Who Creates and Destroys Jobs over the Business Cycle?

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Abstract
We study the cyclical properties of job flows of young versus mature and small versus large firms, as well as their contribution to aggregate employment fluctuations, with a particular emphasis on the Great Recession. For the period of the Great Recession we document that young firms are hit harder than mature firms. In contrast to previous studies we find that size differences among firms do not play a major role in explaining heterogeneity in job flows in the Great Recession.
The general business cycle behavior for the period 1982-2013 are confirming the findings for the Great Recession.
The overall contribution of young firms to employment fluctuations, however, is limited. The larger employment weight of mature firms – mature firms employ around 80 percent of the labor force – more than compensates for their smaller cyclicality.

1 Introduction

Among economists and policymakers the belief of small businesses being the engine of job creation and innovation is widely spread.[1] In 1953 the Small Business Administration (SBA) was founded as an independent agency of the federal government with the goal to "aid, counsel, assist and protect the interests of small business concerns". Discussions about heterogeneous effects on firms are often dominated by the distinction between small and large businesses, neglecting the role of firm age.

We do not challenge the conventional view about small businesses per se,[2] but rather contribute to the discussion on the cyclical sensitivity of small and large firms. In particular, we contribute to this discussion by emphasizing the awareness of firm age as important determinant for cyclical job flows of firms. We ask the general question of who creates and destroys jobs over the business cycle? And in particular who is hit harder during the Great Recession?

This study contributes to two separate, but related questions on the cyclicality of job flows and the contribution of different groups of firms to employment fluctuations. First, we investigate which group of firms in terms of age and size is more sensitive to the cycle. There is a growing scientific interest in determining the cyclicality of large versus small and young versus mature firms. While Moscarini and Postel-Vinay (2012) show that large firms are more sensitive compared to small firms in periods of high and low unemployment, Fort, Haltiwanger, Jarmin, and Miranda (2013) highlight the importance of firm age and argue that firm age is of particular importance when it comes to small firms. Our findings are closer to the latter ones. We find that young firms are more sensitive to the cycle compared to mature firms. Second, we research the contribution to aggregate fluctuations by means of a variance decomposition. Even though young firms are more sensitive to the cycle, their contribution to employment fluctuations is moderate. The reason is that most workers are employed in mature firms. We show that employment shares are crucial in understanding the contribution to employment fluctuations.

By better understanding the cyclical behavior of firms in terms of age and size, policymakers might revise their beliefs and policies. Most policies to support troubled businesses are related to the size of firms, while the economic arguments are rather related to the age of the firms and their growth potential. Furthermore, knowing the actual contributions of different firms to aggregate employment fluctuations helps to evaluate costs and benefits of certain measures to stabilize employment. Very volatile firms might be sensitive to the cycle, but contribute only little to the aggregate fluctuations due to a little weight in the economy. Thus, depending on the goals and costs it might be better to support less sensitive firms as they contribute more to the cyclical fluctuations.

Our main findings are that for the period of the Great Recession there is no heterogeneous behavior of small and large firms. The main source of heterogeneity is the firm age instead. We find that firms younger than 5 years are hit harder than mature firms. However, when measuring the actual contribution to overall employment volatility the findings revert. Because of their small employment share young firms contribute relatively little to overall employment fluctuations.

[1] An important and interesting analysis of small businesses is provided by Hurst and Pugsley (2011). They argue that the conventional view on small businesses in economic models has important caveats. In particular, many small business owners are neither interested in growing large nor innovating, but rather provide an existing service to an existing market.

[2] In particular, we cannot add to the discussion on the general behavior of small businesses as we focus on the business cycle only.

Instead, mature firms contribute the lion's share.
Results for the period from 1982 to 2013 confirm our findings for the Great Recession and show that young firms are more sensitive than mature firms. Moreover, we document that the job creation and destruction due to actual entry and exit of establishments is relatively less important compared to the expansion and contraction of existing establishments.
The paper is structured as follows. The following section discusses the data as well as relevant measures and the empirical strategy for the analysis. The third section discusses results for the cyclical behavior of different groups of firms and their contribution to aggregate fluctuations with a particular emphasis on the Great Recession. The fourth section briefly discusses existing policies, while the last section concludes.

2 Data, Measures, and Empirical Strategy

The main dataset that is used in this study is the Business Dynamics Statistics (BDS) database. The BDS is often used to analyze cyclical labor flows despite being on an annual frequency. Because it covers a long period, starting from the late 1970's, it allows to analyze several business cycles.[3] We classify firms according to size and age. We define size as follows: Small firms are those with employees of less than 50, medium size firms are those with employees between 50 and 1000, and large firms those with more than 1000 employees. As shown in table 1, our classification is in line with the size classification applied by Moscarini and Postel-Vinay (2012). Fort et al. (2013), in contrast, define the small firms more restrictive by applying lower size cut-offs.[4] The age definition is as follows: Young firms are those of age 0 to 5 years, mature firms are older than 6 years.

Table 1: Overview of AGE and SIZE Classification in the Literature

Study	Age	Size	Treatment of Cyclical Job Flows
Moscarini and Postel-Vinay (2012)	No Age	Small: 0-49 Medium: 50-999 Large: 1000+	HP-Filter
Fort et al. (2013)	Young: 0-4 Mature: 5+	Small: 0-19 Medium: 20-499 Large: 500+	Pure Rates
Pugsley and Şahin (2015)	Young: 0-10 Mature: 11+	Small: 1-19 Medium: 20-499 Large: 500+	Linear Trend

The table gives a brief overview of age and size definitions of other studies in the literature. Furthermore, it reports the treatment that was applied when analyzing cyclical job flows.

Throughout the analysis we use three groups – $GROUPS = \{SIZE, AGE, AGE/SIZE\}$ –

[3]Some studies relate also to the Business Employment Dynamics (BED) database provided by the US Bureau of Labor Statistics. It comes on a quarterly frequency, but is not suitable for our purposes as it does not report the age of firms and covers a shorter period, starting from 1992.

[4]Appendix 15 reports results with these alternative size cut-offs of Fort et al. (2013).

to investigate the role of size and age. The individual groups are composed of the following set of firms:

- $SIZE = \{SMALL, MEDIUM, LARGE\}$
- $AGE = \{YOUNG, MATURE\}$
- $AGE/SIZE = AGE \times SIZE$[5]

2.1 Business Dynamics Statistics (BDS)

The administrative BDS dataset is provided by the US Census and covers approximately 98 percent of the nonfarm private-sector employment in the United States.[6] It is based on the Longitudinal Business Database (LBD) and contains information on establishment-level job flows and employment stocks for continuing as well as entering and exiting establishments at an annual frequency for the period 1976 to 2013.[7] The data can be broken down by location and industry of the establishment, as well as by age and size of the parent firm. A firm is thereby simply defined as a collection of all its establishments. The age of a firm is defined by the age of its oldest establishment. Firm size is measured as the sum of all employees in its establishments.

Two notions of firm size are reported in the BDS: On the one hand, size is measured by *initial firm size*, which captures the size of firms at the beginning of a period, i.e. $t - 1$, before job flows take place. It is our preferred measure as it is not subject to the *reclassification bias*.[8] On the other hand, size is reported as the *average firm size* between year $t - 1$ and year t.[9]

Employment for each establishment is measured by the number of employees reported at March 12 for each year. Therefore, the job flows for a given year t are measured between the employment stock of year $t - 1$ year t.

Establishment age is computed by taking the difference between the current year of operation and the birth year and readily available in the BDS. Given that the LBD series starts in March 1976 observed age is by construction left censored. Given our age threshold we can only start in 1982, which allows us to distinguish between firms of age 5 and those that are 6 years and older. Thus, our sample period is restricted to the years 1982 to 2013.

In principle, the BDS allows to use all information broken down by initial firm size as well as age. The only exception are the new born firms, which are reported according to their end of period size. We follow Moscarini and Postel-Vinay (2012) and re-classify new firms according to their

[5] The group of $YOUNG/LARGE$ is dropped from the analysis as will be discussed in section 2.2.

[6] An extensive description is available on the website of the Census at http://www.census.gov/ces/dataproducts/bds.

[7] The BDS tabulations can change over time, because new longitudinal information on the underlying LBD is becoming available. The 2013 version of the dataset is improving in the accuracy, because it ends with a Economic Census year in which the quality of the underlying microdata is higher.

[8] The *reclassification bias* is also known as the *size distribution fallacy* and stems from the fact that the job flows are not correctly attributed to the right firms. As soon as firms are changing between size groups outcomes differ depending on whether flows are attributed to the size groups at the beginning of the period or to the groups defined by the current size. Davis, Haltiwanger, and Schuh (1996, p. 62ff.) provide a further discussion including numerical examples of this issue.

[9] To investigate the potential *regression bias* (Davis et al., 1996, p. 66ff.), one could use both size measures for comparison. The regression bias emerges when a given firm is constantly oscillating between two size groups and therefore systematically biasing the smaller group upward and the larger group downward. Moscarini and Postel-Vinay (2012) have shown that this bias is not strongly pronounced for the BDS at the cyclical frequency.

beginning of period size, i.e. 0 employees. This consistency in defining all firms with their initial period size comes with the drawback that by definition all new firms are considered small.

Firms can change their employment stock either on the extensive margin by opening and closing establishments or on the intensive margin by expanding and contracting the labor force in already existing establishments. Gross job gains include the sum of all jobs added between year $t-1$ and year t at either opening or expanding establishments. Gross job losses include the sum of all jobs lost during a given year in either closing or contracting establishments. The net change in employment or net job creation is the difference between gross job gains and gross job losses. Thus, if a firm expands one establishment and contracts another one, it will contribute to both, gross job gains and gross job losses, while the net job creation will represent the actual number of jobs created or destroyed by the firm.[10]

The BDS exploits information on ownership of multiple establishments owned by the same firm, thus allowing for two notions of entry and exit. On the one hand, one can think of establishment entry and exit, and on the other hand of firm entry and exit. Entering and exiting firms necessarily operate on the extensive margin by opening and closing establishments and the jobs they create and destroy are therefore by definition a subset of all jobs created and destroyed by establishment entry and exit.

2.2 Job Flow Measures

There is no dominant measure for cyclical job flows in the literature. Both measures, job flows as levels and as rates are commonly used. For our purposes, however, and in particular the cyclical analysis we are interested in the behavior of employment growth rates of different firms, without taking into account their overall employment share in the economy. Thus, for us, the appropriate measure is given by the job flow rates as defined below. This measure also allows for comparisons with recent studies of Moscarini and Postel-Vinay (2012) and Fort et al. (2013).

The net job creation rate ($NJCR$) for $s \in SIZE$ – and similar for AGE and $AGE/SIZE$ – is defined as the difference between the job creation rate (JCR_t^s) and the job destruction rate (JDR_t^s), i.e. simply the difference between all establishments with net job gains and those with net job losses in a given group of firms s:

$$NJCR_t^s = \underbrace{\frac{\sum_{e \in S^+} \left(E_{e,t}^s - E_{e,t-1}^s\right)}{\frac{1}{2}\left(E_t^s + E_{t-1}^s\right)}}_{JCR_t^s} - \underbrace{\frac{\sum_{e \in S^-} \left(E_{e,t-1}^s - E_{e,t}^s\right)}{\frac{1}{2}\left(E_t^s + E_{t-1}^s\right)}}_{JDR_t^s}, \tag{1}$$

where E_t^s represents the employment at time t within an establishment that belongs to group s.[11] Depending on whether an establishment is increasing or decreasing its workforce it is counted as job creator (belonging to set S^+) or job destroyer (belonging to set S^-).

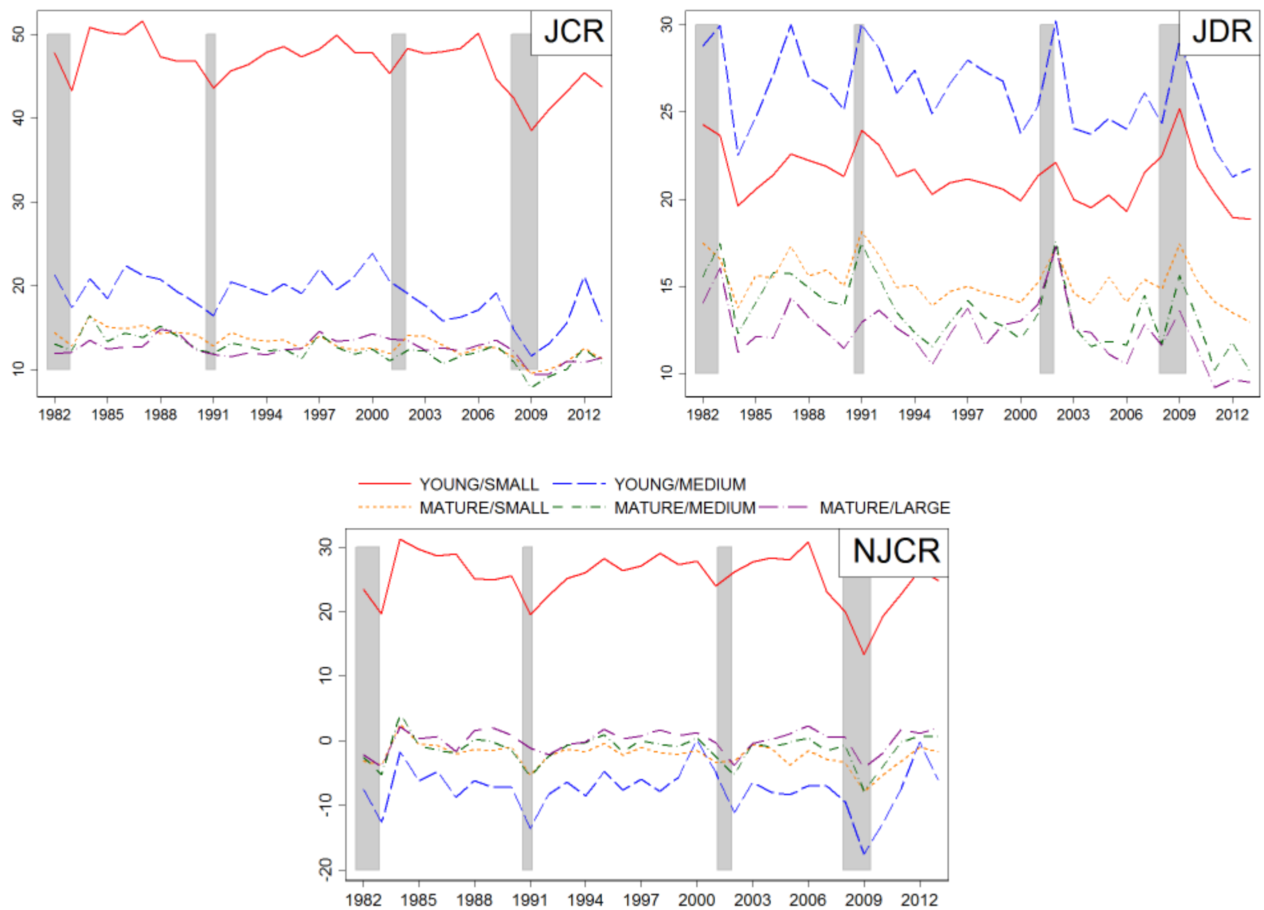
Thus, for each of the six $AGE/SIZE$ categories of firms – and of course for any of the more aggregated $SIZE$ or AGE categories – we generate series of job flow rates. The disaggregated $AGE/SIZE$ series are quite stable over time and vary mainly over the cycle as shown in figure

[10] This example underlines that there is no netting out of job flows within a firm. Since we use establishment-level data a firm can contribute to both, job creation and job destruction at the same time.

