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Firm-level Entry and Exit over the Danish Business Cycle

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Abstract
We use a new registry micro level data set to study firm dynamics in Denmark. A unique feature of the data allows us to gain more information about older firms (operating for 30+ years), and an important proportion of these firms shows deteriorating productivity and rising exit rates. We find supportive evidence for other US-based stylized facts, such as young firms being more likely to exit and to grow faster over time. However, it seems to take longer for Danish firms to reach maturity. The Danish data also do not show any signs of a slowdown in the entry rate. Finally, we do not find long-run scarring effects on firms entering in recessions. However, fluctuations in the entry rate have persistent effects on the long-run aggregate volume of value added.

Resume
Vi anvender registerdata til at se på virksomhedsdynamik i Danmark, også for ældre virksomheder (med mere end 30 års aktivitet). En betydelig del af disse ældre virksomheder viser aftagende produktivitet og stigende konkursrater. Vi finder evidens til fordel for en række etablerede resultater fra amerikanske data. Eksempelvis har yngre virksomheder større tilbøjelighed til at gå konkurs. De vokser også hurtigere over tid, mens danske virksomheder til gengæld er længere tid om at modnes. De danske data viser heller ikke tegn på et fald i opstartsraten for nye virksomheder. Endelig observerer vi heller ikke tegn på varige mén for virksomheder grundlagt under recessioner. Fluktuationer i opstartsraten har dog vedvarende effekter på det langsigtede niveau for værditilvækst.

Key words
Firm dynamics; firm-level microdata; business cycles.

JEL classification
D22; E23; E24; E32.

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The authors alone are responsible for any remaining errors.

Firm-level Entry and Exit over the Danish Business Cycle*

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Abstract

We use a new registry micro level data set to study firm dynamics in Denmark. A unique feature of the data allows us to gain more information about older firms (operating for 30+ years), and an important proportion of these firms shows deteriorating productivity and rising exit rates. We find supportive evidence for other US-based stylized facts, such as young firms being more likely to exit and to grow faster over time. However, it seems to take longer for Danish firms to reach maturity. The Danish data also do not show any signs of a slowdown in the entry rate. Finally, we do not find long-run scarring effects on firms entering in recessions. However, fluctuations in the entry rate have persistent effects on the long-run aggregate volume of value added.

JEL codes: D22, E23, E24, E32

1 Introduction

Firm dynamics and their implications for the aggregate economy, both from the cyclical and long-run perspective, is a very active area of research. Arguably, the most used source of empirical data is the Longitudinal Business Database (LBD) run by the US Census. Although this data set has yielded a great deal of insights, relying on one data source from one country might be limiting. This is especially so when trying to identify a causal effect of trends which are similar across the US, such that geographical differences cannot be used for identification.

In this paper, we introduce a new micro level data set using administrative data for the universe of Danish companies and study the cyclical and long-run properties of firm

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entry and exit rates. We find that the cyclical characteristics of firm entry and exit are comparable to those for the US, but we uncover differences in the long-run trend in the entry rate as well as in the long-run effects of recessions.

We combine three administrative data sets which cover the universe of Danish firms operating at some point between the years 2001 and 2016. We use detailed information on the date of entry and exit and several other variables capturing the decisions of firms (e.g. employment) and firm outcomes (value added, profits, productivity). The firm entry date is a particularly valuable variable, because the entry date is not censored for firms which were active at the time of inception of the dataset.[1] Focusing on firms older than 30 years, we find signs of deterioration in firm indicators, such as an increase in exit rate and drop in productivity.

Many of the stylized facts based on the US data are also true in the Danish context (compared to old firms, younger firms are on average smaller, more likely to exit and they grow faster). Also, the cyclical properties are comparable. However, there are also some differences. The trend of a long-run decline in firm entry which has been documented in the US (Pugsley and Sahin, 2014; Karahan et al., 2018) is not present in the Danish data.[2] Also, we do not detect signs of strong scarring effects of recessions on long run success of firm (Sedláček and Sterk, 2017; Moreira, 2017), rather, cohorts of firms which start in recessions show signs of being more productive.

We then proceed to build a statistical model of the Danish economy which captures the heterogeneity in age as well as both starting and contemporaneous aggregate conditions to study the effects of two shocks: aggregate economic conditions and number of new firms. We use this model to disentangle the short and long run effects of recessions and firm creation. According to the model, the firm creation shocks have very persistent effects on aggregate output measured as the aggregate value added generated by all firms in the economy. The output is still 0.5 percentage point below the steady state even 10 years after the shock hits. The persistence of this effect is driven by the fact that once the entering cohort is smaller, no new firms can ever enter this particular cohort and the fall in entry during a recession leaves a dent in an age-distribution of firms which slowly propagates over time.

The most recent paper summarizing the stylized facts about firm entry and exit in relation to the business cycle is Tian (2018). She uses data from the 2015 release of the Business Dynamics Statistics (BDS) by the US Census covering the years 1976-2013. We are able to replicate some of her findings such as firm entry being pro-cyclical while firm exit is a-cyclical, and that the entry and exit of firms in manufacturing industries appear to be more cyclical than for service industries. In addition, she finds that smaller firms are more cyclical. We find that younger firms, which are also on average smaller in terms of the number of employees and value added, have more cyclical entry rates. Lee and Mukoyama (2015) focus on manufacturing firms (using the Annual Survey of Manufacturers from

[1] In contrast, the Business Dynamics Statistics (BDS) by the US Census, which is the standard source of information in this literature, is censored and covers the time period between 1975 and 2016. For details, see Jarmin and Miranda (2002).

[2] At least on the aggregate level. For some sectors (i.e. services), the entry rate does indeed decline.

LBD between years 1972-1997) and also find that the entry rate is pro-cyclical. They also point out that there is wider dispersion of productivity in booms and that it is important to distinguish between gross and net flows as there are lots of plants still entering in recessions while the net number might be falling. This point was confirmed by Geroski (1995) comparing data for the UK and the US.

There is a growing literature looking at long-run effects of firm entry as well. (Pugsley and Sahin, 2014; Karahan et al., 2018) document a long-run decline in firm entry. Because younger firms behave differently than older, more established firms, changing the composition of the set of active firms should have aggregate implications (Pugsley and Sahin, 2014). Karahan et al. (2018) argue that the long-run negative trend in demographics can explain the falling start-up rate. Here, having the evidence from other countries can be particularly useful. While we do not find any noticeable fall in the aggregate entry rate between 2001 and 2016, it is also the case that the population growth in Denmark has not been falling over the same period.

Furthermore, there is a growing literature showing that recessions have long-lasting scarring effects. For example, Sedláček and Sterk (2017) and Moreira (2017) show that firms not only start smaller, they also never catch up relative to firms with the same characteristics starting in booms. These findings suggest that the costs of business cycles can be potentially larger as the negative effects of recessions persist for a long time and go beyond output and employment falling for a couple of quarters during the recession itself. On the other hand, there is some empirical evidence (Jensen et al., 2014) that an increase in credit availability might encourage entry of lower quality firms and thereby mitigate the aforementioned effect (assuming that credit availability is positively correlated with the business cycle). While we do not find evidence that firms entering in recessions are worse on average in the long run, we find that short-run fluctuations in entry can have long-run effects on output.

