exist the year before. In 2016 there are 738105 unique ERN numbers. Some of these have little activity measured by the number of employees. But some of these will eventually get employees and some are holding companies for other companies with employees. As a consequence, we have included firms where we observe employment within a 10-year perspective and we have included firms with more than 10 mill DKK in assets. We have also included firms, which are in a business group together with firms with employees. Furthermore, we have only selected firms that have never been owned by the State, Regions or Municipalities. This selection is made in order to get a “clean” private sector. After these selections we end up with 149,808 firms. Among these, we identify 7,470 as new.

Of these, 1,764 do not have employees currently but fulfill one of the other criteria. We name this group trivial firms. Some of these will eventually get employees. However, it may take a while and because our data is limited to the period 1980-2017 for the moment we have a right-hand censoring issue. To illustrate the issue, we have found that out of the 1,764 trivial firms, 729 will get employees in 2017.

All the remaining companies have employees from day one, so there is no censoring issue here.

The question is, however, if these 7,470 firms are really new. A number of different scenarios are possible. First, the new firm may be created as part of a reorganization of an existing firm. That could be because a company is transformed to a holding company and a new company subsequently takes over activities and employees. It could also be a consequence of M&A where one company takes over a substantial part of the workers from another firm. Finally, change from one form of corporation to another, i.e. from Aps to A/S in the Danish case will also in most cases mean that the firm is given a new ERN. Second, the firm could get a new owner either because it is sold or because the former owner went bankrupt or a new co-owner is introduced. It seems obvious that you should not call a firm that has been through these administrative changes new or start-up and doing so would over-state the real number of start-ups. We will therefore try to discriminate between real or true start-ups and newly started firms that actually had roots in a prior existing firm.

Decker, Haltiwanger, Jarmin and Miranda, 2014 point at the same problem. They state that “entrepreneurial research should focus on startups and young firms. It should exclude “new” businesses emerging from reorganizations such as mergers and acquisitions”. They use the U.S. Longitudinal Business Database and use its identifiers to track firms over time in order “to distinguish between true “startups, new establishments of existing businesses and new firms formed by combining pre-existing establishments through merger and acquisition activity.”

We will use a different and probably blunter instrument using the number of employees taken over from the previous firm as an indicator that there is a relationship between the start-up and an already existing firm. As a simple rule we use 50% of the employees as a threshold. If there are more than 50% we identify a relationship and we will name the start-up as an administrative change. The threshold of 50% should be compared to the normal turnover in a small firm that is close to 30% and that the normal turnover for a person just employed in a small firm is 45%. That means that the 50% threshold is probably not too inclusive.

This algorithm is used on all new private firms in each year. A private firm is here defined as a firm that has never been owned by the public sector, i.e. State, Municipality or any other part of the public sector. A number of firms has no employees in the year they are started. These firms are called trivial firms in Table 1 below. In 2016 there are 149,808 private firms (including incorporated and privately-owned firms) and there are 7,270 new firms registered. Of these 1,764 do not have employees. That leaves 5,706 new non-trivial firms. Of these 1,955 (34%) appear to be built on already existing firms. That leaves us with 3,751 real new firms, or 66% of all new firms.

Table 1. Start-ups, real start-ups and administrative start-ups, selected years 1981-2016

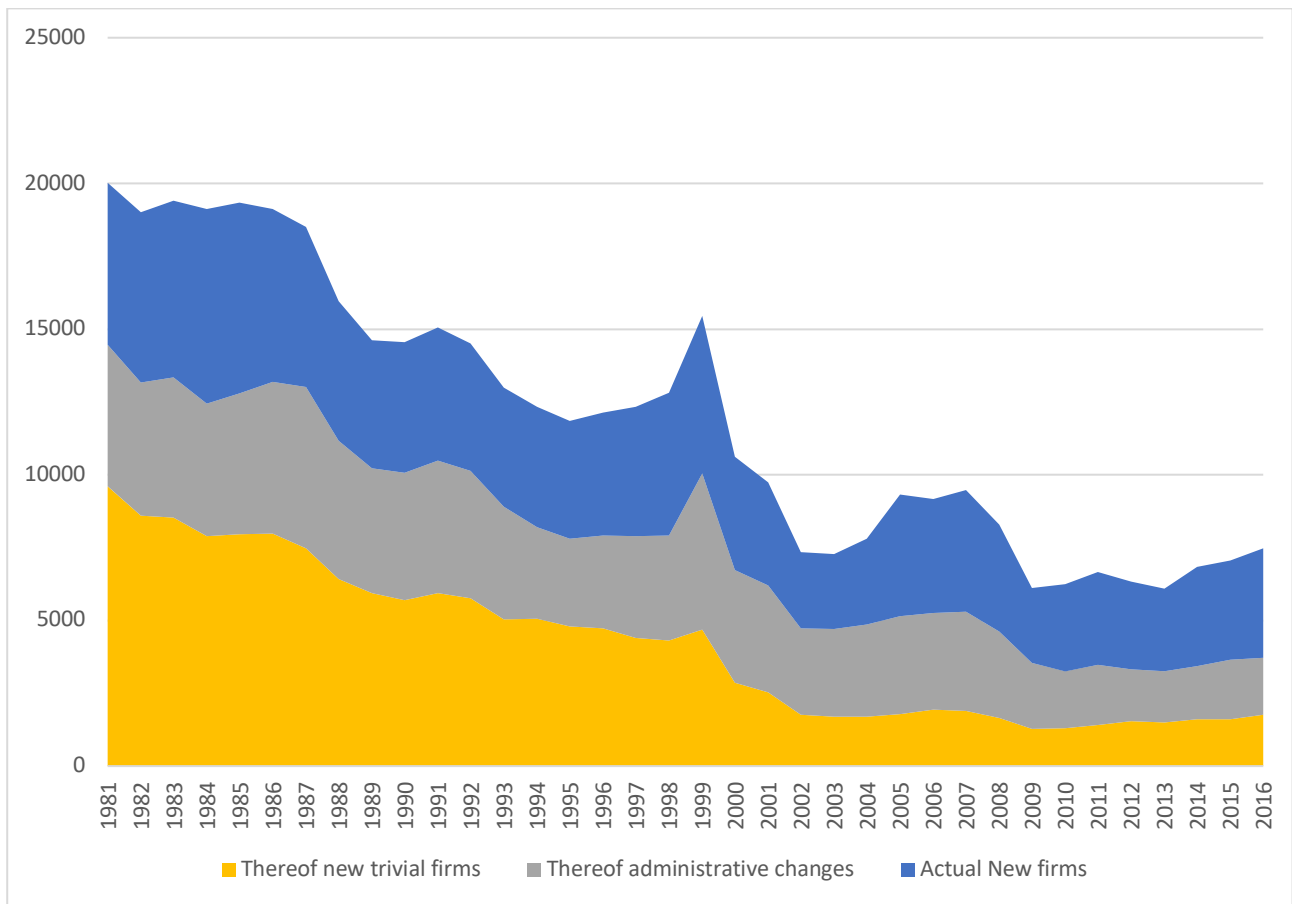
| | Firms total | New firms | <i>Thereof new trivial firms</i> | <i>Thereof non trivial firms (3)</i> | administrative changes (1) | True New firms (2) | (2)/(3) | (1)/(3) |
|------|-------------|-----------|----------------------------------|--------------------------------------|----------------------------|--------------------|---------|---------|
| 1981 | 157,049 | 20,021 | 9,602 | 10,419 | 4,859 | 5,560 | 53% | 47% |
| 1991 | 144,501 | 15,054 | 5,942 | 9,112 | 4,533 | 4,579 | 50% | 50% |
| 2001 | 135,548 | 9,742 | 2,525 | 7,217 | 3,682 | 3,535 | 49% | 51% |
| 2011 | 141,591 | 6,670 | 1,414 | 5,256 | 2,064 | 3,192 | 61% | 39% |
| 2016 | 149,808 | 7,470 | 1,764 | 5,706 | 1,955 | 3,751 | 66% | 34% |

Table 1 describes a large reduction in the number of new firms over the last 35 years. The main part of the reduction comes from what we have called trivial firms, which is firms without employees. Many of these firms are created because of taxation rules and could best be understood as an adaptation to the tax code. Similarly, the reductions are due to changes of the code. The number of new trivial companies stabilizes at a relatively low level after 2001 reflecting a more stable tax systems without big reforms. The number of non-trivial start-ups has gone down from 10.000 in 1981 to 5.700 in 2016.