[11] By dividing through the average employment in group s, this measure provides a symmetric growth rate for each period t. In principle, it is well-defined for entrants and exiters as well, because the denominator will be always positive.

1. The only exception is the group of $YOUNG/LARGE$ firms, which we drop from the sample. Their rates are very jumpy, because there are not many firms entering the market with more than 1000 workers. This problem is further aggravated because the BDS does not disclose information in many years, because the data would rely on too few firms. Therefore, we decided to drop all job flow rates and employment of the $YOUNG/LARGE$ category from our analysis. As a consequence, we re-compute all aggregates, neglecting the existence of $YOUNG/LARGE$ firms in the economy.[12]

Figure 1: Job Flows by AGE/SIZE over Time



The graph plots the BDS job flow rates by AGE/SIZE. NBER recessions are plotted in shaded gray areas. The group of $YOUNG/LARGE$ firms is dropped from the analysis.

Figure 1 shows that the job flow rates for $MATURE$ firms are within a small bandwidth.[13] On average they are negative, meaning that employment is decreasing once firms are growing older. This finding is in line with the findings of Pugsley and Şahin (2015) who show an increase in the employment share of $MATURE$ firms. It indicates that firms grow when they are $YOUNG/SMALL$ and in particular when they enter the market and destroy jobs on average afterwards. When we investigate this issue further by dropping the job flows due to entering firms, we observe that all

[12] This does not bias our results much as they account for only about 1 percent of overall job flows and employment.

[13] This finding is not dependent on the size cut-offs. Figure 29 in appendix 15 reveals the same patterns for the size cut-offs of Fort et al. (2013).

net job creation rates are on average negative as shown in 20 in appendix 8. This finding highlights the importance of the entry margin for overall job creation.

Nevertheless, the average job flows of different groups of firms are not at the focus of this study. We are only interested in their cyclical properties. Figure 1 shows that most series are relative stable, but slight trends are visible as well. Therefore, we generally de-trend the data series – unless specified differently. Our preferred method is to linearly de-trend the series.[14] For any job flow rate X_t, denote $\overline{X_t}$ the trend, we define the cyclical component as deviation from the trend, i.e.:

$$\widetilde{X_t} = X_t - \overline{X_t} \tag{2}$$

2.3 Entry and Exit

A particular emphasis is given to the job creation and destruction due to entry and exit as they account for a substantial part of overall job flows.[15] When economists or politicians think of entry and exit they usually have in mind firms that enter or exit the market. We extend this view and add an additional margin as will be clear soon. The BDS reports establishment-level job flows in entering and exiting establishments. But in addition we know whether these establishments belong to continuing firms or to firms that enter and exit the market as well. This helps to further break down job flows.

All jobs created at entering establishments in period t are captured by JCR_t^{NEW}.[16] Part of these job flows are created by brand new firms, $JCR_t^{NEW,FIRMS}$, and the remaining share by existing firms that set up new establishments, $JCR_t^{NEW,ESTABS}$. The analogue holds for job destruction flows. Thus, we label flows associated with actual firm entry and exit with $FIRMS$, while those flows that are related to the creation and destruction of establishments by existing firms are labeled $ESTABS$.[17]

$$JCR_t^{NEW} = JCR_t^{NEW,FIRMS} + JCR_t^{NEW,ESTABS} \tag{3}$$
$$JDR_t^{DEAD} = JDR_t^{DEAD,FIRMS} + JDR_t^{DEAD,ESTABS} \tag{4}$$

The literature usually neglects this distinction between $FIRMS$ and $ESTABS$ and looks at the job flows of all entrants or exiters, i.e. JCR^{NEW} and JDR^{DEAD}.[18] But there are good reasons

[14] Moscarini and Postel-Vinay (2012) in contrast HP-filter the job flow rates with a high smoothing parameter of 390.625, which is related to the work of Shimer. They argue that this filter is necessary to make sure that no cyclicality is visible in the trend. Our results for HP-filtered rates both, on the cyclicality as well as on the variance decomposition, are robust to this higher smoothing parameter.

[15] While having only an average employment share of around 3.1 percent and 2.6 percent, they contribute 37 percent to job creation and 35 percent to job destruction respectively.

[16] Note that for job flows of entrants and exiters, the previous definition of equation (1) is slightly changed. Instead of dividing by the average employment of the specific group of firms, we divide by the average number of employment in the economy. The rates can be seen as weighted where the weight is given by the employment share in the economy. Take for instance JCR_t^{NEW}, which is defined as $\frac{JC_t^{NEW}}{\frac{1}{2}(E_t+E_{t-1})} = \frac{\frac{1}{2}(E_t^{NEW}+E_{t-1}^{NEW})}{\frac{1}{2}(E_t+E_{t-1})} \frac{JC_t^{NEW}}{\frac{1}{2}(E_t^{NEW}+E_{t-1}^{NEW})}$. The latter term is 2 by definition (employment of NEW in period $t-1$ is 0), while the former term yields the employment share of new establishments in the economy.

[17] Note that even though some job flows are labeled with $FIRMS$ they are still reported on the establishment-level.

[18] A notably exception is the work of Pugsley and Şahin (2015). They make a distinction between entrants and focus on what we label $JCR_t^{NEW,FIRMS}$ as they are interested in "true firm startups rather than new locations of an existing firm".

for why these two entry/exit margins are not identical, such as financial constraints that are very different for expanding existing firms or entering firms.

In a further step, we decompose the actual entry of establishments into an entry rate and a average size with respect to the existing establishments in the economy, i.e. a decomposition into an extensive and an intensive margin.[19]. The entry rate, $entry_t$ is simply defined as the number of establishments of the respective group that enter divided by the number of all existing establishments in the economy. Similar, the average size, $size_t$, is given by the average number of employees in a new establishment divided by the average number of employees in establishments in the overall economy. By construction the average size of entrants is therefore given by half their end of period size. The job creation rate of the two types of entrants can be decomposed as:

$$JCR_t^{NEW,FIRMS} = entry_t^{NEW,FIRMS} \frac{size_t^{NEW,FIRMS}}{size_t} \tag{5}$$

$$JCR_t^{NEW,ESTABS} = entry_t^{NEW,ESTABS} \frac{size_t^{NEW,ESTABS}}{size_t} \tag{6}$$

In the same way, we decompose the job destruction rate of exiting firms into an exit rate and an average size. The exit rate is given by the number of establishments that exit over the overall number of establishments in the economy. The average size is determined by the average number of jobs destroyed by exiting establishments divided by the average size of establishments in the economy.[20]

$$JDR_t^{DEAD,FIRMS} = exit_t^{DEAD,FIRMS} \frac{size_t^{DEAD,FIRMS}}{size_t} \tag{7}$$

$$JDR_t^{DEAD,ESTABS} = exit_t^{DEAD,ESTABS} \frac{size_t^{DEAD,ESTABS}}{size_t} \tag{8}$$

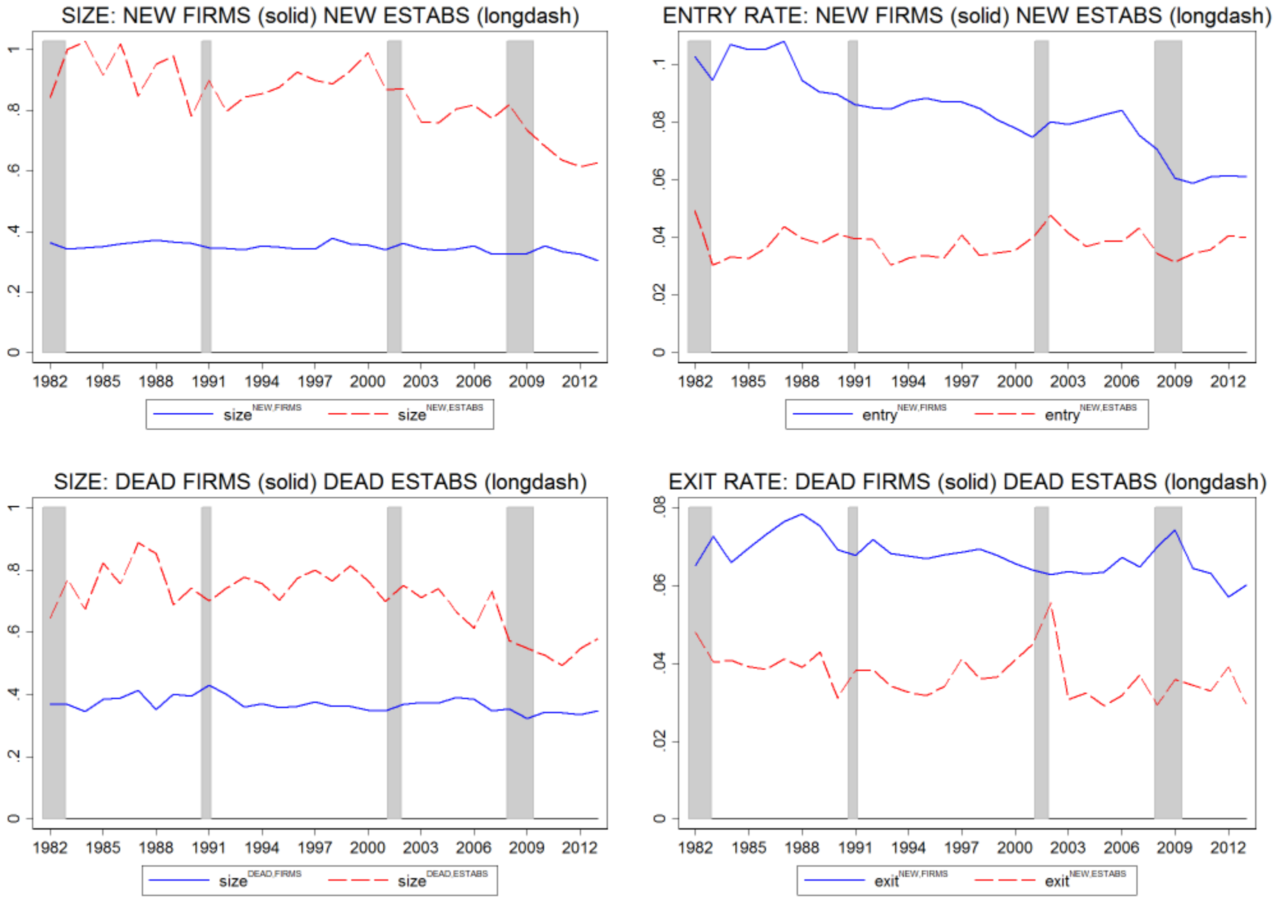
Figure 2 plots the decompositions of job creation and job destruction rates of entering and exiting establishments broken down into the components as defined above.

When we focus on the left plots of the figure we observe that the average size of establishments differ depending on whether they belong to a continuing firm or to a firm that enters or exit the market. On average the size of plants that belong to continuing firms is much closer to the average size in the economy. If we assume that all entering establishments reach roughly the average size at some point this indicates a limited growth potential of $NEW, ESTABS$ compared to $NEW, FIRMS$. Existing firms seem to set up new establishments already with their optimal size. The size difference between the exiting establishments can be related to the up or out dynamic

[19]An alternative decomposition is to decompose the job creation of NEW and $DEAD$ firms at the firm level, similar to Pugsley and Şahin (2015). As we are interested in differences between newly opened establishments by new versus existing firms, the establishment level is the right measure, but a decomposition on the firm level reveals the same pattern as shown in appendix 9. Note further that when computing the contribution to employment growth, Pugsley and Şahin (2015) define a startup growth rate as $g_t^s = \frac{E_t^0 - E_{t-1}^0}{E_{t-1}^0}$ that is very different compared to our cyclical measure, which is $\widetilde{JCR}^{NEW,FIRMS}$. The most important difference is that our measure will reveal percentage point differences from the trend while their measure shows percentage differences from last period.

[20]Again the definition implies that the average size of the exiting establishments is only one half of their employment. However, the employment is measured at the beginning of the period, while employment of entrants was measured at the end of the period. Thus, the only way to get a consistent measure for both job flows is to take into account the average size of establishments in a given period.

Figure 2: Average Size and Entry/Exit Rates



The figure plots the average size and the entry/exit rates of establishments by new/dying firms and continuing firms based on BDS data. The actual definition of the series are defined in equation (5) to (8).

in which many young firms either grow or fail and exit the market. Therefore, part of the difference is due to the firms that did not reach their optimal size yet, but failed in the process.

At the same time, entry and exit rates of establishments belonging to entering or exiting firms are higher. But the time series reveal also some trends. In particular the entry rate for $NEW, FIRMS$ indicate a strong decline in the dynamics of startups as discussed by Pugsley and Şahin (2015). The entry rate roughly halved over the period of observation.