Section 2 summarizes the data sources and the steps needed to create a consistent data set. Section 3 describes the basic facts about the entry and exit in Denmark. In section 4 we use these estimates to build a statistical model with rich heterogeneity and show how fluctuations in entry caused by a recession can have persistent medium- to long-run scarring effects on output. In section 5 we describe the cyclicality of firm entry and exit. Finally, section 6 concludes.

2 Data

We combine firm-level microdata for the universe of Danish firms from firm accounts, general firm statistics and newly available data on firm failures for the period 2001-2016. As a default, we use data on economic variables from firm accounts and general firm statistics when available but add data from the firm failures datasets when data is missing to get as complete a picture as possible. To our knowledge, the microdata on firm failures have not been used by anyone before. However, since we want to look at firm exit in a broader sense than only firm failure, we augment the firm failure dates with firm end dates

from general firm statistics. In our final sample, 11.2 percent of observations have exit information from the firm failure dataset.[3]

From the data we have information on all firms that are *operating* between 2001 and 2016, which includes firms which started before 2001. Given that we have administrative information about the start date for all firms, and potentially an exit date if the firm indeed exited, we are able to construct exit rates for firms older than the span of the data. This feature of the data also allows us to construct age profiles over many variables of interest which are longer than the span of the data and hence provide insights about older firms which would not be available if the start data was not present, which is the case for many alternative datasets.

Statistics Denmark normally operates a threshold for identifying firms as active, i.e. having a certain amount of economic activity, and only active firms are included in their official firm statistics.[4] However, we have also gained access to data for all inactive firms from 2001 onwards. The addition of inactive firms allows us to track more firms across the entire sample period even if firms repeatedly cross the threshold, thus avoiding gaps in the firm histories.

We begin with 9,738,585 firm-year observations. From there, we clean the data in a number of ways. First, we drop a few firms that cannot be consistently matched or have inconsistent start dates between the different data sources along with a rather small number of firm duplicates (this avoids the feature of the Danish firm legislation that a given firm id (cvrnr) of a closed-down firm can be re-used if the individual owning the firm restarts the firm or starts a new company under his own name). Second, we drop firms which disappear from our dataset before the end year but which do not have an exit data recorded from either data source (roughly 0.5 percent of observations). Third, to keep the data as clean as possible, we drop all observations of firms which have gaps in their histories (roughly 5 percent of the sample).

We choose to avoid industry reclassifications by fixing the industry of a given firm to the industry of the first year in which that firm is observed. For firms which appear as unclassified in the first year, we set their industry to that of the first year in which they are not unclassified (if applicable).

For further details on data sources and considerations, see Appendix A.

[3]Firm exit can occur for reasons not necessarily related to firm failure, e.g. because of two firms merging, subsidiaries of business groups being closed for organizational purposes etc. Openings or closings of branches of a firm brand (e.g. a grocery store or a bank department) do not affect either entry or exit in our dataset. The same if true for franchises only if each franchise does not have its own firm id (curiously, the McDonald's franchises in Denmark were all bought by one individual recently and so went from being counted as several firms to only one firm, and so openings/closures of McDonald's restaurants within this new firm do not affect entry and exit as measured in our dataset).

[4]A firm is considered active in the general firm statistics if it meets either of two requirements: 1) At least 0,5 employees on average over the year ('årsværk'). 2) A turnover corresponding to this amount of activity within the industry of the firm.

3 Firm dynamics in Denmark

In this section we describe our empirical findings about the entry, exit and age profiles using the Danish administrative micro level data [5]. We start by describing the aggregate movements in entry and exit, finding that the entry rate has been cyclical but stationary since 2001. We then proceed to describe the age profiles using the unique feature of the data which allows us to learn more about older firms. We also study the effects of recessions on both entry, exit and other variables of interest.

We label firms in the following way. At time t, the number of firms of age j in sector s is labeled as $n_{j,s,t}$. The entrants, that is the firms up to one year old, are labeled as age 1. All firms which are older than 41 are labeled as 41 years old.[6]

We define the age-specific exit rate $\delta_{j,s,t}$ at a given time t, sector s and a given firm age j as the difference between the number of firms of that age at that time $n_{j,s,t}$ and the number of firms one year older one year into the future $n_{j+1,s,t+12}$ normalised by the original number of firms $n_{j,s,t}$:

$$\delta_{j,s,t} = \frac{n_{j,s,t} - n_{j+1,s,t+12}}{n_{j,s,t}}. \tag{1}$$

We cannot separately compute the exit rate for the last two age groups, because the 41+ age group is a catch-all for older groups, and hence we do not observe the survivors. Instead we assume that the exit rate at age 40 is the same as for age 39 ($\delta_{40,s,t} = \delta_{39,s,t}$) and compute the implied exit rate for age 41 in the following way:

$$\delta_{41,s,t} = (1 - \delta_{40,s,t})\frac{n_{40,s,t}}{n_{41,s,t}} - \frac{n_{41,s,t+1} - n_{41,s,t}}{n_{41,s,t}} \tag{2}$$

The entry rate at time t is then the number of firms in the first age bin $n_{1,t}$ over the total number of firms:

$$e_{j,s,t} = \frac{n_{1,s,t}}{\sum_{j=1}^{J} n_{j,s,t}}.$$

The aggregate results are computed by assuming that all firms belong to one sector.

We also study how other variables, such as productivity, number of workers or value added by firm, change with firm age. To do so, we aggregate firms of a selected age and sector at any given time, and compute group specific medians. In other words, we do not run the regressions on an individual firm level, but on medians computed for any given sector-time-age group.

In this section, we study how firms change as they get older. To extract the role of the age from other factors, we estimate regressions of the following type:

$$x_{jst} = \sum_{j=1}^{41} \gamma_j age_j + controls, \tag{3}$$

[5] For the sector definitions used in this section, see Appendix A, "industry classifications".

[6] We choose 41 as a threshold due to confidentiality issues. The number of firms is falling with age, so if the groups get too small it might in principle be possible to infer some information about a particular firm from an age-group mean or median.

where age_j is an indicator variable of firms aged j years. Focus is on the coefficients γ. In this regression, x can be either exit rate, median productivity, value added or employment by firms.

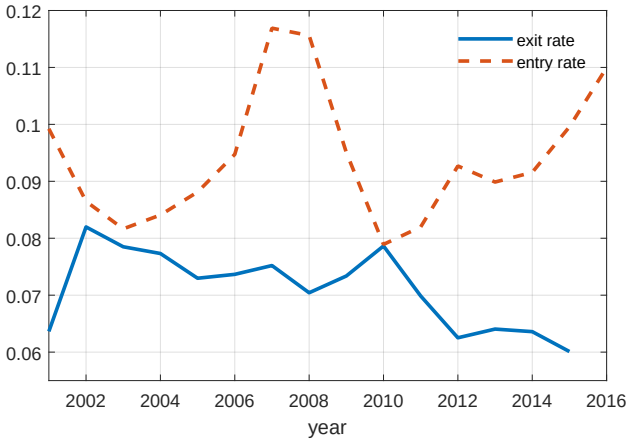
In order to correctly interpret the results, it is important to keep in mind that the composition of groups changes as firm age. Suppose that at time t, there are 100 firms of age j. When we report median productivity, it is computed as the median over these 100 firms. Now suppose that at time $t+1$, there are only 90 firms of age $j+1$ left. Again, the productivity is computed as the median over these 90 firms. Admittedly, it is highly likely that the probability of exit is correlated with some firm characteristics, and so the median computed at time t over *only* the firms which turned out to survive until $t+1$ would be different and potentially very informative for building a structural model to guide economic policy. However, in this paper we focus on the description of Danish firms, so we abstract from these selection issues.