Some of these trivial firms will, however, eventually get employees. And some of these employees may come from other companies and in that way qualify for the criteria of the administrative changes. To illustrate this point, we have found that 40% of the new trivial firms actually get employees within the 2nd year and 45% get it within the 3rd year. We have also found that 31% of these start-ups would be characterized as administrative start-ups. Since, there is a right-hand censoring problem using the trivial start-ups in the comparison between true start-ups and administrative start-ups we have excluded them from the following comparison of true start-ups and administrative start-ups. They will later be included in the comparison with Stat DK data on start-ups.

Applying our reassessment of the non-trivial firms we can for 1981 identify 4,859 as administrative new firms and 5,560 as real new firms. Figure 1 shows that the relation between real new firms and administrative new firms seems not to change very much over time, though it is observed that the share of administrative changes increases in years of crisis and reconstruction, 1987-1992, 1999-2002, 2008-2009. While the first and the last periods are years of crisis, where owners more likely were replaced, it is more difficult to interpret the middle period that started with the dot.com upswing and ended with the burst of the same bubble in 2001-2002. This bubble was also known as a period, where companies were created with high frequency and quickly, so that may explain why there were more administrative new firms in this period and fewer after the burst.

Figure 1. The development in the number of new firms 1981-2016.

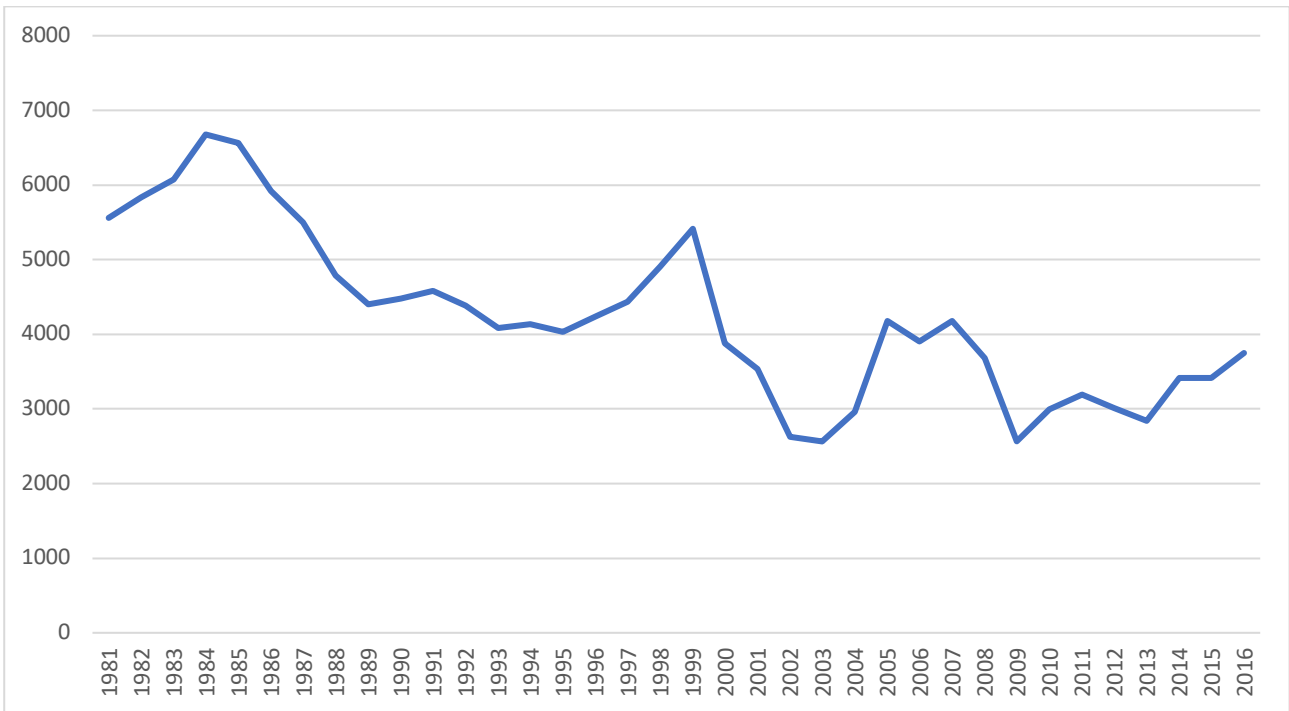


Thus, our use of the uncorrected data on start-ups will give us an exaggerated picture of the true number of start-ups and its decline. Figure 1 presents a picture, where the number of new firms per year goes down from 20,000 to less than 10,000 over 15 years from 1986-2001. Since then it has stabilized around 7,500. However, a large fraction of this drop is due to reduction of the number of new trivial firms. But the sum of true new firms and administrative new firms has also gone down. The share of true start-ups is roughly 50-60% among the non-trivial firms.

The development of the true number of new firms is as described in Figure 2. The graph shows that the true number of annual start-ups went down from 5500 before the dot.com crisis to 2600 and from 4200 to 2.600 around the Great Recession. Thus, there is no doubt that these external shocks have had a great impact on the number of true start-ups especially in the years after the Great Recession.

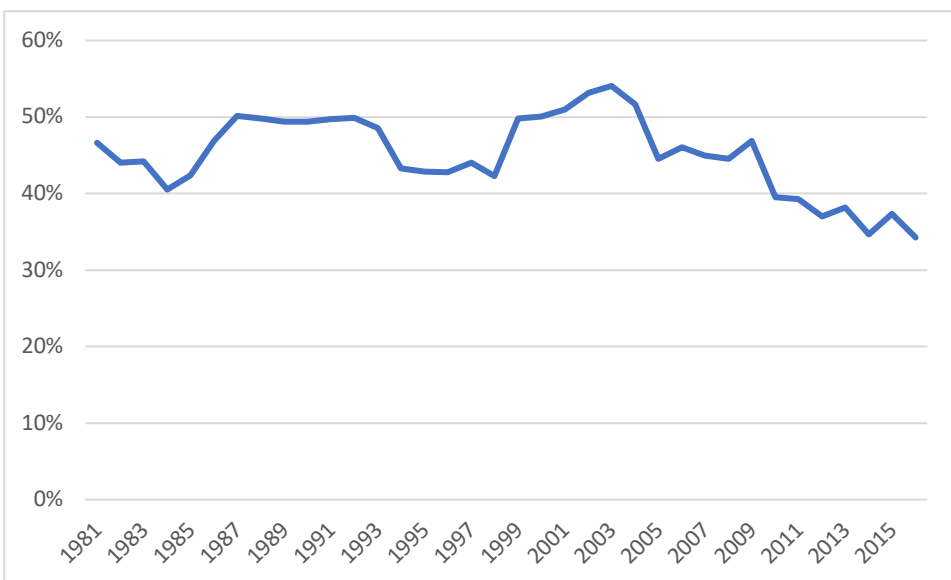
Using the number of new companies based on newly registered ERN's has clearly introduced a bias that has made policy makers and analysts too optimistic about the nature of the number of start-ups in the Recession and its aftermath. We will return to that issue at the end of the paper.

Figure 2. The development in the number of true start-ups.



The relation between true start-ups and start-ups due to administrative changes is described in Figure 3, where there are two high periods and a declining proportion of administrative changes after 2009.

Figure 3. Administrative start-ups as proportion of all start-ups



The reclassification of start-ups has obvious consequences for the number of jobs created by start-ups, mostly because the true start-ups must be expected to have fewer employees than the administrative start-ups.