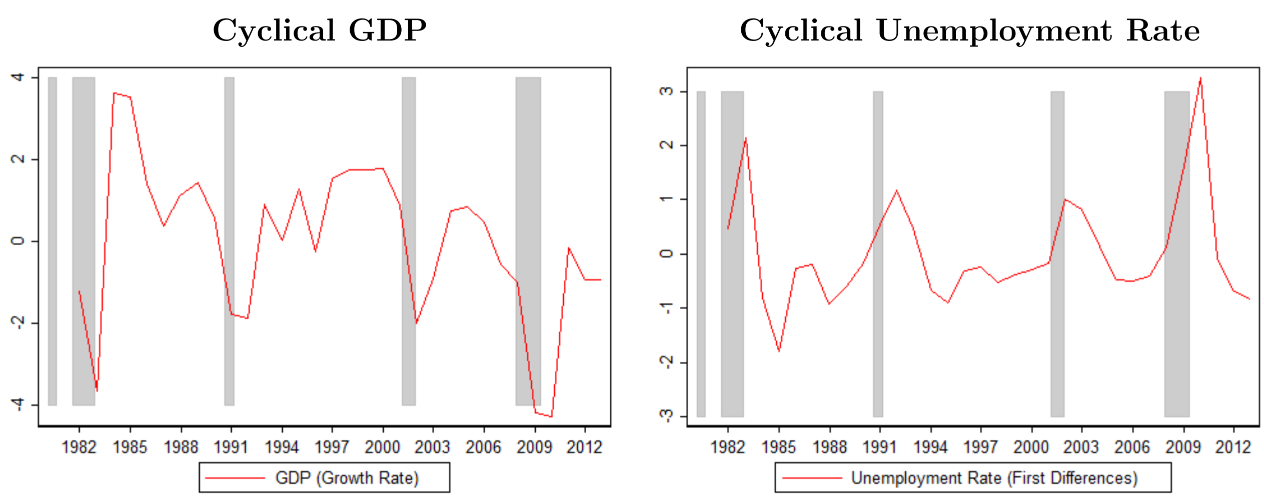
Last, we add the job creation and destruction rates for the continuing establishments to those of the entering and exiting establishments. Those establishments that increase their employment stock are called EXP, while those that decrease their number of employees are called $CONT$. The overall job creation or destruction rate is then given by the following equations:

$$JCR_t = JCR_t^{NEW} + JCR_t^{EXP} \tag{9}$$
$$JDR_t = JDR_t^{DEAD} + JDR_t^{CONT} \tag{10}$$

2.4 Cyclical Indicators

We measure the cyclicality of job flow rates in terms of their correlations with either real GDP or the unemployment rate as cyclical indicators. In general we are interested in the differential behavior of heterogeneous types of firms, either in terms of AGE, or in terms of $SIZE$, or both. Therefore, we correlate the difference of the de-trended job flows with the aggregate cyclical indicator. In doing so, we focus on the contemporaneous correlations and compute the significance of the correlations. An implicit assumption is that the life-cyle dynamics and the business cycle properties of our groups of firms are virtually unchanged over the time period as shown by Pugsley and Şahin (2015). Instead, only compositional changes occurred in which more mature and large firms increased their overall share in employment. These long terms trends are captured by the trend.
For output we use the seasonally adjusted GDP in chained 2005 prices from FRED (series code: GDPC96).[21] Data is reported on a quarterly level. To get a comparable time horizon, GDP in period t is defined as the annual value between the second quarter in $t-1$ and the first quarter in t (remember that the BDS uses the 12th of March as reporting date). The actual numbers are arithmetic means of the four respective quarters (The US reports GDP as yearly values so one does not have to add up four quarters). Cyclical GDP is represented by growth rates as shown in figure 3.
Following Moscarini and Postel-Vinay (2012), the unemployment rate in time t is defined over the period March $t-1$ to February in period t. Again, the data is downloaded from FRED and is averaged over the year (series code: UNRATE).[22] The cyclical unemployment rate is described by the first differenced data series and plotted in figure 3.
Our business cycle indicators reflect periods in which the economy expands or contracts. The growth rate of GDP as well as the changes in the unemployment rate are also related to turning points of NBER recessions as they are defined based on them.

Figure 3: Aggregate Cyclical Indicators



The left graph plots the de-meaned growth rates of real GDP. The right graph shows the first differences of the unemployment rate. Data are downloaded from FRED. Exact sources and computations are written in the accompanying text.

[21] https://research.stlouisfed.org/fred2/series/GDPC96
[22] https://research.stlouisfed.org/fred2/series/UNRATE

When checking for dynamic correlations between the unemployment rate and GDP, we find that the usual lead of GDP with respect to unemployment is not strongly pronounced on an annual frequency. In our sample the contemporaneous correlation is by far larger with a coefficient of -0.88 (compared to -0.54 for the lead of GDP).

2.5 Variance Decomposition

To study the contributions of individual rates to aggregate fluctuations we decompose the variance into contributions of individual components. For most decompositions – such as decompositions into individual AGE, $SIZE$, and $AGE/SIZE$ contributions – one has to deal with employment weights.[23] For example, decomposing the sum $X = (\sum_{i=1}^{n} \omega_i X^i)$ involves the time varying weights ω as well:[24]

$$V(X) = \sum_{i=1}^{n}\sum_{j=1}^{n} Cov(\omega_i X^i, \omega_j X^j) = \sum_{i=1}^{n} Var(\omega_i X^i) + \sum_{i \neq j} Cov(\omega_i X^i, \omega_j X^j) \tag{11}$$

If the shares were constant, one could simply take them out of the terms and compute the contributions of the variables of interest, but in principle weights can fluctuate over the cycle. To overcome this problem, we apply the first order Taylor expansion of X around the trend $\overline{X}$ as:

$$X_t \approx \overline{X_t} + \sum_{i=1}^{n} \left[\overline{\omega_{i,t}}(X_t^i - \overline{X_t^i}) + \overline{X_t^i}(\omega_{i,t} - \overline{\omega_{i,t}}) \right] \tag{12}$$

Rearranging terms leads to

$$\widetilde{X_t} = \sum_{i=1}^{n} \overline{\omega_{i,t}}\widetilde{X_t^i} + \overline{X_t^i}\widetilde{\omega_{i,t}} \tag{13}$$

The overall variance of $\widetilde{X_t}$ is therefore approximated by:

$$V(\widetilde{X_t}) \approx \sum_{i=1}^{n} Cov(\widetilde{X_t}, \overline{\omega_{i,t}}\widetilde{X_t^i}) + Cov(\widetilde{X_t}, \overline{X_t^i}\widetilde{\omega_{i,t}}) \tag{14}$$

$$1 \approx \sum_{i=1}^{n} \underbrace{\frac{Cov(\widetilde{X_t}, \overline{\omega_{i,t}}\widetilde{X_t^i})}{V(\widetilde{X_t})}}_{\beta_{\overline{\omega_{i,t}}\widetilde{X^i},t}} + \underbrace{\frac{Cov(\widetilde{X_t}, \overline{X_t^i}\widetilde{\omega_{i_t}})}{V(\widetilde{X_t})}}_{\beta_{\overline{X_t^i}\widetilde{\omega_{i,t}}}} \tag{15}$$

Our main decomposition exploits the fact that the net job creation rate is composed of the difference of individual job creation and destruction rates, i.e.

$$NJCR = JCR^{NEW} + JCR^{EXP} - JDR^{DEAD} - JDR^{CONT},$$

[23] For example, the net job creation rate is defined as $\frac{NJC_t}{\frac{1}{2}[E_t+E_{t-1}]} = \omega^s \frac{NJC_t^s}{\frac{1}{2}\left[E_t^s+E_{t-1}^s\right]} + \omega^m \frac{NJC_t^m}{\frac{1}{2}\left[E_t^m+E_{t-1}^m\right]} + \omega^l \frac{NJC_t^l}{\frac{1}{2}\left[E_t^l+E_{t-1}^l\right]}$, where the employment share ω^x is defined as $\frac{\frac{1}{2}\left[E_t^x+E_{t-1}^x\right]}{\frac{1}{2}[E_t+E_{t-1}]}$.

[24] For decompositions in which the weights do not play a role, we can just think of $\omega = 1$ in the following equations.

and all these individual rates can be decomposed further into the contributions of our previously defined $AGE/SIZE$ group. We will neglect the contribution of the weights, i.e. $\beta_{\overline{X_t^i}\widetilde{\omega_{i,t}}}$, throughout the analysis, because their contribution is empirically not meaningful as we show in appendix 13.

$$
\begin{aligned}
1 \;\approx\; \sum_{i\in AGE/SIZE} & \underbrace{\frac{Cov\left(\widetilde{NJCR}, \overline{\omega^i}\widetilde{JCR^{NEW,i}}\right)}{V\left(\widetilde{NJCR}\right)}}_{\beta_{\overline{\omega^i}\widetilde{JCR^{NEW,i}}}} + \underbrace{\frac{Cov\left(\widetilde{NJCR}, \overline{\omega^i}\widetilde{JCR^{EXP,i}}\right)}{V\left(\widetilde{NJCR}\right)}}_{\beta_{\overline{\omega^i}\widetilde{JCR^{EXP,i}}}} \\
& - \underbrace{\frac{Cov\left(\widetilde{NJCR}, \overline{\omega^i}\widetilde{JDR^{DEAD,i}}\right)}{V\left(\widetilde{NJCR}\right)}}_{\beta_{\overline{\omega^i}\widetilde{JDR^{DEAD,i}}}} - \underbrace{\frac{Cov\left(\widetilde{NJCR}, \overline{\omega^i}\widetilde{JDR^{CONT,i}}\right)}{V\left(\widetilde{NJCR}\right)}}_{\beta_{\overline{\omega^i}\widetilde{JDR^{CONT,i}}}}
\end{aligned} \tag{16}
$$

This decomposition will yield 20 (5 categories[25] of firms times four rates) coefficients for the contributions to overall fluctuations in the net job creation rate. Out of these 20 coefficients, we can construct all relevant contributions by aggregating and re-basing.
For example, the group of $YOUNG/SMALL$ contributes through EXP, NEW, $CONT$, and $DEAD$ to the overall net job creation rate. If we want to measure the contribution of $YOUNG/SMALL$ to the net job creation we therefore add the four individual contributions. If instead we are interested in the contribution of $YOUNG/SMALL$ to the job creation rate we have to add the contributions of EXP and NEW, but also re-base the variable. Thus, for the denominator we compute the contribution of all groups to job creation, i.e. summing the ten $AGE/SIZE$ contributions to EXP and NEW. As will be clear from the tables of the variance decomposition later on, we can easily compare the contributions across all $SIZE$ and AGE groups in this way.[26]
We deviate from this strategy only for the decomposition of JCR^{NEW} and JDR^{DEAD} into *size* and *entry/exit* rates of firms and establishments. For those rates we run separate decompositions instead of summing individual components.

3 Results

3.1 Cyclicality in the Great Recession

During the Great Recession many jobs were destroyed and fewer jobs than usual were created, leading to a net loss of jobs. What we want to understand better is what type of firms are particularly hit in terms of the net job creation rate, the job creation rate, and the job destruction rate. Among other frictions, financial constraints might have had heterogeneous effects on firms. The data allows us to distinguish effects of size and age so that we can contribute to the discussion on whether small firms or rather young small firms are hit harder. In addition, we will investigate the job creation and job destruction due to entry and exit as well. Unfortunately, the empirical analysis is limited to few annual observations available for the period of the Great Recession. In a

[25]Keep in mind that we dropped the group of $YOUNG/LARGE$ firms from the analysis. Therefore, we only take into account 5 groups.

[26]Alternatively we could directly decompose the job creation rate into the $YOUNG/SMALL$. By doing this we would get different approximation errors for every decomposition and the contributions would not exactly add up.

first part we focus on plots of differential job flow rates between different groups of firms and their correlation with aggregate measures. In a second part we evaluate the importance of individual types of firms for the aggregate fluctuations in job flows. In each part we focus separately on the role of age and size as well as entry and exit.

3.1.1 The Role of Age and Size

Based on the BDS we plot job flow rates for the period 2005 to 2013 in figure 4. We focus on deviations of the job flow rates from their linear trend, computed over the entire sample period from 1982 to 2013.[27] By doing so we construct a counter-factual series for each job flow rate that takes into account long term trends. Apparently these trends play only a minor role as we have seen already in figure 1 in section 2.2. Therefore, simple de-meaned results are very similar, but in our view still inferior as they are not capturing any longer term trends and are stronger impacted by the job flows during the recession period. The official NBER recession period is graphed by a shaded gray area and lasts from December 2007 to June 2009. The overall figure reveals the patterns for the general job flows in the United States as well as job flows broken down by $SIZE$ and AGE.

Figure 4 indicates that the behavior of the general job flow rates is in line with the behavior of the job flow rates broken down by $SIZE$ and AGE. All series are peaking in 2009 at the trough of the Great Recession. The net job creation rate as well as the job creation rate go down, while the job destruction rate spikes up, indicating a pro-cyclical behavior for the former rates and a counter-cyclical behavior for the latter rate.

When comparing the plots for $SMALL$ and $LARGE$ we observe that $SMALL$ reveal a slightly stronger reaction in their job flows during the Great Recession. The difference, however, seems more pronounced when comparing $YOUNG$ and $MATURE$ firms.