3.1 Aggregate entry and exit over time

Over the time period we study, the number of firms is increasing. After cleaning our dataset, we observe an average of 52,000 firms entering in a given year.[7] The entry and exit rates are depicted in figure 1.[8]

While there is a clear cyclical pattern (studied in detail in section 5), there is no sign of a fall in the entry rate which has been documented for the US (Pugsley and Sahin, 2014; Karahan et al., 2018; Decker et al., 2017).

Figure 1: Average exit and entry rate over time

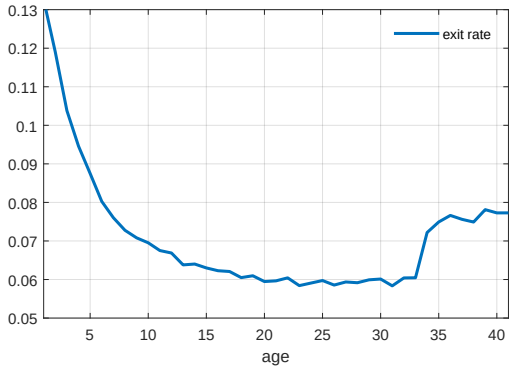


[7] Using a more restrictive definition of firm activity, Statistics Denmark (Statistikbanken, table DEMO1) reports an average of 32,000 firms entering in a given year over the same time period.

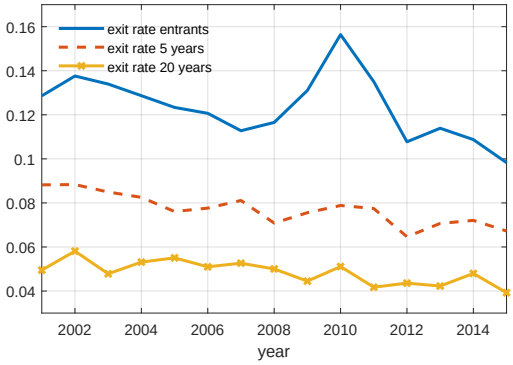
[8] Note that an exit rate cannot be computed for 2016 since we do not observe which of these firms survive or exit.

Figure 2: Exit rate

(a) Age profile



(b) Selected exit rates over time



The aggregate entry rate is more volatile than the exit rate. The entry rate seems to be stationary while it might be argued that there is a decreasing trend in firm exit.

3.2 Age profiles

The stylized fact based on the US literature is that young firms are smaller, less productive and more likely to exit. As firms mature, the chance of exit falls and their relative growth declines (Alon et al. (2018) show that firms stop contributing to the growth of aggregate productivity by age 5).

In the Danish micro data, younger firms are indeed less stable and less productive than older firms. However, they need much longer to reach maturity (ten years for productivity and even more for the exit rate to stabilize). However, using the additional information for the older firms, we also find that past an age of around 30, the exit rate starts to increase again, productivity starts to decline and value added stops growing.

Figure 2, panel a shows that the exit rate is falling sharply for young firms from over 10% to about 7% in the year 8. Afterwards, the rate is still falling but at a much slower pace. For young firms the exit probability seems higher in recessions. However, we do not control for any kind of selection issues. We know that the number of firms entering in recessions falls and the firm population is likely to be different in other dimensions too.

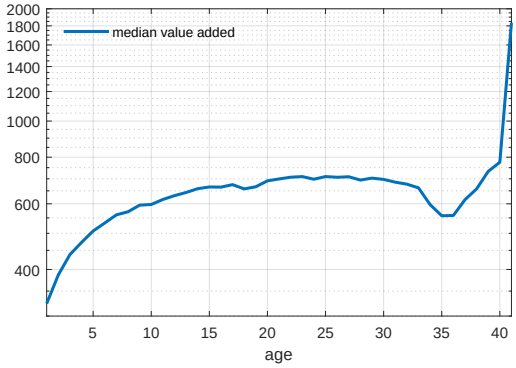
Figure 2, panel b plots the exit rates over time for firms of three different ages (1, 5 and 20 years). For example, the 5 year exit rate is the exit rate for firms aged between 5 and 4 in the given month. The exit rate of older firms is much less cyclical.

We next turn to median value added. Panel a in figure 3 plots the corresponding age profile. The median firm starts small and increases its value added over time. In fact, it takes over 20 years for the profile to level up around an age of 20-25, after which it starts falling, increasing again after age of 35.

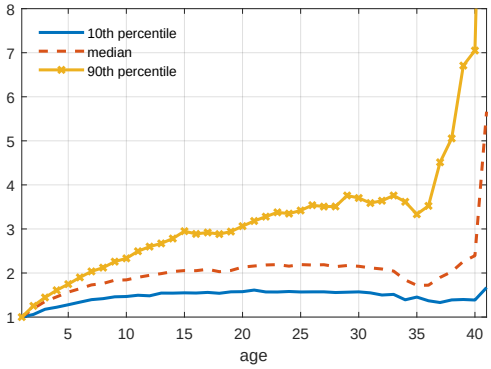
Panel b of figure 3 plots the evolution of the 10th and 90th quantile relative to the

Figure 3: Value added

(a) Age profile



(b) heterogeneity in value added



median. All three lines are normalised by the value added of the entrants. It shows that the right tail of the distribution of value added is growing faster than the left tail. In other words, the dispersion between firms which contribute the most and the least to the aggregate output is increasing over time.

Figure 4 panel a plots the median productivity for firms of different ages over time. Median productivity is increasing early on, but after age 10 it stays fairly constant until around age 25 where it starts falling again. The median productivity stabilizes again after age 35. The median productivity of firms in the age group 41+ is much higher than that of any previous age group.

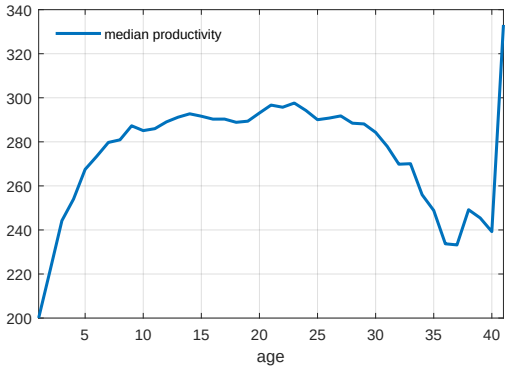
Panel b of the same figure demonstrates how the dispersion in the distribution of productivity changes with firm age. The ordering is the opposite of the results for value added. The right tail of productivity is not increasing over age at all (with expection of age group 41+). In fact, the left tail seems to be catching up.

Finally, we turn to employment. In the data there are lots of sole proprietorships and firms with 1 worker and less so when using the full set of firms, the median is not very informative (over most of the ages, it is close to 0 and with a very high number of workers for age group 41+). To overcome this problem, we restrict the dataset and exclude sole proprietorships and similar. The resulting median employment age profile is captured in figure 5.