[The number of jobs created by real start-ups](#)

Using the definition of true start-ups and administrative start-ups allows us to investigate how many jobs are actually involved in administrative “start-ups” and in true start-ups. Data-wise, it is a simple operation counting how many are employed in either type of start-up. The numbers for selected years are presented in Table 2. In 2016 the usual definition of start-ups would yield 23,864 workers. Almost 2/3 of these appears to be due to administrative “start-ups” and only 1/3 to real start-ups. Figure 4 shows the development over time. It is little surprising that the administrative “start-ups” employ many more workers than the true start-ups. The main reason is of course that they have been active much longer than the newly start-ups.

Table 2. Number of workers in administrative and real start-ups in selected years.

| | Number of workers | | | | Proportion of all workers | | |
|------|-------------------|---------------|-----------------|----------------|---------------------------|-----------------|----------------|
| | Private sector | all new firms | admin start-ups | true start-ups | all new firms | admin start-ups | True start-ups |
| 1981 | 1,015,501 | 47,472 | 35,344 | 12,128 | 4.7% | 3.5% | 1.2% |
| 1991 | 1,104,192 | 39,705 | 30,558 | 9,147 | 3.6% | 2.8% | 0.8% |
| 2001 | 1,249,360 | 49,371 | 39,809 | 9,562 | 4.0% | 3.2% | 0.8% |
| 2011 | 1,185,483 | 23,985 | 17,538 | 6,447 | 2.0% | 1.5% | 0.5% |
| 2016 | 1,291,373 | 23,864 | 16,180 | 7,684 | 1.8% | 1.3% | 0.6% |

Figure 4. The number of jobs in administrative “start-ups” compared with real start-ups.

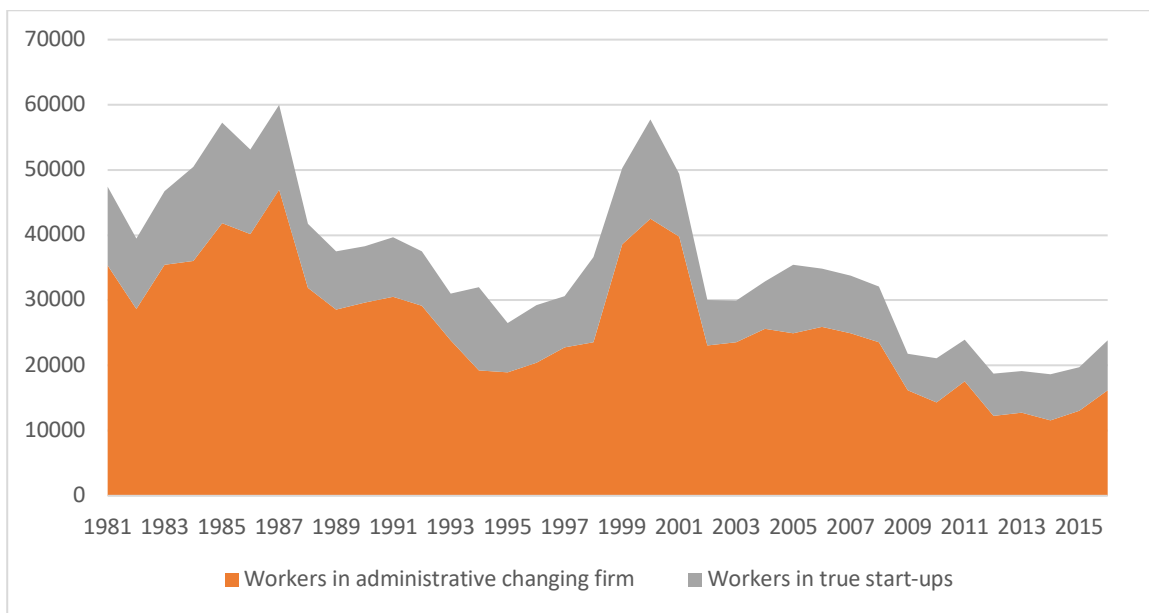
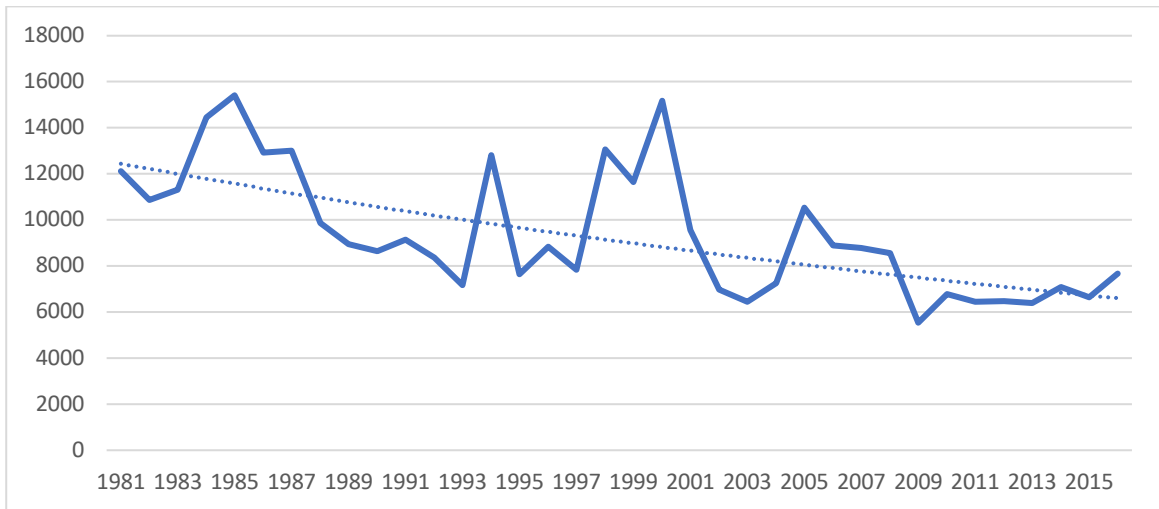


Figure 5. Employment in true start-ups 1981-2016.



Finally, Figure 5 reports the number of workers in true start-ups from 1981 to 2016 with an exponential trend line. It is obvious that the trend is downward as it has been shown for the U.S. in Karahan, F., B. Pugsley and A.Sahin, 2019 and in Decker, Haltiwanger, Jarmin and Miranda, 2014. The development shows also that the different economic crises have had a clear negative impact on the number of new jobs created by start-ups. First, the long crisis in employment 1987-1993, then the dot.com crisis in 2001 and finally the Great Recession in 2008 and 2009. After these crises, the number of created jobs seems to bounce back but to a lower level than before reflected by the trendline.

Age of prior identity

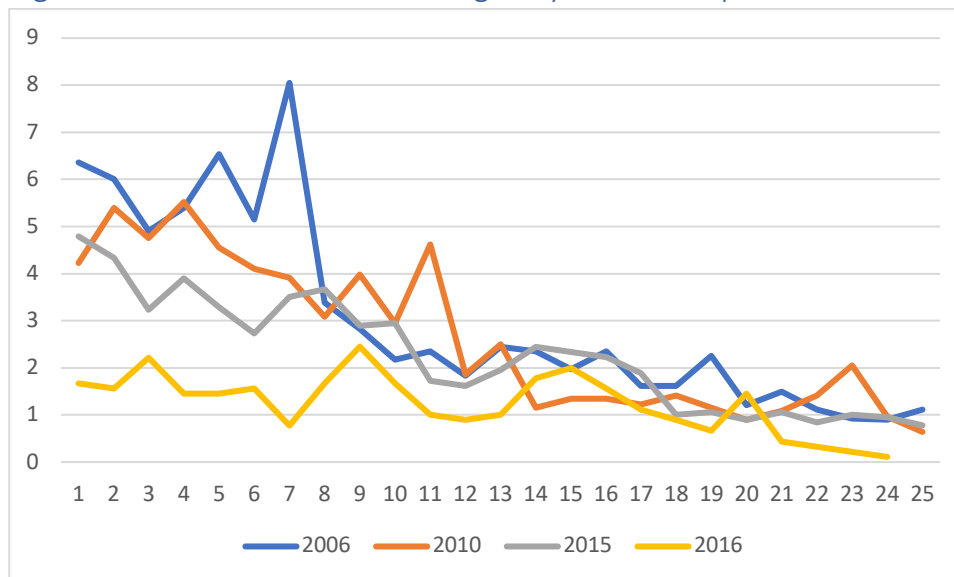
Table 3 shows the distribution of the age of the preceding firms. We have here used the same algorithm and followed firms backwards to the time they were created as a true start-up. For 2006, it shows that most of the preceding firms are more than a few years old. This is also the case in 2010 but has clearly increased in the last two years in the table. The number of firms which were based on a firm created the very same year is a bit worrisome. The large group with 0 tells us either that something else is going on, i.e. it is not a pre-existing firm after all, or it was a short-term business. So, maybe this tells a completely different story of quick changes in firm ERN to avoid taxation or other illicit purposes.