The heterogeneous behavior of firms can be better understood by plotting the differential job flows instead of comparing job flows across graphs. We therefore compute the differentials by taking the difference between the de-trended job flows of the respective groups.[28] Therefore, we direct the attention towards four differentials in figure 5. From the top left to the bottom right we compare

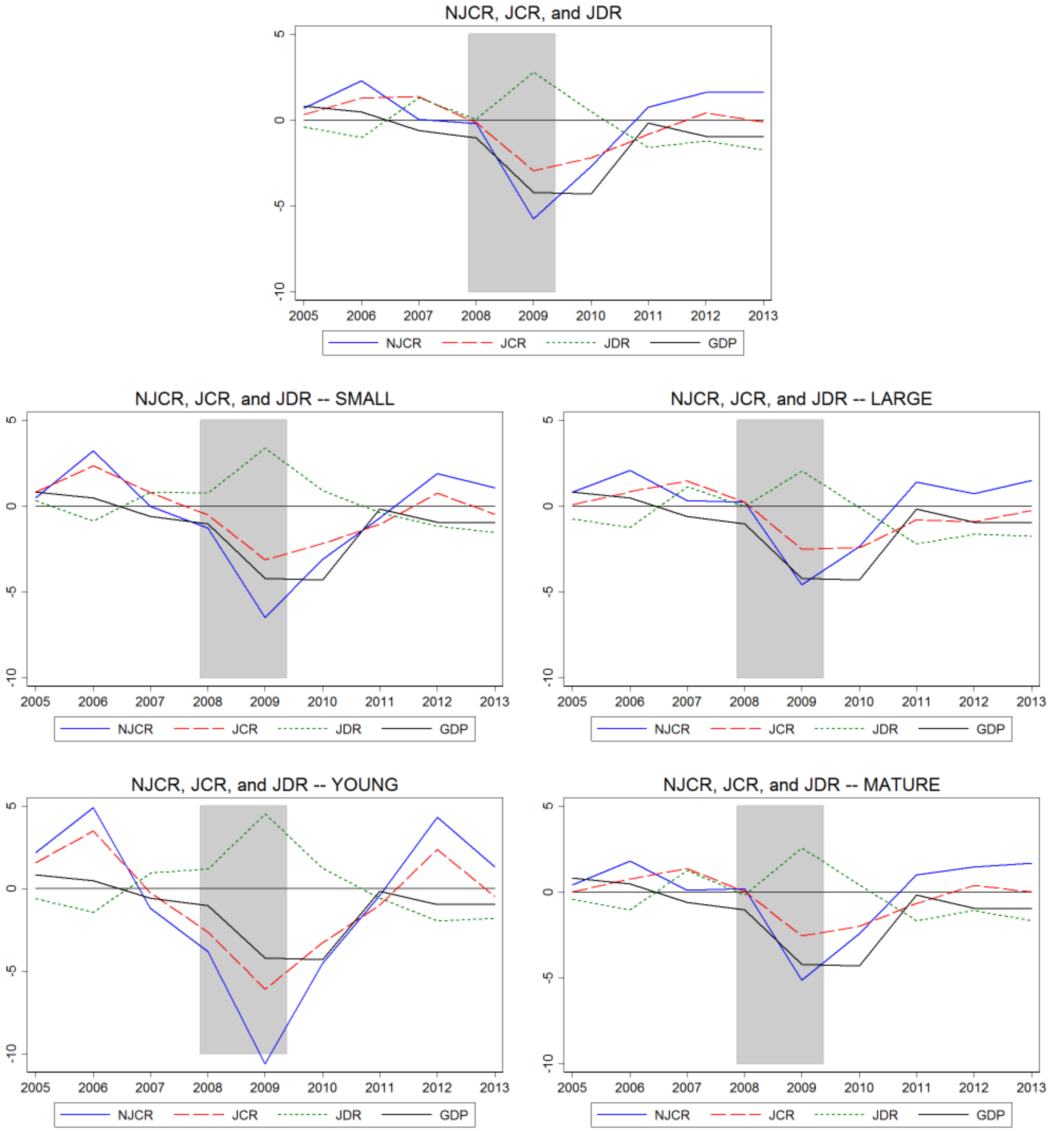
- $SMALL$ and $LARGE$ firms to investigate the role of $SIZE$
- $YOUNG$ and $MATURE$ firms to understand the importance of AGE
- $MATURE/SMALL$ and $MATURE/LARGE$ firms to investigate the role of $SIZE$ conditional on AGE
- $YOUNG/SMALL$ and $MATURE/SMALL$ firms to see the role of AGE conditional on $SIZE$.

From these plots in figure 5 our first set of result for the cyclicality during the Great Recession emerges. $YOUNG$ firms react stronger than $MATURE$ firms in their job flow rates during the

[27] Alternatively one could focus on deviations from an HP-trend. However, we would face the end point problem of the HP-filter, which could become relevant as we only focus on the last nine years of the sample. We will show in appendix 10 that the job flows do not differ between linear de-trended, HP-filtered, and de-meaned data series. The cyclical correlations, however, give different predictions as we will discuss later on.

[28] Note that due to the linearity we could also take the differences of the job flows first and then de-trend with the linear trend. However, this is not true for the HP-filtered differentials for which it is important to first HP-filter before taking the differences.

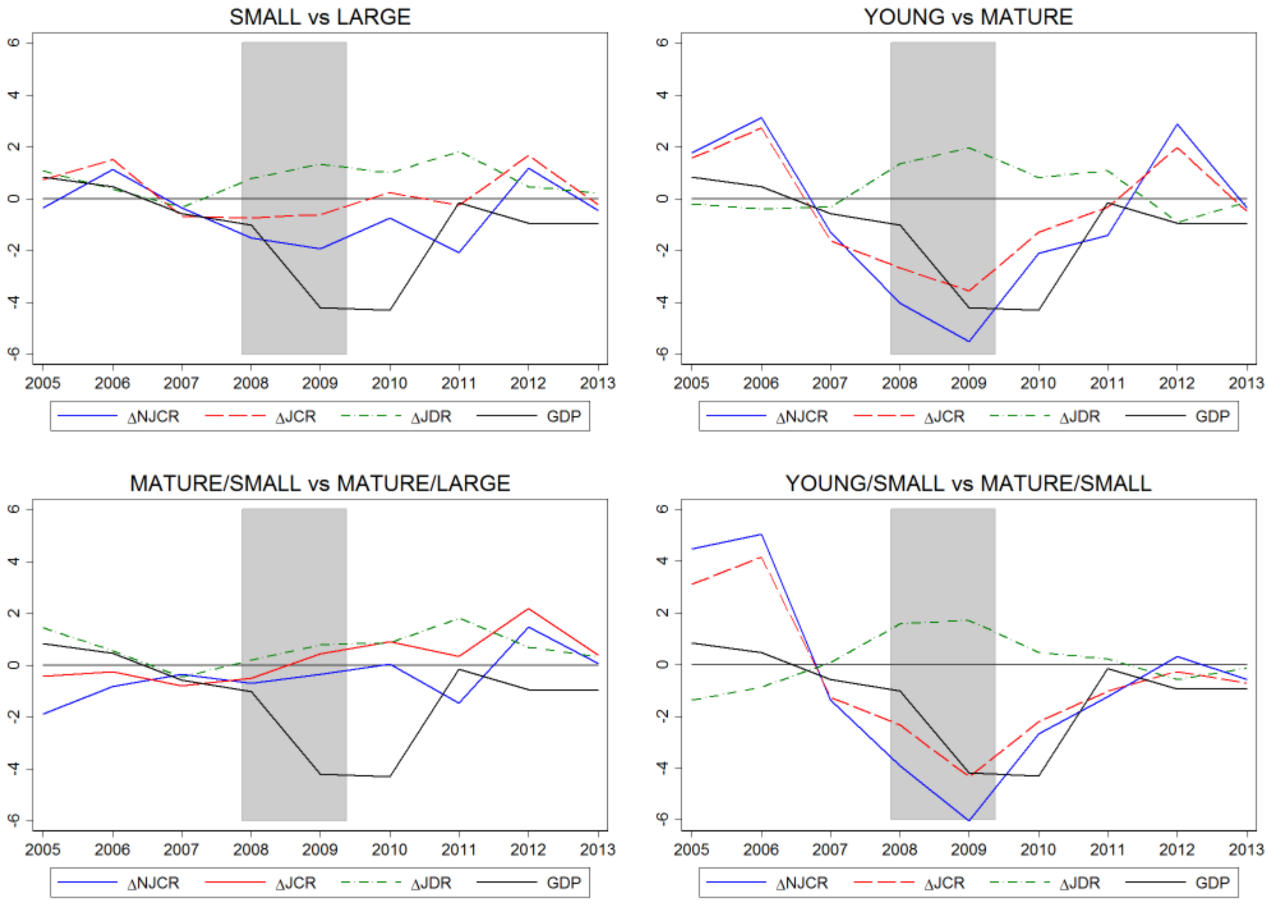
Figure 4: Job Flows during the Great Recession



The graph plots the Job Creation Rate of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. All series are linearly de-trended.

Great Recession. This is true for the JCR, JDR, and the $NJCR$. The result holds also independently of de-meaning or HP-filtering the rates as appendix 10 shows. Quite surprisingly, $SIZE$ itself does not play a role. $SMALL$ firms are slightly more sensitive than $LARGE$ in the top left plot. But the differential reaction is mainly driven by AGE as becomes clear when conditioning on

Figure 5: Differential Job Flows during the Great Recession



The graph plots the Differential Job Flows of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. Differentials are computed by subtracting the respective series. The differentials for JCR, and $NJCR$ can be read in the same way, the one for JDR is consistent when going in the opposite direction. All series are linearly de-trended.

$MATURE$. Among $MATURE$ firms no clear difference emerges between $MATURE/SMALL$ and $MATURE/LARGE$ firms. Thus, the result on $LARGE$ firms being cyclically more sensitive than $SMALL$ firms (Moscarini & Postel-Vinay, 2012) does not hold during the Great Recession.[29] The heterogeneous reaction of $YOUNG$ and $MATURE$ firms is slightly stronger pronounced in the JCR compared to the JDR.

When looking at the contemporaneous correlations of job flow differentials with aggregate GDP and unemployment we get further support for our findings. Table 2 reports the correlation coefficients and their significance level. Even though we base the correlations only on nine observations, many coefficients are statistical significant. The correlations of the $SMALL - LARGE$ differential indicate that $SMALL$ are more sensitive, but with low statistical power. In contrast, the $YOUNG - MATURE$ differential reveals what we have seen in the plots before. $YOUNG$ are reacting more than $MATURE$, indicated by the positive correlation with GDP and the negative

[29] When defining the size cut-off according to Fort et al. (2013) in section 15.1 we verify the results conditional on $MATURE$.

correlation with unemployment. This result can be found for the results of AGE conditional on $SMALL$ firms in the last column. The correlations of $SIZE$ conditional on $MATURE$ are not significant.

Table 2: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.34	0.66*	-0.38	0.78**
		(0.38)	(0.05)	(0.31)	(0.01)
	U	-0.24	-0.51	0.20	-0.54
		(0.54)	(0.16)	(0.60)	(0.13)
JDR	GDP	-0.23	-0.60*	0.10	-0.69**
		(0.55)	(0.09)	(0.79)	(0.04)
	U	0.37	0.60*	0.10	0.52
		(0.33)	(0.09)	(0.80)	(0.15)
$NJCR$	GDP	0.39	0.67*	-0.45	0.77**
		(0.30)	(0.05)	(0.23)	(0.02)
	U	-0.38	-0.56	0.13	-0.55
		(0.31)	(0.11)	(0.74)	(0.13)

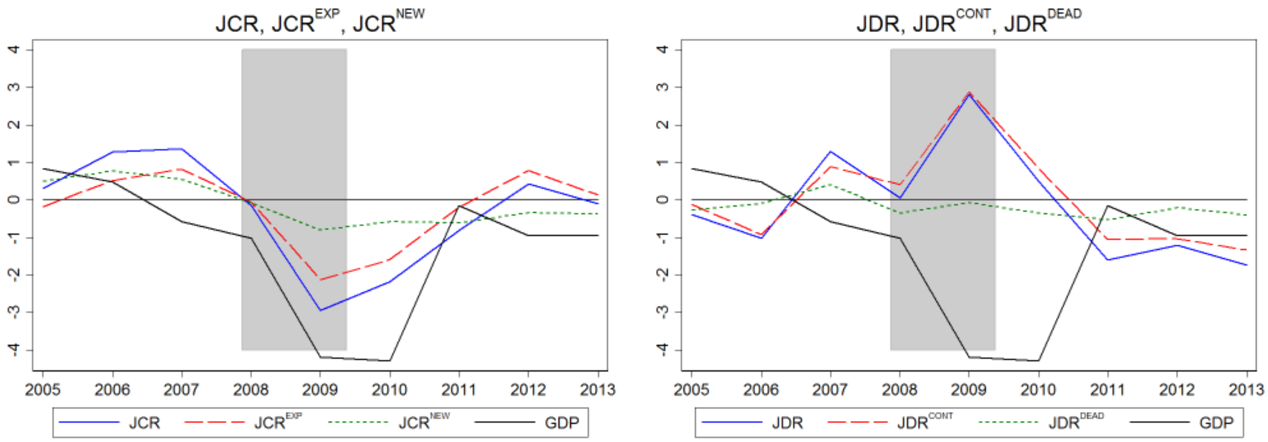
The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

3.1.2 Entry and Exit

In this section we will document evidence on the behavior of job creation and job destruction at the entry and exit margin. When interpreting the rates in this section we should keep in mind that the definition of the rates deviates from the previous definitions of $SIZE$ and AGE groups. The usual definition in which we define the job flow by the average employment of a given category would yield rates of plus and minus 200 for entry and exit. Therefore, the literature defines these rates in terms of aggregate employment of the economy. When interpreting the job flow rates we can think of them as weighted rates where the weight is given by the employment share in the economy.

Before we start analyzing the job flows due to actual entry and exit we will study expanding and contracting establishments. This will help to better understand the importance of the entry and exit margin as these margins are related to the remaining source of job creation and destruction. The left plot of figure 6 shows the time series of the overall job creation rate and the job creation rate related to the expansion of existing establishments and the setup of new establishments. The latter two series add up to the former one by definition. In a similar way, the right graph plots the overall job destruction rate of the economy together with the destruction rate of contracting establishments as well as dead establishments. The figure shows that the lion's share of job creation and job destruction stems from firms that expand and contract existing establishments. New establishments contribute a smaller share to job creation while the exiting establishments almost do not contribute to the job destruction rate. Surprisingly, the job destruction rate of exiting establishments seems very flat over time and does not increase much during the Great Recession. This could be an outcome of policies that were implemented to avoid closure of firms, but also a direct result of lower entry. In normal times the up or out dynamic contributes to the job destruction. With less entry a drop in exit is therefore an immediate consequence.

Figure 6: Job Creation and Job Destruction during the Great Recession



The left plot shows the JCR broken down by JCR^{EXP} and JCR^{NEW}. The right plot shows the JDR broken down by JDR^{CONT} and JDR^{DEAD}. All rates are linearly de-trended.