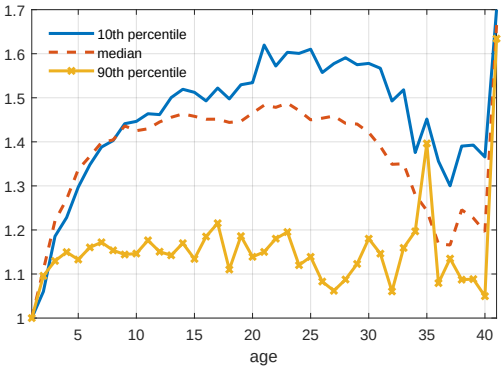
To summarize these findings, we aggregate firm age into 4 different groups (1-10, 11-20, 21-30 and 31-40) and estimate the age-slope individually for each group, allowing for a sector-specific intercept, time trend and effect of recessions at the time of entry and

Figure 4: Productivity

(a) Age profile



(b) heterogeneity in productivity



contemporaneously. Formally, we run the following regression:

$$x_{jst} = \sum_{k=1}^{4} \omega_k j + \sum_{k=1}^{4} \omega_k^0 age\_group_k + \sum_{s=1}^{5} \omega_s^1 S_s \times t + \sum_{s=1}^{5} \omega_s^2 S_s + \sum_{s=1}^{5} \omega_s^3 S_s \times R_{j,s,t}^{now} + \sum_{s=1}^{5} \omega_s^4 S_s \times R_{j,s,t}^{entry}, \quad (4)$$

and report the slope coefficients ω_k. The coefficients from regressions of exit rate, value added, productivity and employment can be found in table . For exit rate and productivity, the results are statistically significant and in line with the age profile graphs: very young firms need time to reach maturity and during this process the exit rate falls and productivity increases. This is in line with the stylized facts using other datasets internationally. What is different to the US is the following. First, this process takes longer. Second, at some age this seems to be overturn and old firms appear to deteriorate. However, it is important to keep in mind that the analysis is done on the age-sector-time level, not on the individual firm level.

Once concern is that sole proprietorships, small firms with imputed accounting data and inactive firms, which we are including for completeness, are driving the results. To address this, we present robustness checks using different subsets of firms, see appendix B. Overall, the results are qualitatively similar to the baseline results. For example, the first table in appendix B shows that across the specifications shown, the age pattern for the exit rate is unchanged: declining for young firms, constant for middle-aged firms and increasing for older firms.

Because we do not control for composition effects, it is possible that there are two groups of firms: very productive firms which never exit (type 1), and less productive firms which have some hump-shaped life profile (type 2). As the number of smaller, less productive firms of type 2 falls, their contribution to median is falling and ultimately the firms of type

Figure 5: Median employment for a subset of firms

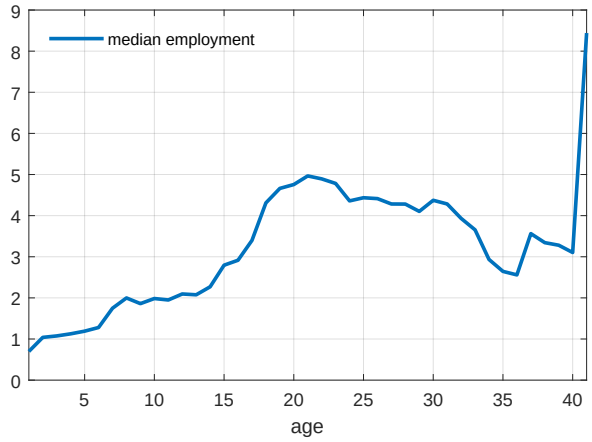


Table 1: Slopes by different ages

	(1) Exit rate	(2) Value added	(3) Productivity	(4) Employment
1-10 slope	-0.0074^{***}	31.8797^{***}	10.4658^{***}	0.1880
11-20 slope	-0.0007^{***}	7.1011	0.4740	0.3723^{*}
21-30 slope	0.0001	−2.0401	−1.3712	−0.0691
31-40 slope	0.0027^{***}	10.9264	-3.3294^{**}	−0.2323
Observations	3070	3193	3192	2127

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1 take over.

3.3 Effect of recessions

To explore the role of recessions on firm outcomes, we estimate the following equation

$$x_{jst} = \sum_{j=1}^{41} \gamma_j age_j + \sum_{j=1}^{6} \beta_j^1 R_{j,t}^{entry} \times A_{j,s,t} + \sum_{j=1}^{6} \beta_j^2 R_{j,t}^{now} \times A_{j,s,t} + t \times S_{j,s,t}, \tag{5}$$

where $R_{j,t}^{entry}$ (and $R_{j,t}^{now}$) is a dummy variable which takes value 1 if firms of age j at time t entered (or currently are) in recession. $S_{j,s,t}$ is a sectoral dummy. Finally, to allow the recession to have different impact according to the age, $A_{j,s,t}$ is an indicator variable which separates firms into 6 groups: entrants (firms of age 1 only), young firms (ages 2-10), three groups of mature firms (ages 11-20, 21-30, 31-40) and finally the remaining group for firms aged 41+.

The parameters of interests are the coefficients β^1 and β^2, which capture the level effect of entering or currently being in the recession for firms of different ages allowing for different trends across different sectors. The results of this estimation are summarized in table 2.

Table 2: Effects of recessions

	(1) Exit rate	(2) Value added	(3) Productivity	(4) Employment
rec entry × entrants	0.013***	−40.5	−11.1**	−1.26
rec entry × aged 2-10	0.0014	12.1	4.13*	−1.00
rec entry × aged 11-20	−0.00016	26.4	9.91***	0.11
rec entry × aged 21-30	0.0011	53.1	3.70	0.43
rec entry × aged 31-40	−0.0036	86.6	20.5***	0.22
rec entry × aged 41+	−0.0079	−146.6	37.0***	3.65
rec now × entrants	0	0	0	0
rec now × aged 2-10	0.0013	−36.7	−5.21**	−0.018
rec now × aged 11-20	−0.0013	−32.3	−10.6***	−0.18
rec now × aged 21-30	−0.0022	−23.4	−11.7**	−0.27
rec now × aged 31-40	−0.0020	51.5	−3.02	0.58
rec now × aged 41+	−0.0042	395.7***	−54.0***	−2.59
age dummies	*Yes*	*Yes*	*Yes*	*Yes*
sectoral time trend	*Yes*	*Yes*	*Yes*	*Yes*
Observations	3070	3193	3192	2127

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Most of the coefficients are not significant, but there is a pattern suggesting that entering in a recession is generally bad early on in the life of a firm (higher exit rate, lower value added, productivity and employment). However, this trend is reversed in the later stages of firms' lifespan.

Current recessions affect young firms negatively, while the impact on older firms is more ambiguous. The exit rate is actually falling in recessions for older firms. Also, while productivity is always negatively affected, firms aged 31+ actually do not see any negative impact on the value added. These findings suggest that young firms find recessions very hard to deal with, and recessions reduce their market share which benefits the older/larger firms. This is in line with the findings in Clymo (2018) about the great recession in the US.