Table 3. The frequency distribution of the firms preceding the current start-ups, age in years, %.

| Old ID age | 2006 | 2010 | 2015 | 2016 |
|------------|-------|-------|-------|-------|
| 0 | 14.31 | 22.26 | 33.13 | 33.00 |
| 1 | 6.36 | 4.23 | 4.79 | 1.67 |
| 2 | 6.01 | 5.39 | 4.34 | 1.56 |
| 3 | 4.91 | 4.75 | 3.23 | 2.22 |
| 4 | 5.39 | 5.52 | 3.90 | 1.45 |
| 5 | 6.53 | 4.55 | 3.29 | 1.45 |
| 6 | 5.15 | 4.11 | 2.73 | 1.56 |

| | | | | |
|------------|------|-------|------|------|
| 7 | 8.05 | 3.91 | 3.51 | 0.78 |
| 8 | 3.39 | 3.08 | 3.67 | 1.67 |
| 9 | 2.83 | 3.98 | 2.90 | 2.45 |
| 10 | 2.18 | 2.95 | 2.95 | 1.67 |
| 11 | 2.35 | 4.62 | 1.73 | 1.00 |
| 12 | 1.83 | 1.86 | 1.61 | 0.89 |
| 13 | 2.45 | 2.50 | 1.95 | 1.00 |
| 14 | 2.35 | 1.15 | 2.45 | 1.78 |
| 15 | 1.97 | 1.35 | 2.34 | 2.00 |
| 16 | 2.35 | 1.35 | 2.23 | 1.56 |
| 17 | 1.62 | 1.22 | 1.89 | 1.11 |
| 18 | 1.62 | 1.41 | 1.00 | 0.89 |
| 19 | 2.25 | 1.15 | 1.06 | 0.67 |
| 20 | 1.21 | 0.90 | 0.89 | 1.45 |
| 21 | 1.49 | 1.09 | 1.06 | 0.44 |
| 22 | 1.11 | 1.41 | 0.84 | 0.33 |
| 23 | 0.93 | 2.05 | 1.00 | 0.22 |
| 24 | 0.90 | 0.96 | 0.95 | 0.11 |
| 25 | 1.11 | 0.64 | 0.78 | |
| 26+ | 9.33 | 10.58 | 9.81 | 8.00 |

Figure 6. The distribution of the age in years of the previous firm if it was 1 year or more.



Owners behind administrative “start-ups”

Ownership is identified through the ownership register of the Danish Business Authority. The register has been in existence for long but owners were not until 2017 enforced to keep it updated. This changed in 2017 so that owners from the middle of that year were obliged to register their share of their direct ownership and of their consolidated ownership of each of the companies they

own. A fine for not registering before July 1, 2017 helped to get the number of registrations up. From December 2018 companies can be dissolved if they have not registered their real owners. The ownership registration is a “from to information” giving the start date and the end date of the ownership. This information is considered to be good for 2017 but has a declining quality when going backwards in time mostly because previous owners have not registered in retrospect and because of a lower quality of data when we go backwards in time. Nevertheless, we have in Table 4 described the ownership changes for all the “administrative start-ups” with the available data. The column with “total known changes” reflects the coverage of data and the last column shows the percentage of all administrative changes where we know the change in ownership. This improves clearly over the years and is 65% in 2016, the year before the tougher enforcement starts. Thus, Table 5 is not presenting a total count of all changes in ownership but it provides an estimate of what has happened in the companies characterized as being an administrative start-up.

Table 4. The type of ownership changes when we observe an administrative “start-up”.

| year | Only new owner(s) | Only previous owner(s) | New and previous owners | Total known changes | % of all changes |
|-----------|-------------------|------------------------|-------------------------|---------------------|------------------|
| 2003 | | | | | |
| 2004 | 81.1% | 4.3% | 14.6% | 487 | 15% |
| 2005 | 77.2% | 4.3% | 18.5% | 606 | 18% |
| 2006 | 76.9% | 3.9% | 19.3% | 675 | 20% |
| 2007 | 76.4% | 4.0% | 19.6% | 850 | 25% |
| 2008 | 75.4% | 5.6% | 18.9% | 797 | 27% |
| 2009 | 72.6% | 5.6% | 21.9% | 576 | 25% |
| 2010 | 72.5% | 4.7% | 22.8% | 535 | 27% |
| 2011 | 66.1% | 7.3% | 26.6% | 631 | 31% |
| 2012 | 68.1% | 6.9% | 24.9% | 590 | 33% |
| 2013 | 66.2% | 6.7% | 27.1% | 687 | 39% |
| 2014 | 64.9% | 8.4% | 26.7% | 865 | 48% |
| 2015 | 65.2% | 6.4% | 28.5% | 1163 | 57% |
| 2016 | 60.2% | 7.9% | 31.9% | 1271 | 65% |
| All years | 69.8% | 6.1% | 24.1% | 9733 | |

A new owner appears to be the most common reason for an administrative change as 60% of those cases (2016), where we observe an administrative change, has a complete change of owners. This percentage is relatively constant even for the years where ownership data are less complete. However, a total of 40% of all cases have the same owner before and after the change. Of these 32ppts. are cases where an owner start sharing ownership with one more owner. And finally, 8ppts. of all cases have the same owner before and after the change.

Industries of start-ups, real and administrative.

The distribution of start-ups over industries in 2016 is described in table 5. The largest proportion of true start-ups is found for “information and communication” and “other business services”, where the proportion of true start-ups are close to 2/3. The largest proportion of administrative start-ups are found within “Construction”, “Trade and Transport” and in the private part of firms within Administration, Education and Health. Financial and Insurance together with Real Estate have a small number of new start-ups, but almost 50% of them are administrative by nature. The growth areas Medical and Chemical industries have under 5 new firms, so they cannot be reported due to data confidentiality concerns.

Table 5. The distribution of start-ups on different industries in 2016

| Industry | Number of firms | | | True new of total | adm start-ups of total |
|---|-----------------|-------------|--------------|-------------------|------------------------|
| | All | true new | adm start-up | | |
| Missing data | 16 | 34 | 40 | | |
| 1. Agriculture, forestry and fishing | 8674 | 71 | 85 | 0.82% | 0.98% |
| 2. Manufacturing, mining and quarrying and public utilities ** | 9431 | 188 | 153 | 1.99% | 1.62% |
| 3. Construction | 16491 | 585 | 312 | 3.55% | 1.89% |
| 4. Trade and transport | 42851 | 1280 | 771 | 2.99% | 1.80% |
| 5. Information and communication | 7418 | 381 | 102 | 5.14% | 1.38% |
| 6. Financial and insurance | 3495 | 63 | 28 | 1.80% | 0.80% |
| 7. Real estate | 4597 | 37 | 42 | 0.80% | 0.91% |
| 8. Other business services | 20301 | 869 | 317 | 4.28% | 1.56% |
| 9. Public administration, education and health | 1050 | 14 | 21 | 1.33% | 2.00% |
| 10. Arts, entertainment and recreation activities | 6950 | 229 | 84 | 3.29% | 1.21% |
| 12. Chemical industry | 169 | .. | .. | | |
| 13. Medical industry | 66 | .. | .. | | |
| | 121509 | 3751 | 1955 | 3.09% | 1.61% |

Are CEO's different between real and administrative start-ups?