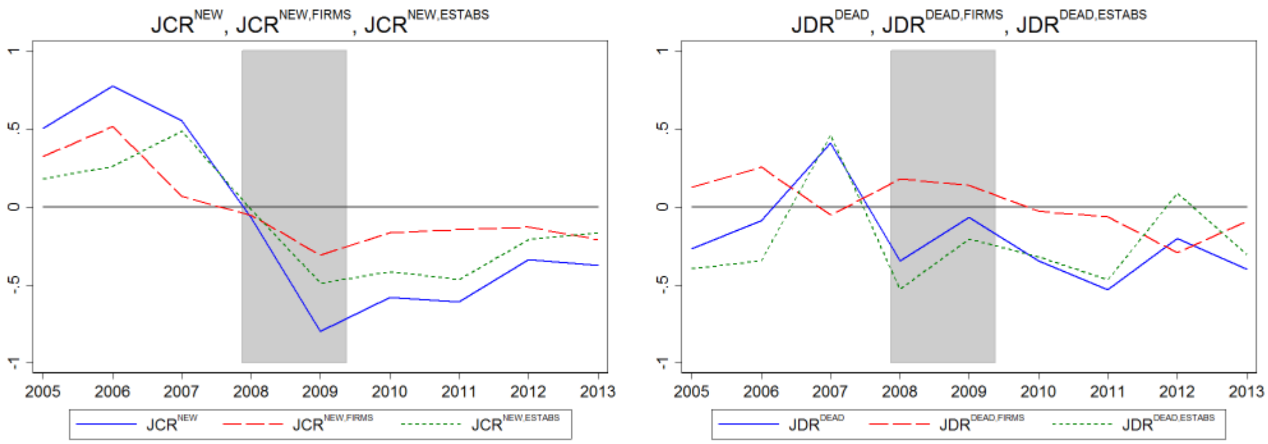
Next, we move on to the job creation and destruction due to actual entry and exit. We compare the job creation in establishments belonging to startups, $JCR^{NEW,FIRMS}$, and the job creation of establishments belonging to already existing firms, $JCR^{NEW,ESTABS}$ in the left plot of figure 7. Often the differences between these types of establishments are neglected in the literature. Either job creation by entry contains both types of establishments or only the first and counting the second type as part of job flows by expanding firms.[30] The plots show that there are differences among both groups. We find that the reaction of the existing firms by setting up new establishments is more pronounced compared to brand new firms.

The right plot indicates that the $JDR^{DEAD,FIRMS}$ went up slightly during the Great Recession while the job destruction of closing establishments of continuing firms is lower than expected during the Great Recession. However, in 2009 the rate goes up. Overall the reaction on the destruction side is much less pronounced compared to the creation side. As mentioned above, the reaction of the destruction margin might be buffered due to the lower entry. If less establishments enter the market less will fail as long as the failure rate is rather constant.

The heterogeneous behavior on the job creation as well as job destruction side can be seen also in terms of the correlations in table 3. The correlations verify that the job creation rate of expanding establishments is more sensitive than the one of new establishments. The same holds true for the job destruction side where the differential between contracting and dead establishments is negatively correlated with GDP and positively with the unemployment rate. However, the differences

[30] An example for the first treatment is given by Clementi and Palazzo (2016), while Pugsley and Şahin (2015) focus only on the entry of new firms.

Figure 7: Job Creation of New and Job Destruction of Dead during the Great Recession



The left plot shows the JCR^{NEW} broken down by $JCR^{NEW,FIRMS}$ and $JCR^{NEW,ESTABS}$. Similarly, the right plot shows the JDR^{DEAD} broken down into $JDR^{DEAD,FIRMS}$ and $JDR^{DEAD,ESTABS}$. All rates are linearly de-trended.

among the new establishments and dead establishments are far from statistical significance. If at all they rather point towards a higher sensitivity of those establishments that belong to continuing firms, i.e. $NEW, ESTABS$ and $DEAD, ESTABS$.

Table 3: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	JCR		JDR	
	$EXP-NEW$	$NEW: FIRMS-ESTABS$	$CONT-DEAD$	$DEAD: FIRMS-ESTABS$
GDP	0.54	-0.21	-0.76**	-0.07
	(0.13)	(0.59)	(0.02)	(0.85)
U	-0.72**	0.38	0.72**	0.17
	(0.03)	(0.31)	(0.03)	(0.67)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

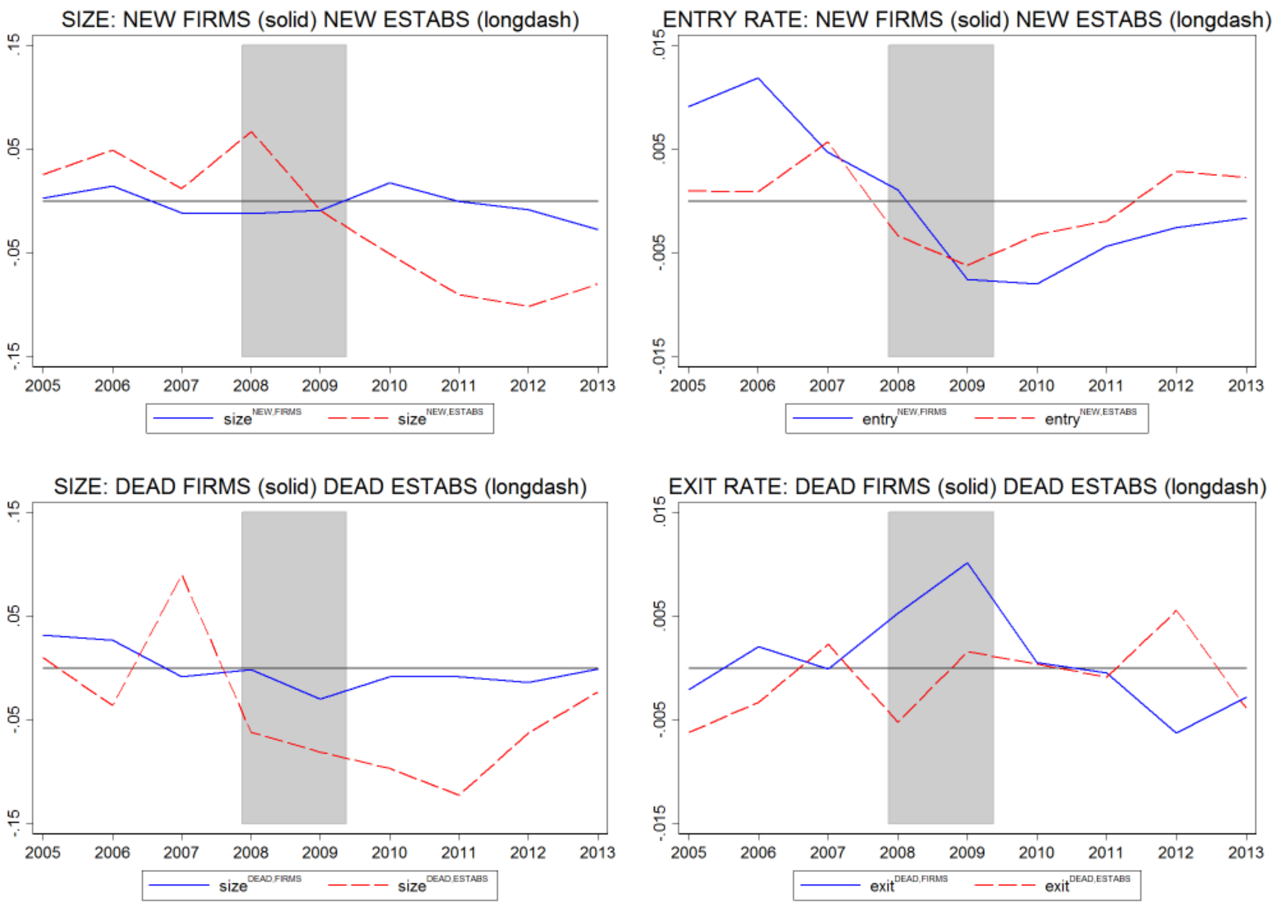
In a last step, we decompose the creation and destruction rates further into the average size and the entry and exit rates as we lined out in section 2.3. By doing this, we investigate the role of average size of entering/exiting establishments as well as their entry and exit rates. The linearly detrended series are shown below in figure 8.[31]

This further decomposition of NEW and $DEAD$ suggest a different behavior, depending on whether their parent company continues or enters/exits the market as well. When we focus on the left plots we observe that the flexibility of establishments that belong to continuing firms is higher

[31] In appendix 9 we show the time series for the entire period 1982-2013 and discuss the differences between decompositions on the establishment compared to the firm level.

in terms of size. Unfortunately, the data does not allow to track whether this is a selection effect or actually related to a re-scaling of operations. In principle, both explanations are in line with the plots. Depending on the aggregate state of the economy, different firms could decide to open up additional establishments, which would lead to a selection of different types of establishments.[32] However, it might well be the case that firms just vary the size of the newly set up establishments, depending on their overall expectations. In a recession they would still open a plant, but of larger scale compared to a boom.

Figure 8: Average Size and Entry/Exit Rates during the Great Recession



The plots split the JCR^{NEW} into the size of $NEW, FIRMS$ / $NEW, ESTABS$ as well as their entry rates. The product of both components corresponds to $JCR^{NEW,FIRMS}$ / $JCR^{NEW,ESTABS}$. The plots split the JDR^{DEAD} into the size of $DEAD, FIRMS/DEAD, ESTABS$ as well as their exit rates. The product of both components corresponds to $JDR^{DEAD,FIRMS}$ / $JDR^{DEAD,ESTABS}$. The series are linearly de-trended.

The result resembles Pugsley and Şahin (2015) who argue that the average size of entrants – even though they compute rates at the firm level – does not vary much over time and therefore focus only on the entry rate of startups. The actual behavior of the entry rates – computed as share of entering plants over the total population of plants – does not differ much between both types of entering establishments. Both rates go down during the Great Recession indicating that

[32]Because we can compare newly set up establishments by existing firms and newly set up establishment by new firms, this bias should be only relevant for the first and not the latter group.

less establishments are created. In contrast, the exit rates differ. While the exit of firms goes up, the closure of establishments that belong to continuing firms does not change much.
As a last check we look at the actual correlations between the entry/exit rates and average size with the aggregate measures. As indicated in table 4 establishments of existing firms react stronger in their size. However, the correlations are not statistically significant. The entry and exit rates reveal the opposite pattern, i.e. a higher sensitivity of establishments belonging to new or dead firms. But unfortunately, also these correlations are statistically not significant.

Table 4: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	$NEW:$ $FIRMS-ESTABS$		$DEAD:$ $FIRMS-ESTABS$	
	$size$	$entry$	$size$	$exit$
GDP	-0.27	0.56	-0.19	-0.11
	(0.48)	(0.11)	(0.63)	(0.78)
U	0.18	-0.31	0.34	0.22
	(0.65)	(0.41)	(0.37)	(0.58)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

3.2 Contribution to Aggregate Fluctuations in the Great Recession

The previous analysis for the cyclicality of different types of firms during the Great Recession can help to understand which firms are hit harder. A potentially more interesting question is how much the different groups of firms contribute to the aggregate employment fluctuations during the Great Recession. The most cyclical firms do not have to be those that contribute most to the aggregate fluctuations in the economy as well. It is a matter of relative and absolute contribution and it turns out that the employment weights are crucial for the contribution to employment fluctuations. This means that the cyclical analysis does not imply which firms contribute most to aggregate fluctuations during the Great Recession. It might well be that $YOUNG$ contribute more than proportional, but the bulk of variance stems from $MATURE$ simply because they represent a much larger fraction of employment in the economy. Thus, in this section the overall importance of the different categories of firms during the Great Recession is evaluated.
The approach we use is close to the actual variance decomposition that we described in section 2.5. But instead of computing the contribution to the variance of the overall job flows, we simply exploit the approximation of overall cyclical changes in the job flow into contributions of rates and weights. Because we show in appendix 13 that the variation of the employment weights do not play a role for the cyclical contributions, we only plot the values for the cyclical rates, weighted by their employment shares. In this sense we could speak of "weighted" contributions as the deviations of the job flows from their linear trend are multiplied by the trend of the employment share, i.e.:

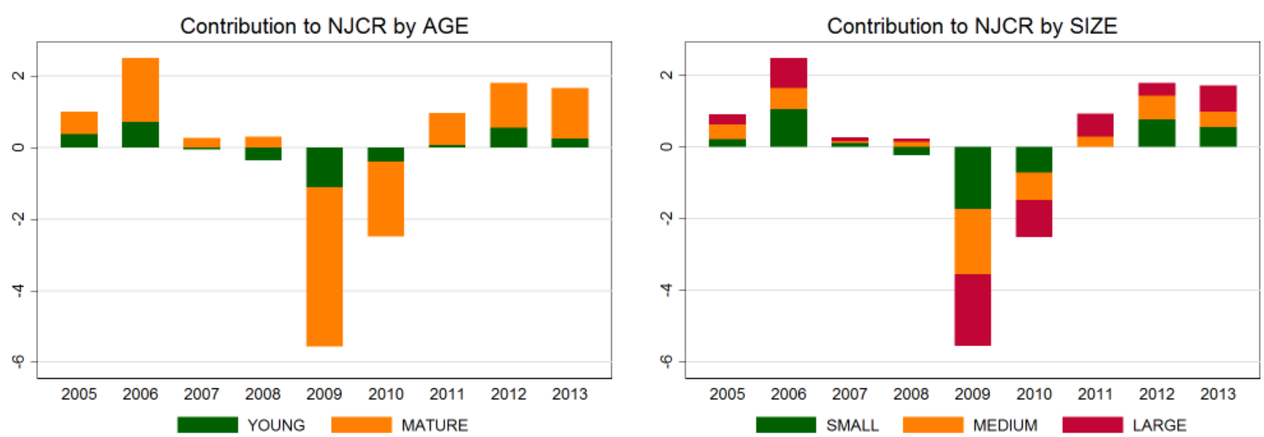
$$\widetilde{X_t} \approx \sum_{i \in GROUPS} \overline{\omega^i}_t \widetilde{X^i_t}, \tag{17}$$

where $X = \{NJCR, JCR, JDR\}$ and $GROUPS = \{SIZE, AGE, AGE/SIZE\}$. When we move to the entry and exit we do not have to additionally weight the rates as they are already weighted. Therefore, those results are in line with the previous findings from the cyclical analysis.