Thus, we cannot confirm the findings of Sedláček and Sterk (2017) and Moreira (2017) in the Danish context. Instead, our findings are consistent with a world where recessions weed out the least productive firms, thereby increasing long-run median productivity and employment while decreasing the exit rate of firms which entered in recession a long time ago.

We allow firms to be different due to their age and the state of the economy, both *current* and *at the time of entry*. The age captures the fact that firms start small and change over time in their productivity or number of people they employ. The existing literature also points towards a scarring effect of recessions, so the firms which start in recessions never become as productive as their counterparts which started in booms, *controlling for age* (Sedláček and Sterk, 2017; Moreira, 2017). Therefore, in principle we should be able test whether their findings are also present in the Danish data.

4 Business cycle implications

Fluctuations in economic conditions can have long lasting effects: in bad times, more firms fail but also fewer firms enter. A lower entry rate can thus generate gaps which propagate over many years. Furthermore, as the previous section established, firms which enter in booms and recessions are on average different along important characteristics, such as their exit rate or the the value added they generate. In this section we use the age profiles for exit rate and value added to study what are the long-run effects of recessions.

In this exercise, we assume that a representative firm behaves exactly as estimated in the previous section and captured in the regressions which generate table 2. Formally, we use an overlapping generation structure, with age specific effects and allowing for firms which enter in booms and recession to be different. The number of new firms aged 1 in every period also fluctuates depending on the aggregate state of the economy. All firms which start at the same time are identical. Firm behaviour is not derived from optimisation. Instead, we make firms behave exactly like we estimated in the previous section. The goal of this model is to provide an accounting exercise of how much fluctuations in firm entry affect the aggregate economy.

We find that a fall in the number of entrants contributes only modestly on impact. However, the effect of missing firms is very persistent, decreasing the aggregate value added by half a percentage point ten years after the shock. In this sense, we find recessions to be scarring long-run output. This effect would be hard to detect using aggregate time series, since any detrending is likely to misattribute it to some underlying trend in the economy.

4.1 Statistical model

Aggregate state The aggregate state affects how many firms enter and how much every firm produces. This effect on production is different by firm age and it also depends on whether a given firm entered in a recession or in a boom.

The aggregate state is an exogenous random variable modelled as a two-state markov chain, capturing whether the economy is in boom or recession. The transition probabilities are estimated from time series of booms and recessions in the Danish data from 1966 onwards provided by Abildgren et al. (2011).

Firms In this exercise, we track firm numbers and how much they produced as measured by the value added. At time t, there are $n_{j,t}$ firms aged j. In particular, $n_{1,t}$ captures the number of new firms/entrants at time t.

The exit probability $\delta_{r_{start}}^{r_{current}}(j)$ is time invariant, but it differs for firms of different ages j, allowing for differences based on the *current* conditions r_c and the condition at the *start* r_s (r_s and r_c are binary). The law of motion for the number of firms in each cohort is

$$n_{j+1,t+1} = \delta_{r_s}^{r_c}(j) n_{j,t} \tag{6}$$

These age/conditions-specific exit rates are directly estimated from the data as the average exit rates for corresponding groups using the specification in equation (5) and table 2 column 1, from which we ignore the sectoral controls. For example, for firms aged j (which belong to age group l) which entered in recession and are currently in recession, we have

$$\delta_1^1(j) = \gamma_j + \beta_l^1 + \beta_l^2$$

Following the same steps, we use equation (5) to get the amount of value added $y_{r_s}^{r_c}(j)$ produced by a firm characterised by its age, and the current and starting economic condition, captured by $y_{r_{start}}^{r_{current}}(j)$. Because the firms within each cohort are identical, the total value added by cohort j at time t is then $n_{j,t} y_{r_s}^{r_c}(j)$. The aggregate value added at time t is the sum of all value added by firms of all ages:

$$y_t = \sum_{j=1}^{J} n_{j,t} y_{r_s}^{r_c}(j) \tag{7}$$

4.2 Results

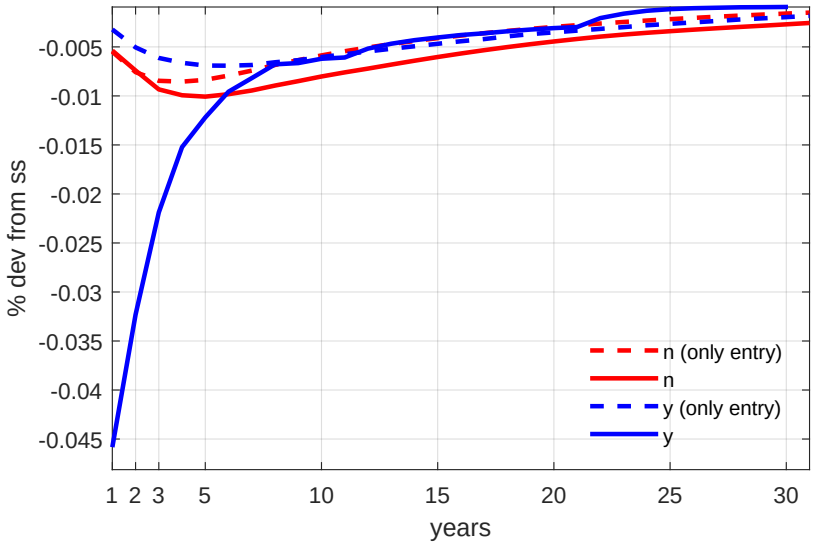
Recessions are times of lower production for most firms, but also the time when fewer firms enter and more exit. In this section we separate these two channels and asses their contribution to short and medium run deviations of output from its steady state. We do so by comparing generalised impulse response functions from two exercises. In the first exercise, which is our baseline, we let all variables be affected by the aggregate state: value added y, exit rate δ and the number of entering firms n_1. In the second exercise, the number of entering firms the same (that is, what it should be in a recession). However, we set firms to produce and exit as much as they would, were they in a boom.

To eliminate any possible effect of randomness, we run 5,000 simulations with 100 burn-in periods and present the impulse response functions as the average percentage deviation between the two treatment groups and the control group.

The results are captured in figure 6. On impact, the difference in entry only contributes only 10% of the fall in value added. This is the consequence of young firms being very small relative to older firms. However, as the recession goes away (the probability of leaving a recession is estimated to be 29%), the missing firms is the only reason for lower value generated. By year 5, more than half of the gap in output is caused by missing firms. By year 8, the effect of missing firms completely dominates.

Interestingly, after year 12, the economy is actually better off having experienced a full-blown recession rather than only a drop in the entry rate. The firms which entered in recession on average produce more, however the magnitude of this effect is small.

Figure 6: Impulse response function



Overall, we find not large, but very persistent effects of fluctuations in entry on medium/long-run output. Note that it would not be possible to uncover this effect using a standard aggregate time series approach. Due to its persistence, a standard approach would likely mistake this effect for a trend and filter it out.

5 Cyclicality of entry and exit

The entry and exit of firms in and out of the economy is naturally expected to be closely related to the movement of business cycles: the decision of entrepreneurs to start or close a business is affected by the supply and demand conditions in the relevant market; and the headline economic movements are eventually an aggregate of individual firm and household behaviour.