One should expect that the CEO's are older and more experienced in the administrative start-ups than in the real start-ups because they have been engaged longer in the previous firm. Figures 7 and 8 illustrate that this is also the case but the difference in years is small. Thus, CEOs in administrative start-ups are on average 2 years older than CEOs of true start-ups. (It is remarkable, that the age of both groups increases with almost 4 years from 2012 to almost 44 years in 2016 meaning that CEOs are remaining in the job during the aftermath of the crisis. (This is probably related to the adverse conditions for start-ups during and after the Great Recession). Similarly, it is found that top-leader experience is going up after 2011 for the true start-ups and already from 2009 for the administrative

start-ups. And it is found that the average CEO in administrative start-ups has almost one more year of experience than in a true start-up firm. Likewise, it is found that the general level of experience goes up with about 1.5 years from just before the Great Recession to 2016.

Figure 7. Mean age for CEOs in start-ups.

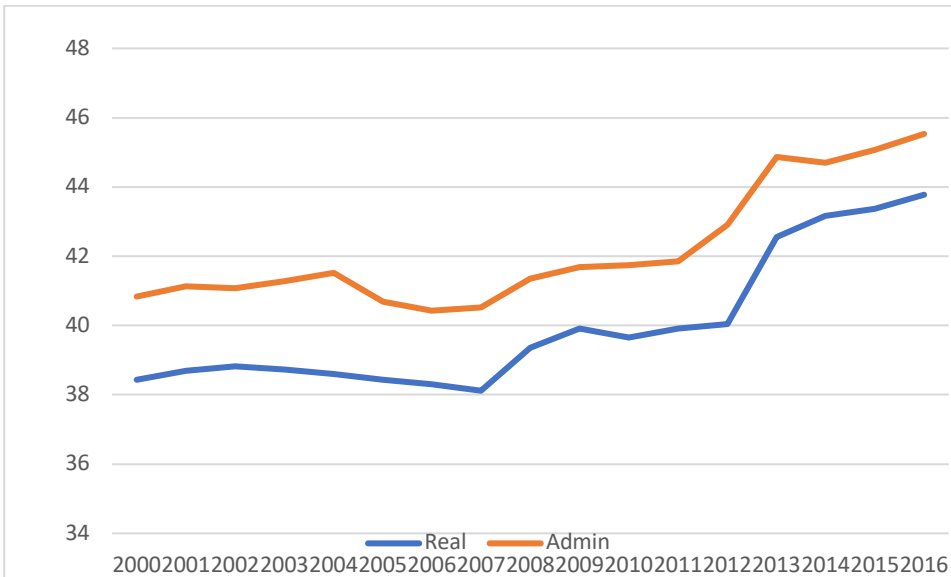
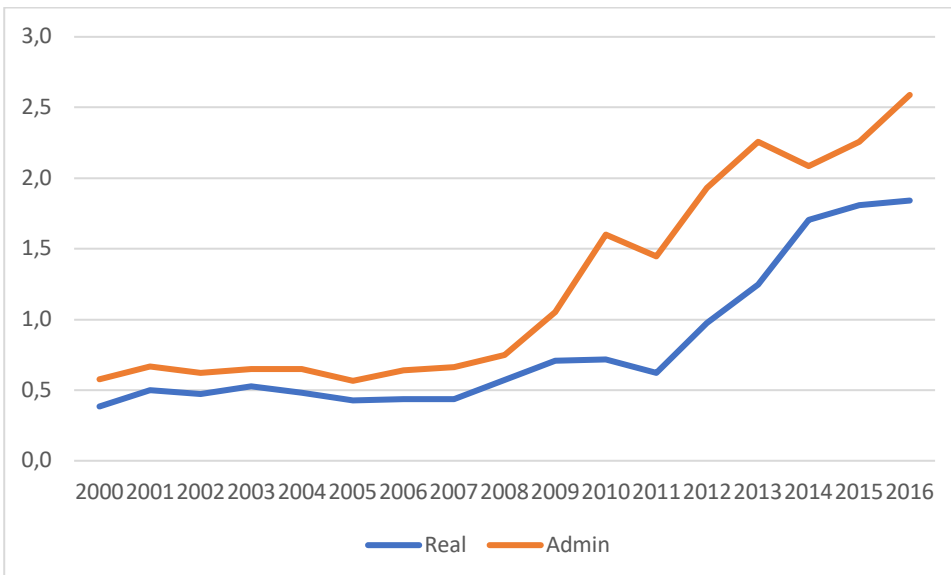


Figure 8. Mean previous experience for CEOs in start-ups.



Analyzing the top leader educational distribution in Table 6 shows that top-leaders of start-ups have acquired more education when we compare 2006 with 2016. That probably explains part of the age increase. CEOs have become older and are more educated but their experience has not increased as much because they have used more time in the educational system. The true start-ups have slightly higher educational levels than the administrative start-ups shown in Table 6.

Table 6. The educational attainment of CEOs in true start-ups.

| Level of education | True start-ups Percent of all | | Admin start-ups Percent of all | |
|--|----------------------------------|-------|-----------------------------------|-------|
| | 2006 | 2016 | 2006 | 2016 |
| Missing data | 4.7 | 3.3 | 3.4 | 1.6 |
| Primary school | 15.0 | 13.1 | 13.6 | 12.7 |
| Secondary school / vocational training | 51.3 | 42.7 | 59.5 | 48.9 |
| Short higher education | 7.4 | 6.3 | 7.3 | 6.7 |
| Bachelor / Middel-level higher education | 11.5 | 15.8 | 9.7 | 14.3 |
| Master | 9.8 | 17.6 | 6.5 | 15.0 |
| Ph.d. | 0.3 | 1.2 | .. | 0.9 |
| | 100.0 | 100.0 | 100.0 | 100.0 |

The survival rates of start-up firms

In this section we will compare the survival rates of true start-ups and administrative start-ups. We define the survival rate at 5 years as the proportion of all start-ups which has not closed 5 years after they were created. The first row in Table 7 shows the proportion of survived firms that were identified as restarted as “administrative changes” in each of the selected years 2000-2009. The *apparent* proportion of survivors is close to 60% in all years if you follow each of these ERNs for 5 years after the year of start or restart. However, if you allow them to change identity over the 5-year period following our method, the *actual* survival rate increases to 86-89%.

Table 7. The 5-year survival rate for different types of start-ups

| Starting year/adm. Change year | 2000 | 2003 | 2006 | 2009 |
|--|------|------|------|------|
| Adm. Change apparent 5 years survival rate | 0.58 | 0.64 | 0.62 | 0.62 |
| Adm. Change actual 5 years survival rate | 0.89 | 0.89 | 0.86 | 0.86 |
| True new firm apparent 5 years survival rate | 0.43 | 0.51 | 0.48 | 0.51 |
| True new firm actual 5 years survival rate | 0.54 | 0.61 | 0.56 | 0.56 |