3.2.1 The Role of Age and Size

We will start out by investigating the role of the different groups in terms of AGE and $SIZE$ separately and then discuss the combined $AGE/SIZE$ contributions. Because there are no visible differences across the job flow rates we decided to focus only on the $NJCR$ in this section and refer the interested reader to appendix 11 for the contributions to JCR and JDR.
Figure 9 plots the annual contributions to the net job creation rate of AGE (left) and $SIZE$ groups (right). The left plot reveals that the lion's share of contribution stems from $MATURE$ and not from $YOUNG$ firms. This indicates that the employment weights matter a lot. The results from the cyclical analysis showed that the $NJCR_t^{YOUNG}$ is more responsive than the $NJCR_t^{MATURE}$. Thus by equation (17) we know that the difference in the contributions stems from the employment weights. $YOUNG$ firms account to roughly 11 percent of the employment stock, while $MATURE$ firms employ the remaining workers. This means that even though $YOUNG$ firms show a stronger reaction during the Great Recession, this behavior is buffered, because of their small employment share. In absolute terms their contribution is found to be much less important.[33]

Figure 9: Contribution to $NJCR$ by AGE and $SIZE$ – Great Recession



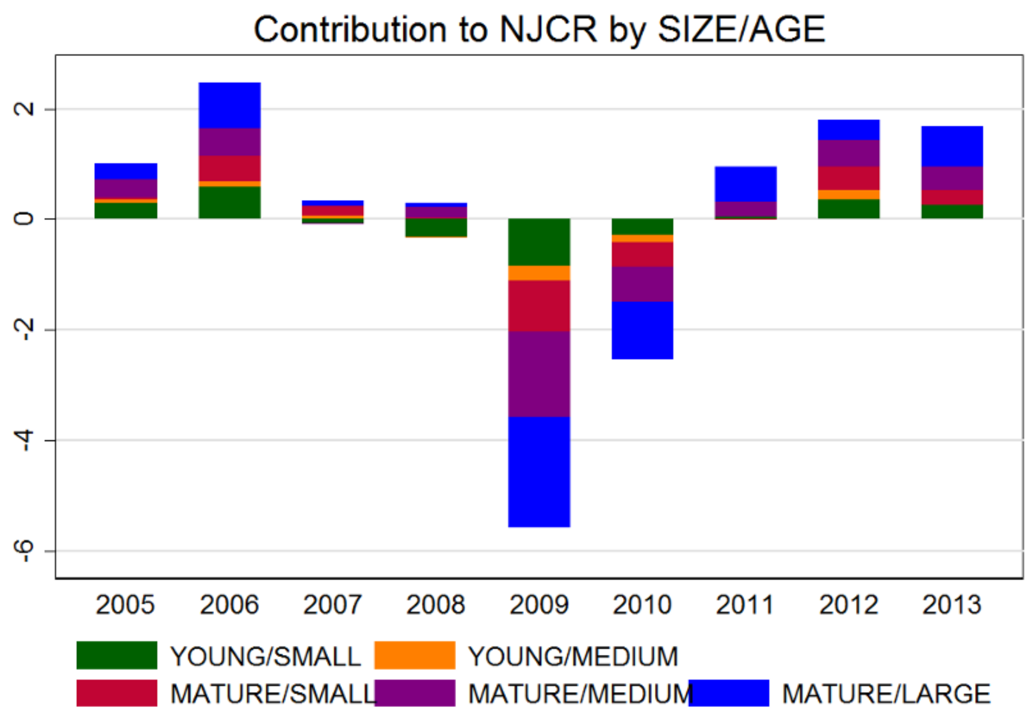
The graph plots the weighted contributions of individual job flow rates to overall $NJCR$. The left plot shows the contributions broken down by AGE, the right plot is broken down by $SIZE$. The procedure follows equation (17).

The right plot of figure 9 in contrast does not show strong heterogeneity for the different $SIZE$ groups. The bar chart shows that $LARGE$ contributed slightly more to aggregate job flows

[33]It is important to keep in mind that the contribution we measure here is only related to the direct and immediate effect. There are additional effects that we do not take into account. For example, less entry and less growth of $YOUNG$ firms has additional effects when they are supposed to grow older. Pugsley and Şahin (2015) show a direct relation between the decline in the startup rate and the gradual shift of employment towards more mature firms. Also Sedlacek and Sterk (2014) focus on the impact of recessions for life cycle patterns of firms and aggregate implications.

compared to $SMALL$.[34] The employment shares of the $SIZE$ groups are quite close with $SMALL$, $MEDIUM$ and $LARGE$ at 29 percent, 27 percent, and 44 percent respectively. Together with the previous findings that there was no strong difference in terms of the cyclical behavior this explains the results.
The last decomposition is along the $AGE/SIZE$ dimension at once. Figure 10 shows that among the $MATURE$ mainly the $LARGE$ and $MEDIUM$ size firms contribute to overall job flows. Among the $YOUNG$ it is mainly the $SMALL$ that contribute.

Figure 10: Contribution to $NJCR$ by $AGE/SIZE$ – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall $NJCR$. The procedure follows equation (17).

This means that relative and absolute contributions are different for the job flows according to AGE and $SIZE$. Taking into account the employment weights overturns the cyclical results.

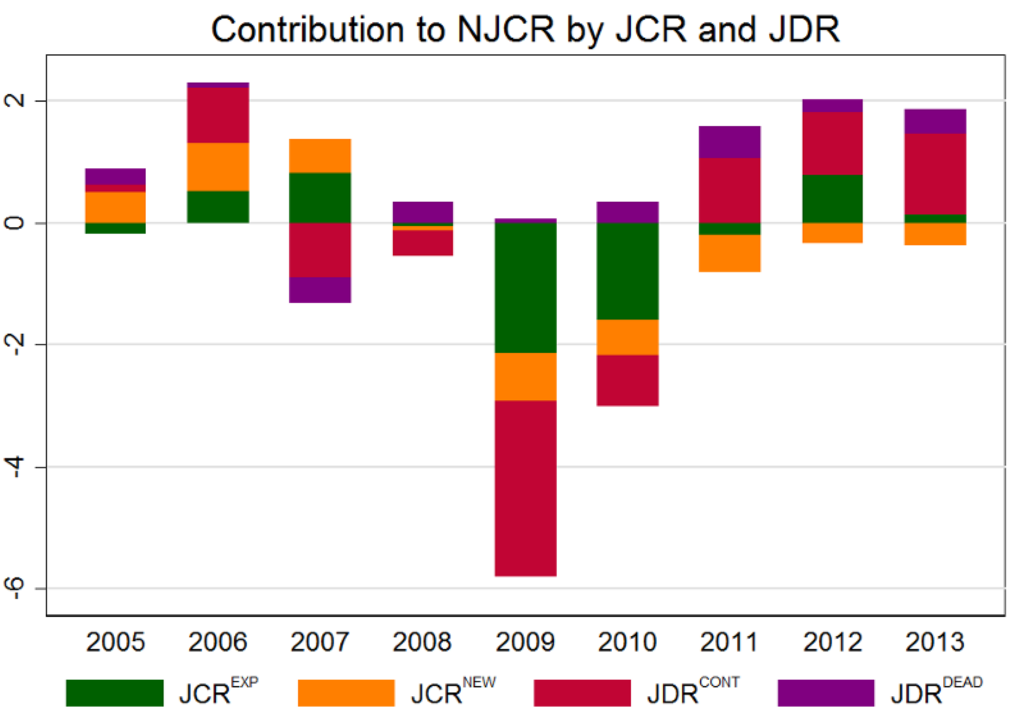
3.2.2 Entry and Exit

The contributions by entry and exit confirm the cyclical results. Since there is no additional weighting applied, this section adds mainly to the understanding of the different contributions over time.
Again, we start by studying also those establishments that expand and contract. As shown by figure 11, the lion's share of aggregate fluctuations comes from JCR^{EXP} and JDR^{CONT}. When

[34]The results of appendix 15.2, which are based on the cut-offs of Fort et al. (2013) shows a larger contribution of $LARGE$ compared to $SMALL$, which is mainly a consequence of the smaller employment share for $SMALL$ due to the different size cut-offs.

it comes to entry and exit, it is mainly the entering establishments that contribute to the net job creation rate. In particular during the Great Recession the job creation of NEW contributed a bigger share, but still not much compared to the contribution of continuing firms. Interestingly, the contribution of JDR^{DEAD} is quite negligible during 2009, meaning that very few jobs were destroyed because of establishments that actually had to leave the market. This could be an effect of supportive policies that were targeting the survival of firms during the Great Recession.

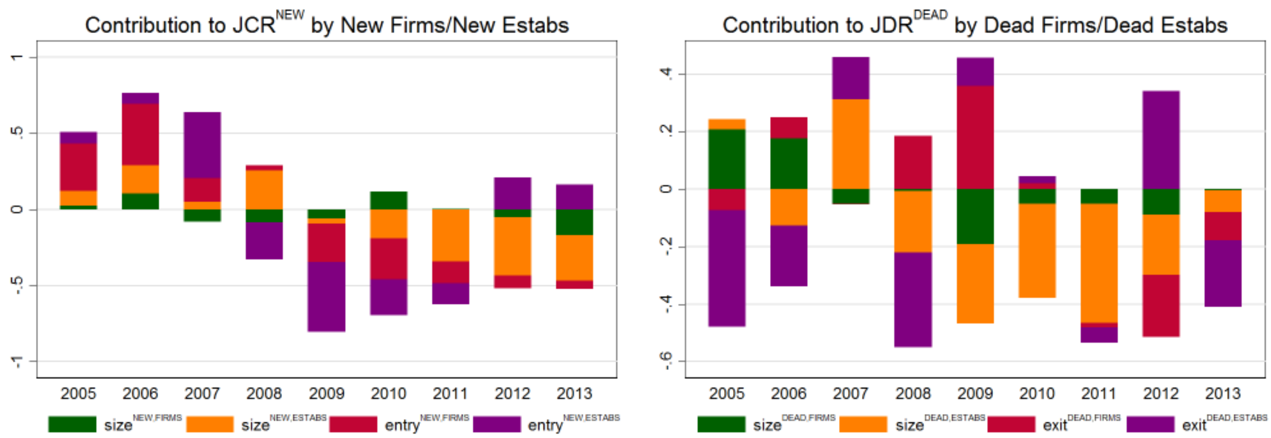
Figure 11: Contribution to NJCR by Entry and Exit – Great Recession



The graph plots the contribution of JCR^{NEW}, JCR^{EXP}, JDR^{DEAD}, and JDR^{CONT} to $NJCR$. The procedure follows equation (17). Rates are linearly de-trended.

Next we look at the actual entry and exit of firms and decompose the JCR^{NEW} and JDR^{DEAD} further into contributions of $size$ and $entry/exit$ rates. We thereby distinguish between the contributions that stem from entering and exiting firms, i.e. $NEW, FIRMS$ and $DEAD, FIRMS$, and continuing firms that set up or close establishments, i.e. $NEW, ESTABS$ and $DEAD, ESTABS$. It can be seen that the role of $size$ of the latter group contributes substantially.
The decline of the JCR^{NEW} is partially due to the lower entry rate of new establishments, particularly in 2009. But we observe an additional phenomenon starting from 2009. The average size of $size^{NEW,ESTABS}$ is declining over the subsequent years, indicating that firms open up smaller plants than before. At the same time this could be an indication that certain frictions make it harder for those firms that want to open up relatively large establishments.
One of the reason why the overall JDR^{DEAD} did not contribute much to the $NJCR$ in 2009 is due to a compositional effect. Although the exit rates of $DEAD, FIRMS$ and $DEAD, ESTABS$ went up, the overall impact was buffered because the average size of exiting plants was smaller than usual.

Figure 12: Contribution to JCR^{NEW} and JDR^{DEAD} Flows – Great Recession



The graphs decompose the entry, JCR^{NEW}, and exit margin, JDR^{DEAD}, into contributions of *size* and *entry*/*exit*. The procedure follows equation (17). Rates are linearly de-trended.

3.3 Cyclicality over the Business Cycle

While the previous part focused only on the period of the Great Recession, we now move towards the full sample period between 1982 and 2013. The longer sample period allows us to take into account also the 1981/82, 1990/91, and 2001 recession periods and verify our previous findings in a more general context. We focus on heterogeneous cyclical reactions of different groups of firms, similar to Moscarini and Postel-Vinay (2012) and Fort et al. (2013). First, we analyze the $SIZE$ and AGE groups and then investigate the entry and exit of establishments.
The longer time series allows us to compute meaningful correlations of differentials with the aggregate measures. We will focus on deviations from a linear trend.[35] So we measure for instance the correlation between the de-trended growth rate of GDP and the differential of the net job creation rate over time:

$$Corr(\log(\widetilde{GDP_t}), \widetilde{NJCR_t^{SMALL}} - \widetilde{NJCR_t^{LARGE}}) \tag{18}$$

Similarly, we will look at differences between various groups on the entry and exit margin.

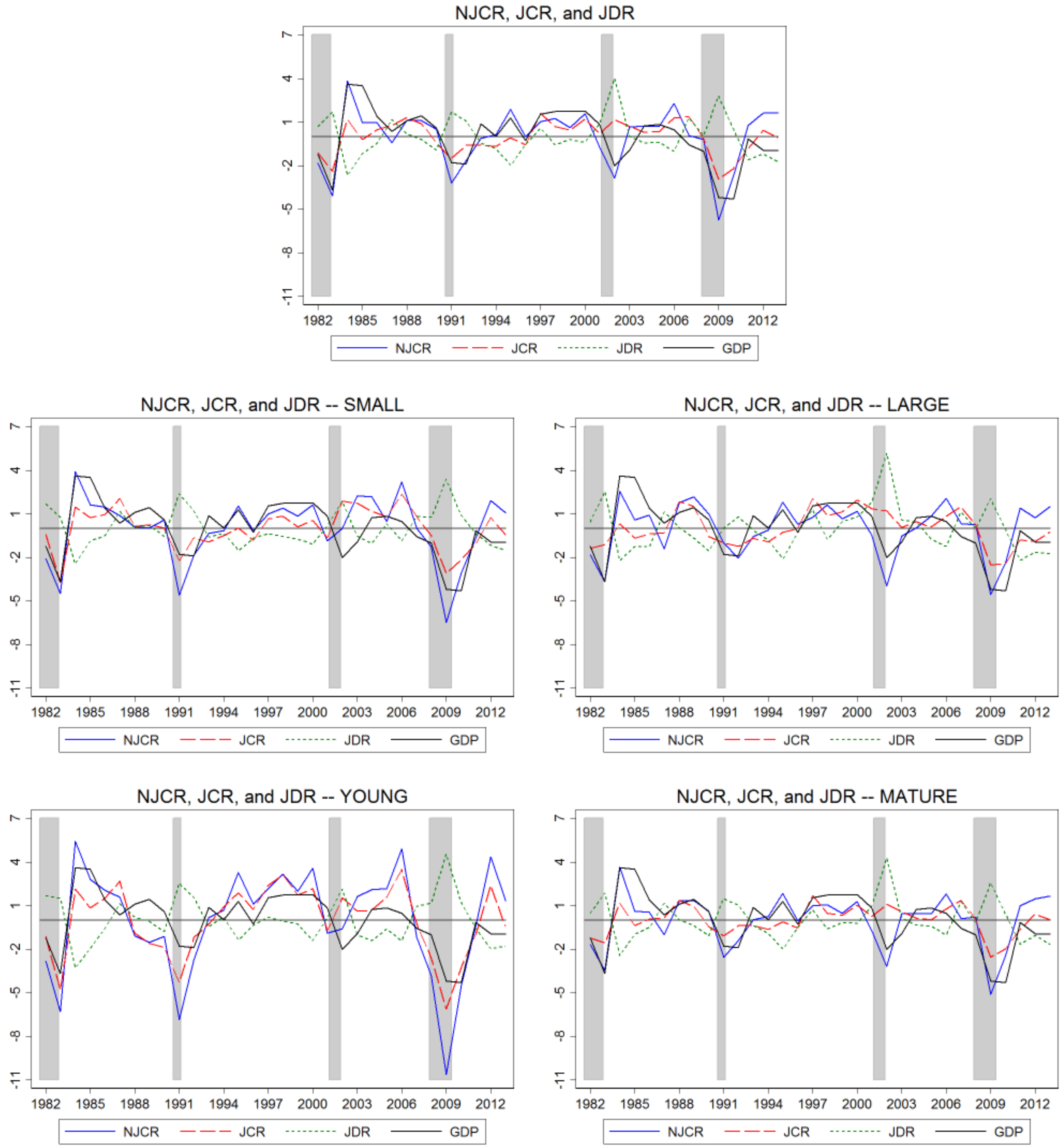
3.3.1 The Role of Age and Size

This section contributes to the discussion on AGE versus $SIZE$ for heterogeneous responses over the cycle. While Moscarini and Postel-Vinay (2012) highlight the heterogeneous response between $SMALL$ and $LARGE$ firms and conclude a higher sensitivity of $LARGE$ firms during periods of high and low unemployment, Fort et al. (2013) put forward the importance of AGE and particularly $YOUNG/SMALL$ firms.