While a large amount of the changes in economic activity probably comes from firms scaling up and down its activities, i.e. movements along the intensive margin, it is reasonable to expect the movement of firms in and out of the economy, i.e. movements along the extensive margin, to be important for the aggregate economy as well. For example, according to Statistics Denmark, there were 29,911 new firms started in 2015 out of a total of 297,238 firms, or 10 percent. Of these, 9,741 firms had employees. Similarly, there were 4,029 firm failures in 2015 corresponding to about 1.4 percent of firms. While startup firms

are typically small measured in economic activity, they are numerous. Failing firms are fewer, but they may be larger and so equally significant for aggregate economic activity. For example, the employment in failing firms was 9,818 full-time individuals in 2015, or about 2.4 employees per failure.

To assess the relation between firm entry and exit and the business cycle, we compute simple correlations between measures of entry and exit and GDP in levels as well as the GDP growth rate. To do this, we first count the number of firms in a given year as well as the number of entrants and exits. We then compute entry and exit rates in each year as the ratio of entry or exit out of the total number of firms. We construct one year leads and lags of the GDP levels and GDP growth rates. To remove trends, we detrend the entry, exit and total number of firms as well as GDP in levels using a HP filter with a smoothing parameter of 6.25 following Ravn and Uhlig (2002). We do not detrend neither firm entry or exit rates nor the GDP growth rates since these series appear to be already stationary.

We perform the exercise first for all firms. We then check how this may be different for different industries by focusing on two broad categories of firms: 1) manufacturing and 2) service industries.[9] The results of the exercise are shown in the table below and give rise to a number of stylized facts about entry and exit. These stylized facts generally confirm the pattern found for US firms in Tian (2018), although there are some deviations as described in the below.

The first insight comes from looking at the sign of the correlation between either the number of entrants and exits or the firm entry and exit rate and contemporaneous GDP levels. Overall, firm entry is somewhat pro-cyclical while firm exit is a-cyclical.

Second, the correlation patterns with contemporaneous GDP generally do not hold when looking at GDP growth instead of GDP levels. In particular, firm exit becomes pro-cyclical. The cyclicality of firm entry and exit is thus sensitive to the measurement of cyclicality. This is consistent with the findings in Tian (2018), where also the sensitivity is mostly related to firm exit only.

Third, there are signs of both firm entry and exit positively leading the cycle when measured against GDP levels, while both firm entry and exit in fact seem to be synchronized with the cycle when comparing with GDP growth rates. This is somewhat at odds with the findings in Tian (2018) and could potentially be clarified if quarterly data were to be used.

Fourth, the results for the contemporaneous cyclicality of firm entry and exit are generally similar in the manufacturing industries, whereas the patterns are less clear in the service industries. This is in line with the heterogeneity among sectors found in Tian (2018).

There might be several explanations for why entry and exit in the manufacturing industries are more in sync with the business cycle than is the case for service industries. If manufacturing industries are more competitive and dependent on the development in ex-

[9]Manufacturing and service industries are defined using the standard Danish industry codes (DB07). For manufacturing, we use the codes 10001-33000. For service industries, we use the combined internationally and home-oriented service industries as defined by Produktivitetskommissionen (2013), p. 30.

port markets, synchronized movements of the domestic and foreign cycles will affect these industries more, whereas service industries may be more shielded from such developments. Also, manufacturing industries typically have higher value added per firm, so entry and exit in these industries may affect the domestic cycle stronger.

In sum, we find some of the same patterns as in Tian (2018), most notably that firm entry is pro-cyclical while firm exit is a-cyclical. The patterns are heterogeneous among industries. The ambiguity of the lead and lag structure of both entry and exit might be resolved by looking at quarterly or even monthly frequencies.

Table 3: Cyclicality of firm entry and exit at the aggregate level

Variable of interest	Correlation coefficient between variable of interest and HPf gdp_{t-1}	HPf gdp_t	HPf gdp_{t+1}	Δgdp_{t-1}	Δgdp_t	Δgdp_{t+1}
			all firms			
Simple counts						
Total number of firms in year t (detrended)	0,50	0,72	0,48	0,51	0,12	-0,31
	(0,07)	(0,00)	(0,08)	(0,06)	(0,69)	(0,27)
Number of firm entry in year t (detrended)	-0,03	0,48	0,65	0,27	0,46	0,13
	(0,92)	(0,08)	(0,01)	(0,35)	(0,10)	(0,66)
Number of firm exit in year t (detrended)	-0,35	0,13	0,58	0,05	0,53	0,43
	(0,23)	(0,65)	(0,03)	(0,86)	(0,05)	(0,13)
Non-detrended rates						
Firm entry rate in year t	0,00	0,42	0,63	0,38	0,50	0,17
	(0,99)	(0,13)	(0,02)	(0,18)	(0,07)	(0,57)
Firm exit rate in year t	-0,27	0,16	0,59	0,15	0,58	0,49
	(0,35)	(0,59)	(0,03)	(0,60)	(0,03)	(0,08)
			service firms only			
Simple counts						
Total number of firms in year t (detrended)	0,46	0,72	0,53	0,52	0,16	-0,28
	(0,10)	(0,00)	(0,05)	(0,06)	(0,59)	(0,33)
Number of firm entry in year t (detrended)	-0,07	0,44	0,67	0,25	0,46	0,17
	(0,82)	(0,11)	(0,01)	(0,39)	(0,10)	(0,57)
Number of firm exit in year t (detrended)	-0,38	0,07	0,55	0,01	0,51	0,46
	(0,18)	(0,80)	(0,04)	(0,97)	(0,06)	(0,10)
Non-detrended rates						
Firm entry rate in year t	-0,04	0,38	0,62	0,37	0,50	0,20
	(0,90)	(0,18)	(0,02)	(0,20)	(0,07)	(0,49)
Firm exit rate in year t	-0,30	0,11	0,56	0,14	0,58	0,51
	(0,29)	(0,72)	(0,04)	(0,63)	(0,03)	(0,06)
			manufacturing firms only			
Simple counts						
Total number of firms in year t (detrended)	0,72	0,12	-0,58	0,02	-0,62	-0,65
	(0,00)	(0,68)	(0,03)	(0,94)	(0,02)	(0,01)
Number of firm entry in year t (detrended)	0,69	0,82	-0,01	0,50	0,08	-0,68
	(0,01)	(0,00)	(0,98)	(0,07)	(0,80)	(0,01)
Number of firm exit in year t (detrended)	0,40	0,86	0,50	0,57	0,42	-0,29
	(0,15)	(0,00)	(0,07)	(0,03)	(0,14)	(0,32)
Non-detrended rates						
Firm entry rate in year t	0,60	0,75	0,17	0,31	0,08	-0,53
	(0,02)	(0,00)	(0,56)	(0,27)	(0,78)	(0,05)
Firm exit rate in year t	0,29	0,62	0,46	0,22	0,28	-0,12
	(0,32)	(0,02)	(0,10)	(0,44)	(0,32)	(0,68)

Note: The table reports standard Pearson correlations. P-values are in parentheses. Firm entry and exit is counted as the number of entrants or exits from January to December in a given year. GDP is taken from the latest version of the national accounts published by Statistics Denmark. Firm counts and GDP levels are detrended using a HP filter with a smoothing parameter of 6.25.