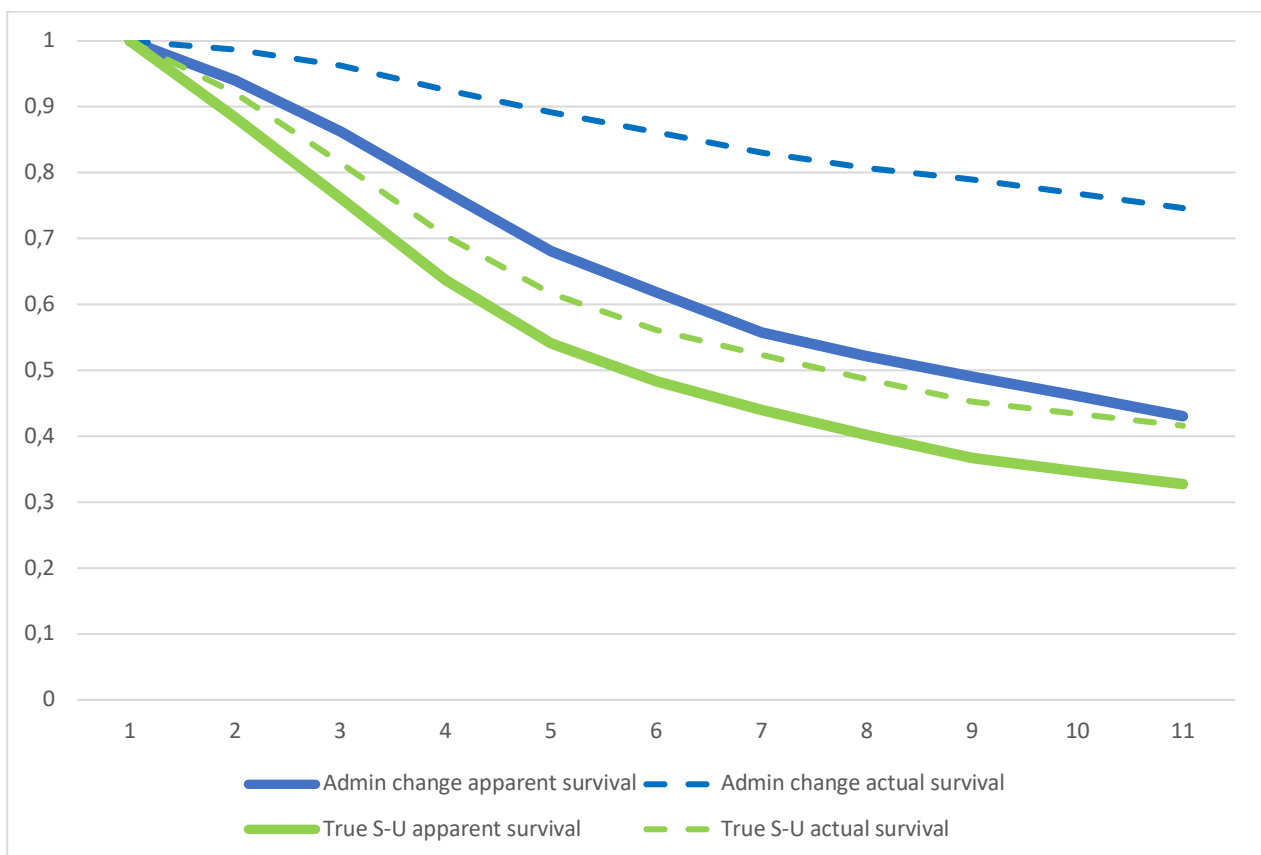
If the start-up was a true start-up from the beginning the 5-year survival rate is about 43-51% and we only looking at the *apparent* survival of the ERN of the start-up firm. If we allow these true start-ups to change ID following our method, we get a little higher *actual* survival rate with percentages between 54-61%. Thus, it is clear that the survival rate is higher for the administrative changed firms than for the true start-ups. Furthermore, it is clear that the start-ups which have been restarted are

more likely to survive. And it seems also evident that this relation has not changed much over the investigated years. We will therefore not loose in generality by looking at one particular year.

The difference in the destiny of the two groups becomes even more clear when comparing what happens with a group of firms that were true start-ups from the outset and a group of firms that were restarted in the same year. Figure 9 describes the survival rates for the two groups. Thus, the Graphs are describing what happened to 100 start-ups that started in 2006. After 11 years, about 33% of the true start-ups have survived, whereas 42% of the administrative start-ups have survived. Furthermore, only 9ppts of the true start-ups had “saved” themselves with a second life in the form of a new ID, whereas more than 30ppts of the administrative start-ups got a second life in the 11 years window.

This indicates that the survival rates between the two groups differ with more than a factor 2 and that the two groups also differ in their ability to get a second chance. This may be explained by the fact that the administrative start-ups are larger and more mature as firms. Therefore, it is more likely that they are preserved as entities when changes happen on the ownership side in the form of takeover, M&A or restructure. Another reason could be that the administrative start-ups have been used to changes in ownership or that they are part of a different segment of business.

Figure 9. The accumulated survival rate for true and administrative start-ups (S-U) by age.



Growth in trivial firms

We defined in the beginning a trivial start-up as a start-up that did not have employees in the year of start-up, but would eventually get employees within a 10-year period or they had from the onset assets worth more than 10 mill DKK. Table 8 shows that more than 50% of these firms create at least one job within a 5-year period. The last years in italic are right hand censored because we are currently only able to follow the firms to 2017.

It is remarkable that the number of trivial firms drop in the years just after the Great Recession with almost a quarter, but the proportion of them eventually creating jobs is not lowered. This means that those started were as sound as in the years before.

Table 8. The number of start-ups with no employees in starting year (trivial firms) which create employment within 5 years.

| | Over 10 years | | | 2nd year | | |
|------|---------------|-----------------------------|-----------------|---------------------------|----------------|---------------|
| | Trivial firms | Creating jobs at some point | % creating jobs | Creating jobs in 2nd year | of which admin | of which true |
| 2000 | 2851 | 1384 | 49% | 957 | 322 | 635 |
| 2001 | 2525 | 1262 | 50% | 880 | 311 | 569 |
| 2002 | 1757 | 950 | 54% | 698 | 346 | 352 |
| 2003 | 1692 | 992 | 59% | 756 | 279 | 477 |
| 2004 | 1698 | 1003 | 59% | 754 | 270 | 484 |
| 2005 | 1787 | 1023 | 57% | 776 | 277 | 499 |
| 2006 | 1929 | 1214 | 63% | 965 | 239 | 726 |
| 2007 | 1888 | 1015 | 54% | 836 | 298 | 538 |
| 2008 | 1654 | 914 | 55% | 706 | 234 | 472 |
| 2009 | 1278 | 834 | 65% | 690 | 281 | 409 |
| 2010 | 1295 | 744 | 57% | 608 | 208 | 400 |
| 2011 | 1414 | 738 | 52% | 577 | 194 | 383 |
| 2012 | 1544 | 820 | 53% | 631 | 184 | 447 |
| 2013 | 1507 | 773 | 51% | 619 | 203 | 416 |
| 2014 | 1616 | 883 | 55% | 737 | 159 | 578 |
| 2015 | 1613 | 792 | 49% | 706 | 195 | 511 |
| 2016 | 1764 | 729 | 41% | 729 | 204 | 525 |

Most of these firms create very few jobs, but a few create some. In Figure 10 we have shown the distribution of the maximum of jobs created over the 5 years after start-up for 5 different start-up years. The graphs show that 2 jobs have on average been created within a 5-year period by the 50th percentile of all trivial start-ups creating jobs. Similarly, we show that the 90th percentile have created between 6 and 10 jobs depending on when the firm was started. It is remarkable that the number of jobs created for this group increases over time, so that 2011 starters tend to create more

jobs than 2000 starters. The reason is probably that starting in the recession years of 2010 and 2011 reduced the possibilities to hire employees right away and postponed the first employments to better times. Consequently, some firms, which in better years would have been classified as true or administrative are registered as trivial start-ups in these years.

Similar Graphs have been made for the true start-ups and the administrative start-ups. Though there are also differences between the years in these curves they are never larger than 4 employees. Consequently, we have in Figure 11 used the average of jobs created in each of the three types of start-ups in order to compare the three types of start-ups.

Figure 10. The distribution of the maximum jobs created in trivial start-ups within 5 years of their start-up (the y-axis).