Based on the BDS data we plot the linearly de-trended job flows in figure 13. NBER recessions are plotted in shaded gray areas. Starting from the first plot in which we include the overall $NJCR$, JCR, and JDR, we focus on $SMALL$ and $LARGE$ firms in the middle and $YOUNG$

[35]The main reason of why we de-trend linearly and do not focus simply on the untreated rates is that in some of the more disaggregated series we observe trends over time.

Figure 13: Job Flows over the Business Cycle

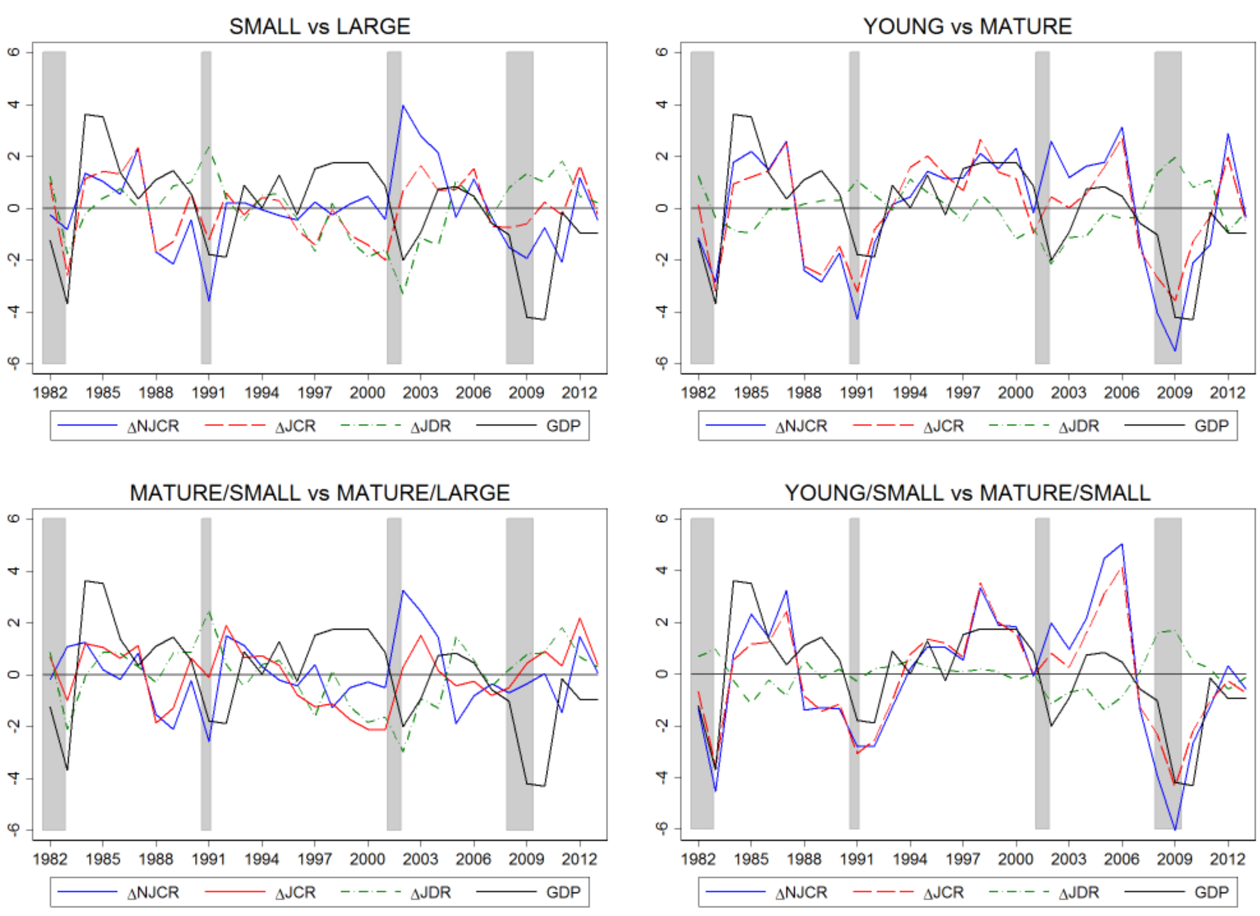


The graph plots the Job Creation Rate of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. All series are linearly de-trended.

and $MATURE$ at the bottom. All plots show a pro-cyclical behavior of the $NJCR$ and the JCR, while JDR behaves counter-cyclical.
The graphs allow to compare the behavior across different recessions, the behavior of different job flows, and the behavior of different types of firms. While the previously mentioned pro-

and counter-cyclicality of the job flows is a general feature that consistently shows up across all recessions, the magnitudes of cyclical deviations vary across time. A feature of the Great Recession is that it is the recession with the biggest negative drop in the $NJCR$ over the entire sample period. This is not generally true for the individual JCR and JDR. Other recessions episodes played a crucial role as well. The 2001 recession is the one with the highest peak of the overall JDR and was particularly harsh for $LARGE$ and $MATURE$ firms. $YOUNG$ and $SMALL$ were actually hit harder on the destruction side during the Great Recession. The drop in the JCR is of similar magnitude as in the 1981/82 recession, especially for the $SMALL$ and $YOUNG$ firms.

Figure 14: Differential Job Flows over the Business Cycle



The graph plots the Differential Job Flows of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. Differentials are computed by subtracting the respective series. The differentials for JCR, and $NJCR$ can be read in the same way, the one for JDR is consistent when going in the opposite direction. All series are linearly de-trended.

To understand the actual differences between $SMALL$ and $LARGE$, and $YOUNG$ and $MATURE$ we plot the differentials in figure 14. Besides plotting the two unconditional differentials in the upper graphs, we include the $SIZE$ differential conditional on $MATURE$ and the AGE differential conditional on $SMALL$ at the bottom.

For each of these differentials we correlate the differential with the business cycle measure. So generally speaking, each graph corresponds to a correlation coefficient for each job flow differential. In addition to the pure correlation coefficient, the graphs might be interesting to analyze specific periods of booms and recessions. But in the end the correlation coefficient is our statistic of interest to measure the cyclicality. Therefore, we abstain from plotting all individual graphs for correlations with the unemployment rate or GDP and set up a table with correlation coefficients instead. In addition to the correlation coefficients, we compute the p-values for the coefficients, which are displayed in parentheses in table 26.

Table 5: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.13	0.54***	-0.24	0.69***
		(0.49)	(0.00)	(0.19)	(0.00)
	U	-0.15	-0.48**	0.17	-0.58***
		(0.42)	(0.01)	(0.35)	(0.00)
JDR	GDP	-0.11	-0.34*	-0.03	-0.42**
		(0.54)	(0.06)	(0.87)	(0.02)
	U	-0.08	0.19	-0.16	0.38**
		(0.66)	(0.30)	(0.39)	(0.03)
$NJCR$	GDP	0.19	0.56***	-0.19	0.64***
		(0.30)	(0.00)	(0.31)	(0.00)
	U	-0.05	-0.45**	0.30*	-0.55***
		(0.79)	(0.01)	(0.09)	(0.00)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

Table 26 reports the correlation coefficients based on linearly de-trended job flow rates. As shown by the first column, we do not find any statistical support for the result of Moscarini and Postel-Vinay (2012), i.e. $LARGE$ being more sensitive than $SMALL$ related to cyclical unemployment.[36] However, when conditioning on $MATURE$ firms, we find their $SIZE$ result. As seen in column 3, the correlation between the differential $NJCR$ and cyclical unemployment is 0.30 (p-value 0.09).[37]

The strongest results, however, are related to AGE. The results in columns 2 and 4 are fully in line with the previous findings for the period of the Great Recession. $YOUNG$ firms are cyclically

[36]The results of Moscarini and Postel-Vinay (2012) were found for the period 1979-2009 on a slightly older version of the BDS and with HP-filtered aggregate measures. Our codes give a correlation coefficient for the $NJCR$ differential and cyclical unemployment of 0.38 (p-value 0.03) for the same period, using the HP filter with parameter 390.625, which is in line with their findings. For an extensive discussion of the relation to the results of Moscarini and Postel-Vinay (2012) see appendix 18.

[37]When we investigated the correlations of the linearly de-trended job flow rates with HP-filtered aggregates only the higher cyclical sensitivity of $MATURE/LARGE$ compared to $MATURE/SMALL$ for the JCR and $NJCR$ is found as well.

more sensitive than $MATURE$, indicated for example by the positive correlation of the $NJCR$ differential with GDP (0.56).

3.3.2 Entry and Exit

This section aims to better understand how sensitive job creation and destruction due to entry and exit is over the cycle. Arguments for policies that try to avoid large fluctuations on the entry and exit margin are often mixing up the disproportionate role that entry and exit play in general and the cyclical role of it.
We start again with a wider view and take into account expanding and contracting establishments as well. Table 6 reports the differential for $EXP - NEW$ and $CONT - DEAD$ establishments. When focusing on deviations from a linear trend, we find a stronger sensitivity of the establishments that expand and contract.

Table 6: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	JCR		JDR	
	EXP $-NEW$	$NEW:$ $FIRMS$ $-ESTABS$	$CONT$ $-DEAD$	$DEAD:$ $FIRMS$ $-ESTABS$
GDP	0.58***	0.15	-0.81***	-0.09
	(0.00)	(0.41)	(0.00)	(0.61)
U	-0.51***	-0.11	0.77***	0.03
	(0.00)	(0.56)	(0.00)	(0.88)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

Next we investigate differences between those new establishments that belong to brand new firms and those that are part of continuing firms. The linear de-trending does not indicate any heterogeneous behavior.
Table 7 goes a step further and decomposes the job creation and job destruction rates of NEW and $DEAD$ establishments into the *size* and *entry/exit* rates. The results indicate that $NEW, ESTABS$ react stronger in terms of establishment size, while $NEW, FIRMS$ show a stronger reaction in the entry rate. On the destruction side we again find a stronger reaction of $DEAD, ESTABS$ in terms of size, but no evidence related to the exit rate.

Table 7: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	$NEW:$ $FIRMS - ESTABS$		$DEAD:$ $FIRMS - ESTABS$	
	size	*entry*	*size*	*exit*
GDP	-0.32*	0.51***	-0.31*	0.03
	(0.07)	(0.00)	(0.08)	(0.88)
U	0.18	-0.41**	0.24	-0.06
	(0.33)	(0.02)	(0.19)	(0.76)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

3.4 Contribution to Aggregate Fluctuations over the Business Cycle

The cyclical sensitivity of different groups of firms that we have documented helps to understand the relative impact that these groups have. The total impact, however, is strongly related to the employment share of the individual groups of firms as we have seen for the Great Recession. Therefore, we decompose the variance of aggregate fluctuations into contributions of groups of firms and relate the results with the findings in the Great Recession.[38]

Pugsley and Şahin (2015) show that the life-cycle dynamics did not change over the period we are investigating. Therefore, changes in the overall employment dynamics are mainly driven by compositional effect that we take into account by de-trending the variables.

We describe the role of AGE and $SIZE$ first and then discuss the contributions that stem from the entry and exit of establishments. The results for the Great Recession period are generally confirmed.