6 Conclusion

Understanding firm dynamics is crucial for our understanding of the aggregate economy. Indeed, since many models treat aggregate productivity as an exogenous variable driving firms' decisions about entry and exit, it seems at least possible that aggregate variables like output and employment are at least to a certain extent the outcome of firms' decisions (including the entry/exit decision), rather than the cause. Any economic policy which could affect these decisions, or at least be more informed about the conditions of these decisions (for example credit availability for firms), could be more effective in stabilizing the traditional policy targets like output or unemployment.

At the same time, it is unlikely that secular trends, such as changing demographics or shifts in the sectoral composition would not affect firm behaviour. The level of firm entry rate which would be a sign of bad economic conditions two decades ago might actually be a good sign today. For these reasons, learning more about firm dynamics is crucial.

In this project, we want to contribute to the literature on firm dynamics by introducing a new data set which can be used to test different theories about firm dynamics. This data set is constructed using registry micro level data and covers the universe of Danish firms between 2001 and 2016.

We use the data set to compare the stylized facts about entry, exit and firm dynamics in general. The basic stylized facts derived from the US data are similar. Younger firms grow faster and are likely to exit before they mature. Also, we find that the correlations of entry and exit with the business cycle are comparable in the Danish data to the ones reported by Tian (2018) for the US data.

However, there are also interesting differences and we are also able to use a unique firm entry date to extract information about more older firms than what is usually available. First, we find that younger firms in Denmark need longer time to mature compared to the evidence provided by Alon et al. (2018). Focusing on the older firms, our findings suggest that at least for some significant fraction of firms, the productivity and exit probability begin to deteriorate after the age of 30. Explaining why this is the case is beyond the scope of this paper. However, one plausible hypothesis is that the founders decide to retire and that the new directors are not as good at running the firm.

The differences in the long-run trends in the entry rate highlight one of the benefits of having access to similar data for different countries. Karahan et al. (2018) argue that the decline in the entry rate in the US can be caused by falling population growth. While it is true that the entry rate is not declining in the Danish data, it is also the case that the population trend in Denmark is different. Indeed, population growth has accelerated since the 2000's rather than slowed down, and hence the finding in this paper are at least qualitatively consistent with the findings of Karahan et al. (2018).

We also build a statistical reduced-form model with rich age heterogeneity. We use this model to demonstrate that the fluctuations in entry caused by recessions can have very persistent and non-trivial effects on the level of aggregate economic activity. Given the persistence of the effect, it is likely to be washed away with detrending techniques standard in aggregate time series analysis.

References

Abildgren, K., Buchholst, B. V., Qureshi, A., and Staghoj, J. (3rd quarter, 2011). Realokonomiske konsekvenser af finanskriser. *Quarterly Monetary Review, Danmarks Nationalbank*.

Alon, T., Berger, D., Dent, R., and Pugsley, B. (2018). Older and slower: The startup deficit's lasting effects on aggregate productivity growth. *Journal of Monetary Economics*, 93:68 – 85. Carnegie-Rochester-NYU Conference on Public Policy held at the Stern School of Business at New York University.

Clymo, A. (2018). Firm dynamics at the zero lower bound. working paper.

Decker, R. A., Haltiwanger, J., Jarmin, R. S., and Miranda, J. (2017). Declining dynamism, allocative efficiency, and the productivity slowdown. *American Economic Review*, 107(5):322–26.

Geroski, P. A. (1995). What do we know about entry? *International Journal of Industrial Organization*, 13(4):421–440.

Jarmin, R. S. and Miranda, J. (2002). *The Longitudinal Business Database*. Center for Economic Studies, U.S. Census Bureau.

Jensen, T. L., Leth-Petersen, S., and Nanda, R. (2014). Home Equity Finance and Entrepreneurial Performance - Evidence from a Mortgage Reform. Harvard Business School Working Papers 15-020, Harvard Business School.

Karahan, F., Pugsley, B., and Sahin, A. (2018). Demographic origins of the startup deficit. Technical report, wp.

Lee, Y. and Mukoyama, T. (2015). Entry and exit of manufacturing plants over the business cycle. *European Economic Review*, 77(C):20–27.

Moreira, S. (2017). Firm Dynamics, Persistent Effects of Entry Conditions, and Business Cycles. Working Papers 17-29, Center for Economic Studies, U.S. Census Bureau.

Produktivitetskommissionen (2013). Konkurrence, internationalisering og regulering. *Analyserapport*.

Pugsley, B. and Sahin, A. (2014). Grown-up business cycles. Staff Reports 707, Federal Reserve Bank of New York.

Ravn, M. and Uhlig, H. (2002). On adjusting the hodrick-prescott filter for the frequency of observations. *The Review of Economics and Statistics*, 84(2):371–375.

Sedláček, P. and Sterk, V. (2017). The growth potential of startups over the business cycle. *American Economic Review*, 107(10):3182–3210.

Tian, C. (2018). Firm-level entry and exit dynamics over the business cycles. *European Economic Review*, 102(C):298–326.

A Data structure and cleaning

We combine firm-level data for the universe of Danish firms from firm accounts (FIRE), general firm statistics (FIRM) and newly available data on firm failures (EXIT) for the period 2001-2016.[10] The data on firm failures consists of two sample periods which we combine: 2001-2008 (EXIT1) and 2009-2015 (EXIT2). These datasets comprise the microdata underlying the official statistics on firm failures published by Statistics Denmark. To our knowledge, these microdata have not been used by anyone before. However, since we want to look at firm exit in a broader sense than only firm failure, we augment the exit dates from EXIT with firm end dates from FIRM. In our final sample, 6.3 percent of observations have exit information from EXIT. Firm exit can occur for a number of reasons, see 'firm boundary considerations' below.

Statistics Denmark normally operates a threshold for identifying firms as active, i.e. having a certain amount of economic activity, and only active firms are included in their FIRM database[11]. However, we have also gained access to all inactive firms from 2001 onwards. Our FIRM dataset is therefore a superset of the usual FIRM datasets. The addition of inactive firms allows us to track more firms across the entire sample period even if firms cross the threshold, thus avoiding gaps in the firm histories.

Cleaning of data We begin with 9,738,585 firm-year observations. From there, we do the following changes to the data:

EXIT1: drop firm-duplicates: 329 firm-year observations dropped.

EXIT2: drop firm-duplicates: 20 firm-year observations dropped.

By dropping these duplicates, we are disregarding the possibility that a given firm id (cvrnr) of a closed-down firm can be re-used if the individual owning the firm restarts the firm or starts a new company under his own name. The number is quite small, however.

EXIT1/EXIT2: drop firms not matched with FIRM-dataset: 160 firm-year observations dropped. Gaps: to keep the data as clean as possible, we drop all observations of firms which have gaps in their histories. Roughly 5 percent of the sample (411,536 firm-year observations) are dropped. Firms with no exit information: Some firms disappear from our sample before the end of the sample period without any information on exit dates from either data source. We choose to drop these 59,749 observations.

Use of data sources when data is missing As default we use FIRM/FIRE data when available but add data from EXIT1 or EXIT2 when data is missing to get as complete a picture as possible. For example, information about firm ownership status is found in FIRM but missing in some instances. In 37,860 cases, we are able to mend this missing data gap with ownership data from EXIT2.