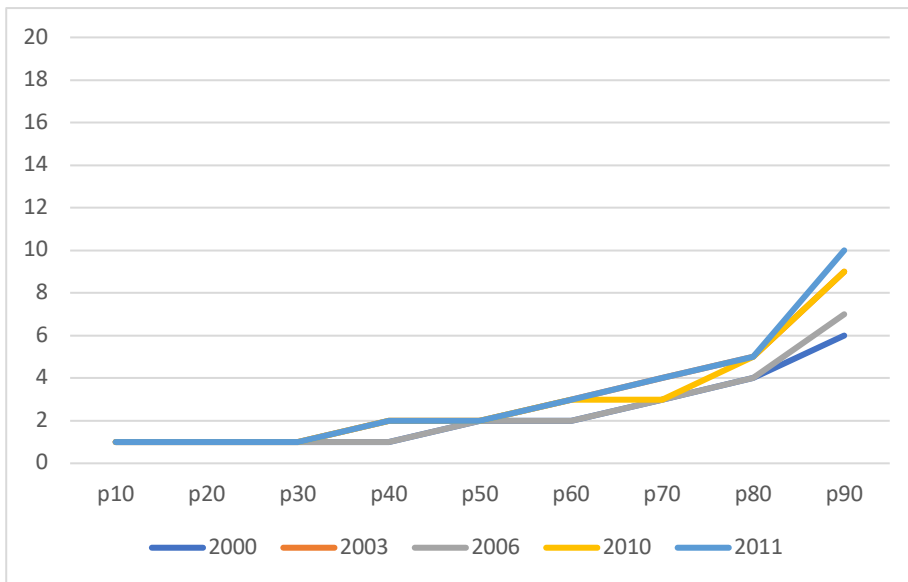
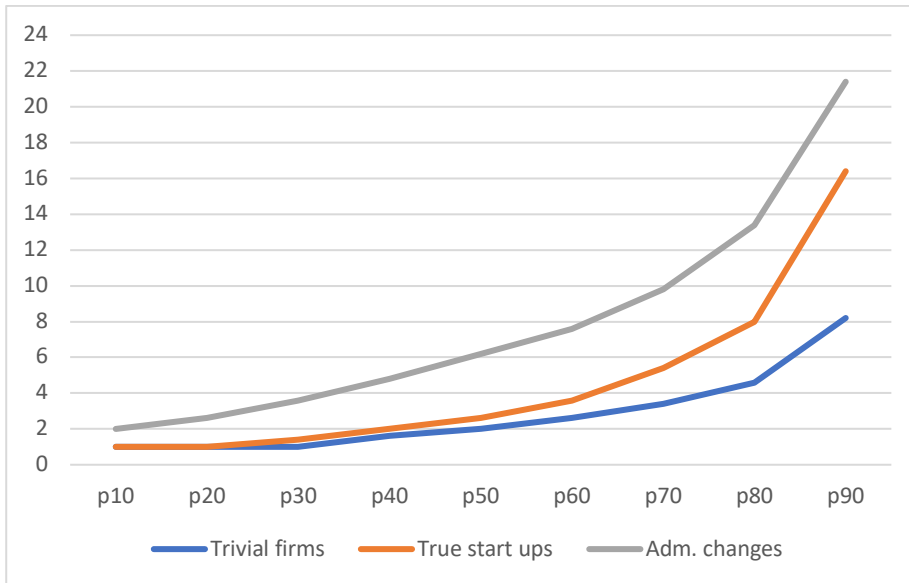


Figure 11. The distribution of the average maximum job creation within 5 years in the three types of start-ups.



The Graphs in Figure 11 show that 50% of all start-ups among the trivial and the true start-ups reach 2 employees while 50% of the administrative start-ups reach 6 employees within 5 years. The largest differences are found for the 90th percentile, where the trivial firms only reach 8 employees and the true start-ups reach 16 and the administrative start-ups reach 21. Part of the difference between the different groups is probably that they have started at different times and therefore had different possibilities to develop.

Spin-offs

Among the administrative start-ups there may be true daughter firms and firms created because a group of workers break out and start their own. While the first type happens with the consent of all implicated the latter may happen in a less harmonious way. The daughter start-ups are characterized as having the same owners as the mother firm, so they are clearly distinct different from true start-ups. In the appendix we have used the difference in corporate taxation rules to distinguish between the two types of firms. The main result is that there is very little difference in the proportion of people who leave the original firm between those who get employment in a daughter start-up or a spin-off.

Comparison with Statistics Denmark

Finally, we will compare our results to the official data from Statistics Denmark (DST). The source of the raw data is the same and the difference will therefore depend on which selections have been made under way in the process of creating the statistics. We will start the comparison by recalling what we have done in order to validate the raw numbers of new ERN's illustrating with data from 2016.

First, we have restricted the number of potential start-ups to those firms that will either get at least one employee within a 10-year horizon or has 10 million DKK in assets from their start. That gives 7470 new firms in 2016. DST does not make this validation. When we applied our distinction between trivial, administrative and true start-ups, we ended up with 3751 true start-ups. From the last columns of Table 8 we can see that out of 1764 trivial start-ups (no employees at start) in 2016 729 actually got employees in their second year. Of these around 72% were true start-ups whereas 28% took over employees from other companies and were classified as administrative start-ups. When we add the true start-ups among the “trivials”, we end up with 4262 true start-ups in 2016. These are with other words those start-ups that have employees within the first 2 years of their existence. There will be up to 1000 more of the late starters which will get employees in the coming years if we apply the observed pattern from earlier years.

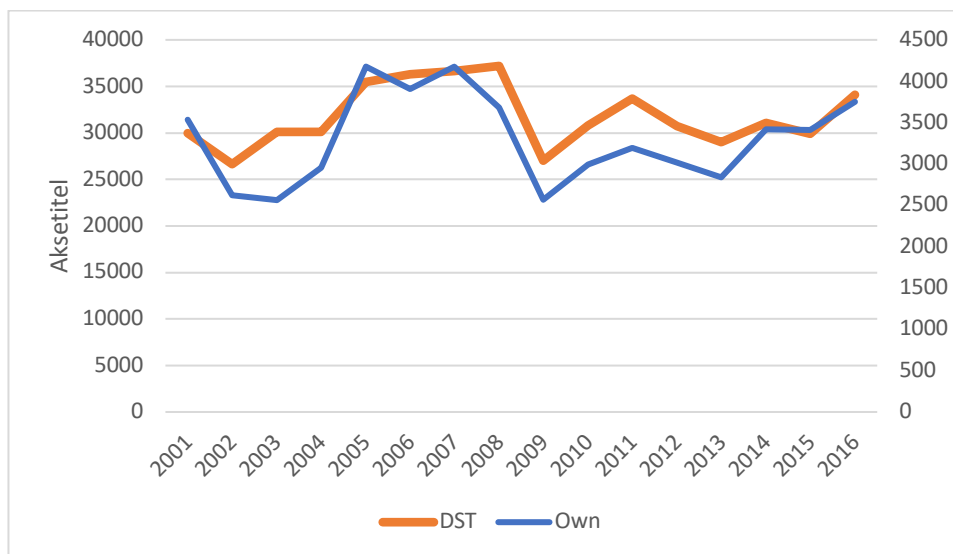
Table 9.

| | 2016 |
|--------------------------------------|--------|
| Total | 781305 |
| Trivial firms and non-private | 631497 |
| Remaining non trivial and non public | 149808 |
| Of which new | |
| One employee or 10 mill | 7470 |
| True start-ups | 3715 |
| Trival s-u becoming true | 547 |
| True start-ups | 4262 |

It looks like DST is including all new firms though it is stated that they make almost the same validation of new firms with respect to weeding out administrative changes of the data as we have done but they state that their validation focuses on the larger firms with more than 10 employees. Thus, for 2016 DST reports 34,116 new start-ups including all ownership forms as we have done. Thus, their numbers of start-up firms still end up around 9 times larger than our numbers.

The difference in numbers is reported in Figure 12, where we have to use different scales in the same Graph to display the difference. It is, however, very interesting that the 2 curves develop in parallel despite the large difference in levels. That means that the true start-ups are constantly around 1/9 of the number Statistics Denmark publishes based on the development of new ERNs. We have also analyzed the number of newly started incorporated companies (Aps+A/S). The difference between the number of incorporated start-ups according to Statistics Denmark and the true number according to our method is now lower but we still find only 1/6 of what Statistics Denmark find. This shows that Statistics DK has scrutinized the incorporated companies more than the single owner non-corporate firms.

Figure 12. Comparison of Statistics Denmark (left scale) and our validated data for start-ups, 2000-2016 (right scale).