[10] EXIT data for 2016 is not yet available, but we can still identify firm exit in a broader sense for 2016 using data from FIRM as explained in the below.

[11] A firm is considered active in the general firm statistics if it meets either of two requirements: 1) At least 0.5 employees on average over the year ('årsværk'). 2) A turnover corresponding to this amount of activity within the industry of the firm.

There are 78 cases of missing start dates for firms in the FIRM dataset. None of these firms have missing start dates in all years. Therefore, we choose to use the start date from one of the other years to replace the missing start dates.

Inconsistent start dates between FIRM and EXIT Both the FIRM and EXIT datasets have firm start dates included. Most firms from EXIT are naturally included in FIRM, since FIRM is much bigger, and we generally use FIRM start dates. However, 2,822 firm-year observations are included in both dataset but do not have consistent values. We delete these observations since we cannot know which date is correct.

We are left with 9,056,285 firm-year observations with the number of unique firms in each of the years from 2001-2016 and the split between active and inactive firms shown in the table 4. This table also lists the official number of active firms as recorded by Statistics Denmark in each year which appears reasonably close to the number of active firms in our final sample.

Table 4: Number of firms in the data

	Our cleaned dataset			Statistics Denmark
Year	Total	Inactive	Active	Active
2001	465,175	212,827	252,348	284,166
2002	468,891	219,213	249,678	281,653
2003	470,919	227,330	243,589	275,712
2004	477,713	228,994	248,719	282,968
2005	497,317	240,647	256,670	293,885
2006	524,543	266,067	258,476	298,214
2007	554,391	291,196	263,195	305,319
2008	574,837	310,257	264,580	307,433
2009	575,840	319,759	256,081	296,072
2010	585,516	326,631	258,885	298,081
2011	593,303	330,353	262,950	300,733
2012	605,245	340,041	265,204	301,483
2013	623,060	359,178	263,882	298,581
2014	647,091	380,663	266,428	299,763
2015	678,166	412,376	265,790	297,238
2016	714,278	437,230	277,048	308,157
Total	9,056,285	4,902,762	4,153,523	4,729,458

Industry classifications For the analysis in section 3, we split firms into five sectors using the standard Danish industry codes (DB07) in the following way:

- Sector 1 (1,049,976 observations): agriculture, forestry and fishing (codes 1000-5999)

- Sector 2 (450,747 observations): manufacturing, raw materials and utilities (codes 6000-39999)
- Sector 3 (597,858 observations): construction (codes 40000-44999)
- Sector 4 (1,618,808 observations): trade and transportation (codes 45000-57999)
- Sector 5 (3,330,737 observations): information and communication (codes 58000-63999), finance and insurance (codes 64000-67999), business services (69000-83999), and culture, leisure and other services (codes 90000-99990)

Firm boundary considerations Changes in firm boundaries and firm structures may affect entry and exit as defined in our dataset. Below we highlight some of the issues.

Business groups ('koncerner'): each member of a business group has its own firm id (cvrnr). A decision by the mother company to open or close a daughter company and move the activities from or to another daughter company for administrative reasons not related to economic conditions may thus show up as the daughter firm entering or exiting the economy. This may somewhat bias upwards the recorded amount of entry in our data. With respect to exit, most such closures will be recorded as 'dissolved' and therefore not count as a bankruptcy as such in our data (although the firm will disappear from our dataset when dissolved).

Branches: branches of a firm brand (e.g. a grocery store or a bank department) do not have their own firm id (cvrnr) and thus openings/closures of branches do not affect either entry or exit.

Franchises: franchises may have their own firm id, and so openings/closures of franchises will affect entry and exit. Curiously, the McDonald's franchises in Denmark were all bought by one individual recently and so went from being counted as several firms to only one firm (and so openings/closures of McDonald's restaurants within this new firm will count as changes in firm branches and so not affect entry and exit).

Sales/mergers of firms: if firm A buys firm B, the resulting firm may choose continue with the firm id (cvrnr) of either firm A or B, while the other firm will be dissolved (but not bankrupt). There will thus be no entry and no failure recorded in our EXIT dataset in this case (although one of the firms will disappear from the dataset). If firm A buys firm B and merge into a new firm C, then the result will be 1 new firm entering the economy. Since firm A and B will be dissolved, there will be no failure recorded (although both firms will disappear from our dataset).

New firm types since 2014 Since 2014, legislation changes allowed two new types of firms:

- *Personligt ejet mindre virksomhed* (PMV) ("Small personally owned firm"): Introduced in 2014 to allow small enterprises with less regulatory burden in the case of employment which is not full time. Some 'enkeltmandsvirksomheder' (sole proprietors, also included in our dataset (code '10')) may have switched company status

because of this. It is difficult to assess the economic importance of these firms. Our dataset does not contain PMVs.

- *Ivaerksaetterselskaber* (IVS) ("Startup companies"): Introduced in 2014 to enable startup of small firms without the need to provide 50.000 DKK capital (as for ApS companies). The group may also contain firms that were previously started as ApS and thus are 'real' firms. There are 2,650 IVS firms (code '81') in our dataset in 2015. However, we only have this variable for a subset of about 200,000 firms (about 25 percent of firms).

B Robustness

For robustness, we present here additional results comparing our baseline results to two additional subsamples of our data:

- "Rest 1 th2" excludes the full firm history if more than 50 percent of the observations of that firm are recorded as a mix of either sole proprietorship, imputed accounting data, accounting data derived from the tax authorities (SKAT), or inactive firm.
- "Rest 3 full" excludes the full firm history if in any year an observation of that firm is recorded as a mix of either sole proprietorship, imputed accounting data, or inactive firm.

Note that for employment, we always restrict the dataset and exclude sole proprietor firms and similar.

Table 5: exit rate

	(1) all firms	(2) rest 1 th2	(3) rest 3 full
1-10 slope	-0.0050^{***}	-0.0012^{***}	-0.0017^{***}
11-20 slope	-0.0004^{*}	-0.0004	-0.0010^{***}
21-30 slope	0.0002	0.0002	0.0001
36-40 slope	0.0018^{***}	0.0016^{***}	0.0023^{***}
Observations	3677	3477	3387

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Median employment

	(1) rest 1 full	(2) rest 1 th2	(3) rest 3 full
1-10 slope	0.19	0.10	0.23^{**}
11-20 slope	0.37^{*}	0.20^{***}	0.20^{*}
21-30 slope	-0.07	-0.04	0.03
36-40 slope	-0.23	0.01	-0.01
Observations	2127	3106	3092

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Median productivity

	(1) all firms	(2) rest 1 th2	(3) rest 3 full
1-10 slope	10.47***	6.22***	3.45***
11-20 slope	0.47	−1.23	2.85***
21-30 slope	−1.37	−0.70	−0.78
36-40 slope	−3.33**	−3.29	0.80
Observations	3192	2339	2140

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Median Value added

	(1) all firms	(2) rest 1 th2	(3) rest 3 full
1-10 slope	31.88***	1418.73***	562.38***
11-20 slope	7.10	205.86	498.08***
21-30 slope	−2.04	35.36	627.67**
36-40 slope	10.93	2696.42***	4946.47***
Observations	3193	2367	2140

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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