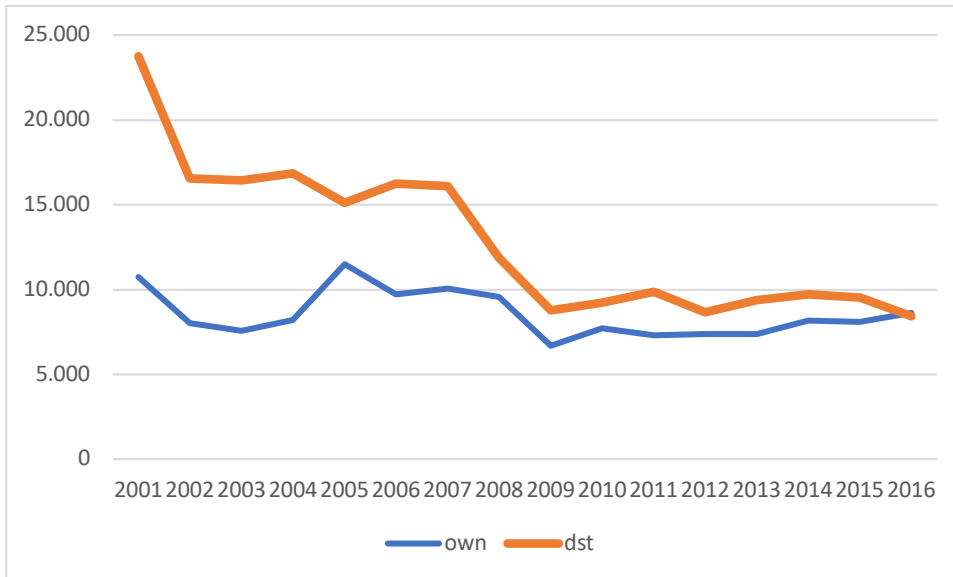


StatDk has also published the number of employees in these start-ups. Our estimates are now much closer simply because we have limited start-ups to firms with employees. Furthermore, we have both by different methods weeded out firms that also existed prior to the start-up. Figure 12 demonstrates that our estimate of the true number of new firms is actually of the same order in more recent years. But our numbers deviate vastly prior to the Great recession.

Using DST numbers of employment, one would reach the conclusion that there was a large decline in start-ups after 2001 and this would tell a story of declining importance of job creation among newly formed businesses. Furthermore, such a conclusion would support the conclusion in Decker, Haltiwanger, Jarmin and Miranda, 2014, where they show that the US has experienced a decline in the contribution to job creation from new firms. Contrary to this, the conclusion on Denmark is that true start-ups have been relative stable over the last 20 years but with clear impacts of the two crises. First, the number of new jobs from true start-ups went down in the dot.com crisis but rebounded 2005-2008. Second, the Great Recession gave a severe dip in 2009 with a very slow growth in the years afterwards, which in 2016 was 1000 short of the level in 2008.

The results in Figure 12 and 13 both demonstrate that the creation of new firms have been very low in a period after the crisis where it was important to create new firms that could increase the number of jobs and could contribute with higher productivity.

Figure 13. Comparison of number of employees in start-ups according to current study and DST. Thousands.



Conclusions

Start-ups play a great role in industrial politics in many countries. It is commonly believed that a steady growth of new firms is essential to job creation and productivity growth in society. Therefore, society should be concerned that it has the right policies towards start-ups. As a first step, it is essential that we measure the number of start-ups correctly.

We have in this paper revisited the statistics on the creation of new firms. By mixing register data on new firms with data from the previous year we have identified true start-ups that are not based on previous firms. Similarly, we have identified administrative new firms that are based on the labour force of pre-existing firms. We have shown that more than 40% of all firms formerly classified as start-ups in a given year are not real start-ups because the majority of the employees were the same as in a previous firm and the start-up status was achieved because they got a new firm registration number. We have demonstrated that 60% of these firms were given a new registration number because they changed ownership. 40% had either the same owner or got an additional owner. Thus, the ownership data supports our revised look at start-ups.

These two types of start-ups differ greatly with respect to their survival rates. After 11 years, almost 60% of the true start-ups had closed down, whereas only 25% of the administrative start-ups had closed down, meaning that the true start-ups live a much more dangerous life than hitherto expected. Furthermore, only 10% of the true start-ups had “saved” themselves with a second life in the form of a new ID, whereas more than 30% of the administrative start-ups got a second life more than once over a 11-year span. Thus, there are several reasons to consider the two groups of start-ups as separate groups.

Consequently, mixing the two groups of start-ups overestimates the true rate of survival for start-ups. It also means that we have overestimated the effect of newly started firms on job creation because the administrative start-ups have a two times larger work-force than true start-ups. This misconception may have had an impact on policies to assist the start-ups in the sense that these

polices have had less effect than believed or in the sense that they may have been targeting the start-ups with least problems.

The consequence of this is that the uncorrected statistics on the number of start-ups is overstating the number of firms and the number of jobs coming from start-ups. Comparing the true start-ups according to our method with the numbers published by Statistics Denmark is indicating that the number of true start-ups is 1/9 of the official numbers. Furthermore, we have found that the actual numbers of people employed in true start-ups have been roughly the same since 1981 with significant reductions in the years of crises. Thus, we are not finding the same negative tendency as found for the USA.

The numbers in this paper come from Danish register information, which may not be representative for similar data in other countries. But I feel that the measurement problem laid bare in this paper is so important that it is advisable to document how researchers and administrations in different countries treat their data in this respect.

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Appendix

A note on Administrative start-ups

We have used the term *administrative start-ups* for all firms where a group of persons (more than 50%) of the workforce comes from a firm existing the year before.

These firms consist of different types. One is a daughter firm, which is a company with joint taxation with the mother company. The condition for joint taxation is that 50.1% of the shares are owned by the other company in the joint taxation, so this indicates that at least 50% of the owners are identical. This also indicates that there is an ongoing business relation between the mother and the daughter firm. Consequently, these daughter companies do not consist of persons who have broken out of a company and created their own company. According to Table A1, these companies consist

of about 30% of all cases. From the statistics we can also see that daughter firms tend to come from larger firms, see Figure A1.

Table A1. New daughter firms as percentage of all administrative changed firms.

| | Admin | of which daughter firms |
|------|-------|-------------------------------|
| 2005 | 3358 | 20.8 |
| 2006 | 3331 | 24.4 |
| 2007 | 3407 | 30.9 |
| 2008 | 2960 | 32.6 |
| 2009 | 2264 | 31.6 |
| 2010 | 1955 | 32.0 |
| 2011 | 2064 | 29.9 |
| 2012 | 1773 | 21.0 |
| 2013 | 1752 | 24.3 |
| 2014 | 1815 | 23.1 |
| 2015 | 2035 | 29.8 |
| 2016 | 1955 | 31.7 |

The remaining firms are most likely spin-offs where a group of workers leave a company to start their own firm. However, there is a slight probability that it could also be a daughter company where there is no joint taxation because the ownership share is below 50.1%. For simplicity we call all these firms spin-offs firms.

The question is, however, if the spin-offs and the daughter companies make up a different environment for the start-ups, so that it makes sense to distinguish between the two groups. In Figure A1 we have compared the fraction of workers who leave a firm and who enters a new firm for those firms we have identified as daughter firms and those identified as spin-offs. Since the fraction of employees leaving differs between small and large firms, a Graph has been made for size groups. Furthermore, the comparison has been made for deciles of the two distributions. Figure A1 shows the fairly obvious result that the larger a firm is, the smaller share of the employees will leave and start on their own. Even at the median of each distribution the fraction of people leaving to start a new firm is pretty small except for the smallest firms. We can only observe a difference for the largest firms and only for about 30% of them. For these, the daughter firms appear to consist of

larger contingencies of the firms than the spin-offs. Similarly, we find a difference for the smallest firms. Besides these large and small firms, it is hard to see a difference between the true daughter companies and spin-offs with respect to the conditions.

This is remarkable, since you will expect a difference between the two groups due to their nature. A daughter company is created as a result of a change with mutual consent and active support from the firm and in most cases the employees as well. Similarly, a spin-off could be created by workers breaking out of a firm creating their own firm, and this could happen without the consent of the former employer and even in opposition to the former employer in the cases where the new firm starts competing with the old firm or where they take valuable information with them.

Another empirically question is of course, if there is difference between how successful these two groups of firms are in the future. This has not been dealt with in the present paper.

Figure A1. The distribution of the fraction of employees leaving different size firms and for spin-offs and daughter firms over the period 2004-2016.