3.4.1 The Role of Age and Size

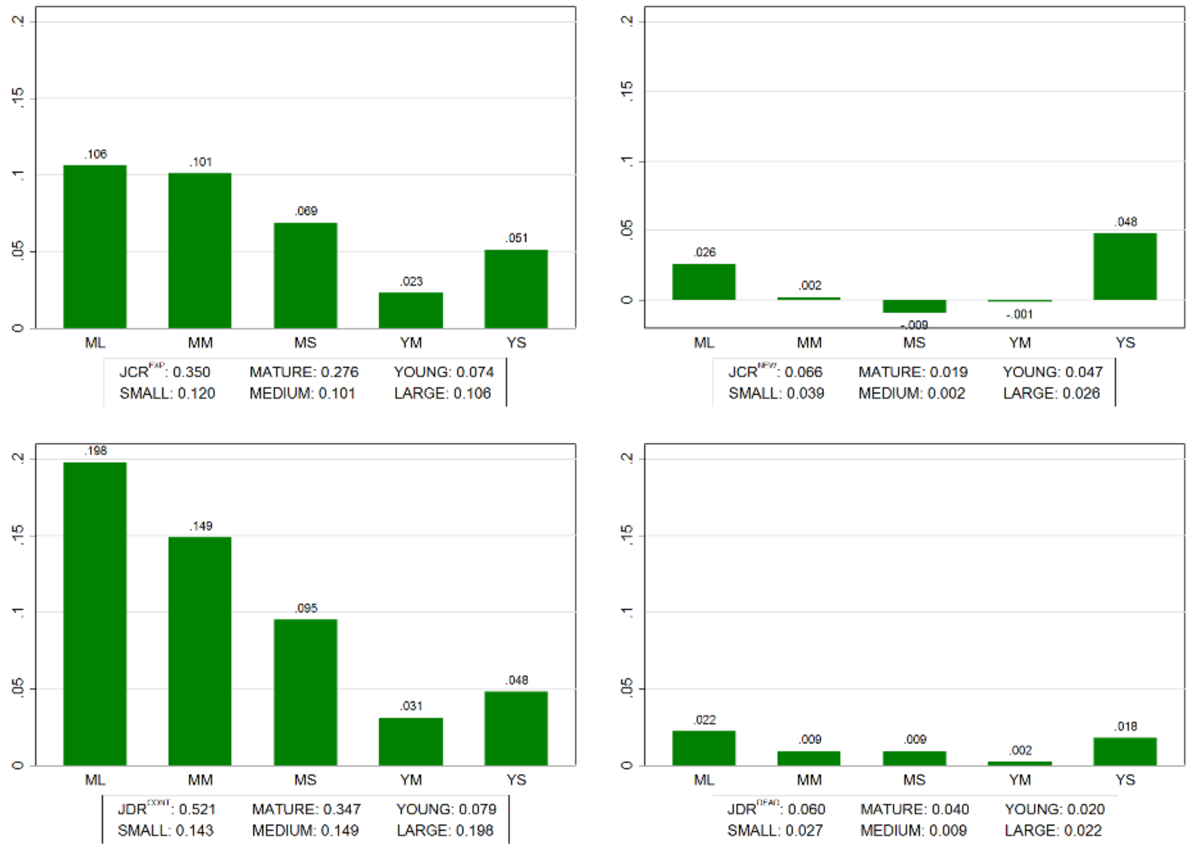
Figure 15 visualizes the contributions of job flow rates of $AGE/SIZE$ groups to overall $NJCR$. As described in section 2.5 we decompose the $NJCR$ into the $AGE/SIZE$ contributions according to JCR^{NEW}, JCR^{EXP}, JDR^{DEAD}, and JDR^{CONT}. Therefore, the 20 contributions from figure 15 add up to unity with some approximation error.[39] The approximation error stems from the fact that we implement a Taylor expansion around the trend. In addition, we neglect the contributions of cyclical employment weights in this analysis. Those contributions are reported in appendix 13, but are negligible.

Figure 15 shows that the two left plots, i.e. the expansion (34.9 %) and contraction (51.9 %) of existing establishments, contribute the lion's share to aggregate job fluctuations. The destruction side is dominating this decomposition with an overall share of 58.3 %. The plot reveals already

[38]In principle, cyclical variations can stem from changes of the job flow rates of a group or by compositional changes due to changes in the employment weights. We neglect the latter contributions of the weights, because weights contribute only a tiny share to aggregate fluctuations as shown in appendix 13. General trends in the employment weights, however, are taken into account as described by our methodology in section 2.5.

[39]Remember that we dropped the $YOUNG/LARGE$ firms from our analysis.

Figure 15: Variance Decomposition according to $AGE/SIZE$ – Weighted Results



The bar charts report the weighted results of the variance decomposition, which is described in section 2.5. The weight consists of the trend of the employment share of the respective group. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are linearly de-trended.

the dominance of $MATURE/LARGE$ firms. Their impact on overall net job flows is enormous. This sets the ground for a more rigorous comparison between AGE and $SIZE$. The nice feature of these very disaggregated contributions in figure 15 is that we can use these numbers to compute any other contribution that might be of interest. Table 27 reports these results for linearly de-trended rates. Before interpreting the results, we briefly explain again how to compute these contributions. Take for instance the contribution of $SMALL$ to $NJCR$, i.e. 0.323. This is simply the sum of all contributions of $YOUNG/SMALL$ and $MATURE/SMALL$ from figure 15 across all four plots. Instead, the contributions of $SMALL$ to JCR is computed by summing the contributions of $YOUNG/SMALL$ and $MATURE/SMALL$ in the upper two plots and dividing them by the overall contribution of JCR.[40]

When we look at the contributions of different $SIZE$ groups, we observe that $LARGE$ matter a bit more for the $NJCR$ due to a stronger importance on the job destruction margin. On the job creation margin, however, $SMALL$ are more important. This relates a bit to the often used argument in the public debate that small firms are the engine of employment growth and need to be supported when cyclical shocks hit. This argument, however, leaves out the AGE of firms.

[40]The sum of the contributions in the upper two plots is given by 0.155, while the total contribution of job creation is given by 0.415. Therefore, $SMALL$ contribute 37.3 % to overall JCR.

Table 8: Variance Decomposition of Job Flows

Decomposed Rate	$SIZE$ S	M	L	AGE Y	M	$AGE/SIZE$ YS	YM	MS	MM	ML
$NJCR$	0.323	0.311	0.367	0.216	0.784	0.162	0.054	0.160	0.257	0.367
JCR	0.373	0.292	0.335	0.284	0.716	0.234	0.051	0.140	0.241	0.335
JDR	0.286	0.324	0.389	0.168	0.832	0.111	0.057	0.175	0.268	0.389

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

Comparing $YOUNG$ and $MATURE$ firms reveals a very clear picture that $MATURE$ contribute around three quarters to the overall cyclical job flows. This is not surprising as $MATURE$ firms employ about 85 percent of the overall workforce. Thus, it is quite natural that they play a crucial role for the overall job flows. Again, we observe differences on the job creation and destruction margin. While $MATURE$ contribute 83.2% to the JDR, they contribute substantially less to JCR with 71.6%.

The last five columns of the table show the contributions of all $AGE/SIZE$ categories. Among $YOUNG$ mainly $YOUNG/SMALL$ contribute to cyclical fluctuations. They contribute a very disproportional share to the cyclicality of overall job flows. In terms of individual groups that contribute most to aggregate fluctuations, we can see that $MATURE/LARGE$ and $MATURE/MEDIUM$ play a crucial role and in sum matter for more than half of the overall cyclical job flows.

An important point, however, that the decomposition illustrates is that policies that might help $SMALL$ and in particular $YOUNG/SMALL$ can obviously have a disproportionate effect on the overall cyclicality of job flows, but are limited at the same time. Overall, any policy tool that supports for instance $YOUNG/SMALL$ is limited to affect a small fraction of overall net job creation, while a policy that targets large mature firms can act on a much larger share of the cyclical $NJCR$. Thus, this exercise helps to better understand the angle that policies are working on and their limitations when it comes to the stabilization of overall employment fluctuations.

In a last step, we compute "unweighted" contributions. This will highlight the relative contribution as it takes into account the employment weights. We divide the "weighted" contributions by average employment shares over the period, reported in table 9.[41]

Figure 16 plots the unweighted contributions of the different $AGE/SIZE$ groups. The plots show the crucial role of $YOUNG/SMALL$ businesses at the entry and exit margin and $YOUNG$ firms in general. The actual numbers do not have a precise meaning, but can be interpreted as relative contributions compared to other categories. The results also relate to the standard deviations for the de-trended rates. Those categories with a higher relative contribution to aggregate volatility feature higher standard deviations for their de-trended rates as well.

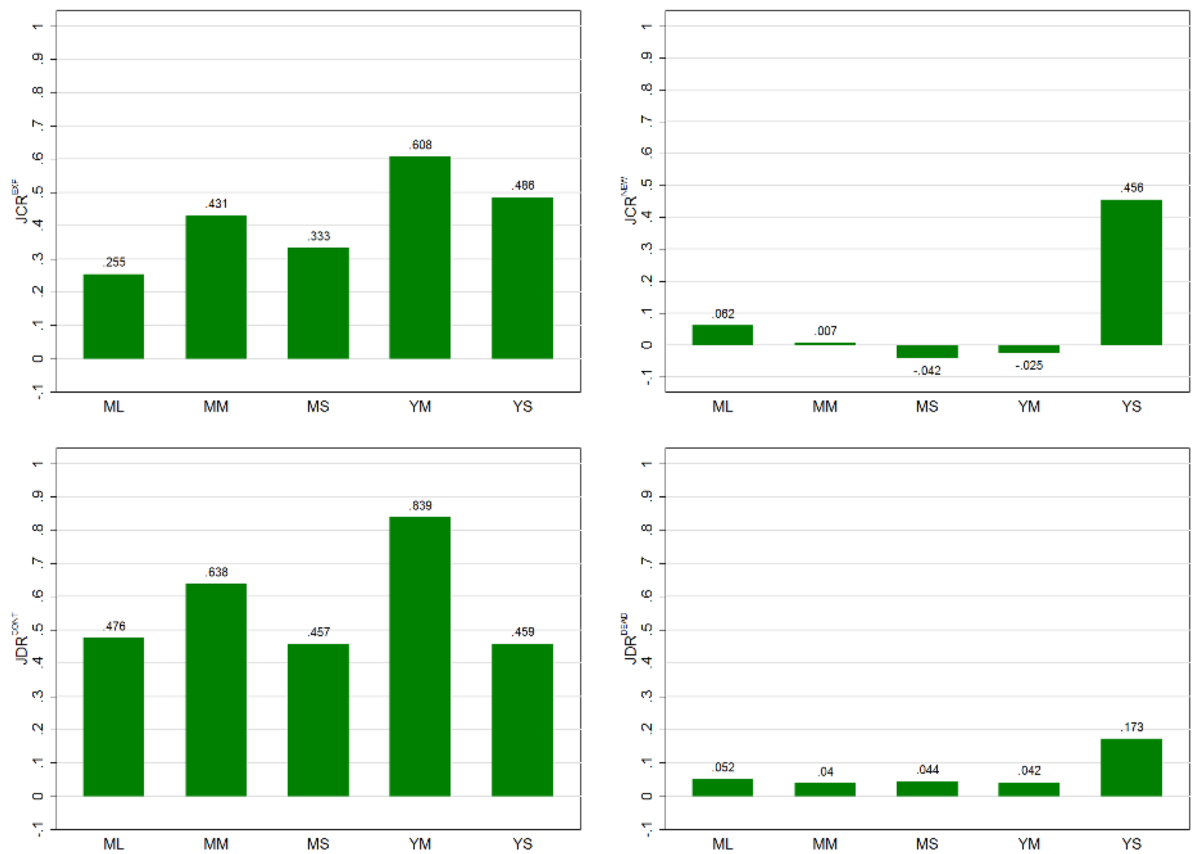
[41] A problem that we face in this respect is that we can only divide by the average employment share and therefore might face a bias. Since the cyclical behavior did not change significantly over time as found by Pugsley and Şahin (2015), we do not face a general problem with the variance decomposition. However, when dividing by the employment share of $LARGE$ firms, for instance, we will over-state the importance at the beginning and under-state the importance towards the end of the period. Similarly for groups that faced a decrease in the employment share over time we will face the opposite pattern.

Table 9: Average Employment Weights

	$YOUNG$		$MATURE$		
	$SMALL$	$MEDIUM$	$SMALL$	$MEDIUM$	$LARGE$
Employment Share	10.4%	3.7%	20.5%	23.1%	42.3%

The table reports the average employment shares of the firm groups in the economy over the period 1982-2013. Young Large firms were completely dropped from the analysis and therefore do not contribute to overall employment.

Figure 16: Variance Decomposition according to $AGE/SIZE$ – Unweighted Results



The bar charts report the results of the variance decomposition, which is described in section 2.5. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are linearly de-trended. Actual contributions are unweighted as the weighted contributions are divided by the average employment share over the observation period, shown in table 9.

3.4.2 Entry and Exit

The job creation and job destruction of NEW and $DEAD$ as well as EXP and $CONT$ establishments are reported in table 10. We have seen already from figure 15 that the margin of expansion and contraction plays a more important role than the actual entry and exit.
In general $MATURE$ firms are dominating the decomposition with a contribution that is around four times higher than the one of $YOUNG$ firms. The only exception where the pattern is reversed is the JCR^{NEW}.

When it comes to $SIZE$ the expansion and contraction of existing establishments is quite evenly caused by all three size categories. In contrast, the opening and closing of new establishments is dominated by one group. While $SMALL$ are responsible for about three quarters of overall cyclical JCR^{NEW}, about half of the JDR^{DEAD} is due to $LARGE$.

Table 10: Variance Decomposition of Job Flows at Entry/Exit Margin

Decomposed	$SIZE$			AGE		$AGE/SIZE$				
Rate	S	M	L	Y	M	YS	YM	MS	MM	ML
JCR^{EXP}	0.335	0.347	0.318	0.206	0.794	0.143	0.063	0.192	0.284	0.318
JCR^{NEW}	0.576	0.000	0.424	0.697	0.303	0.712	-0.015	-0.136	0.015	0.424
JDR^{CONT}	0.270	0.343	0.387	0.150	0.850	0.091	0.060	0.179	0.283	0.387
JDR^{DEATH}	0.422	0.172	0.406	0.313	0.688	0.281	0.031	0.141	0.141	0.406

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

Next we decompose the JCR^{NEW} and the JDR^{DEAD} further into contributions of *size* and *entry/exit* rates. The results of the linearly de-trended rates confirm what we observed for the period of the Great Recession. Continuing firms are more flexible when it comes to adjusting the size of new establishments and closing establishments. The size of $JCR^{NEW,ESTABS}$ and $JDR^{DEAD,ESTABS}$ contributed significantly to overall fluctuations. In addition, most of the contribution to the overall rates is caused by NEW and $DEAD$ establishments of continuing firms. The actual entry and exit of firms contributes mainly through the entry and exit rate as argued by Pugsley and Şahin (2015).

Table 11: Variance Decomposition of JCR^{NEW} and JDR^{DEAD}

Decomposed Rate	*size*	*entry / exit*
$JCR^{NEW,ESTABS}$	0.198	0.506
$JCR^{NEW,FIRMS}$	0.098	0.208
$JDR^{DEATH,ESTABS}$	0.355	0.468
$JDR^{DEATH,FIRMS}$	0.076	0.068

The table reports the contributions of the the Size and the Entry/Exit Rates to JCR^{NEW} and JDR^{DEAD}. The four components for each, JCR^{NEW} and JDR^{DEAD}, sum to one with some approximation error. The methodology is described in section 2.5.

4 Discussion of Policies

Discussing policies on small and large firms is a highly controversial field in the political domain. The accusations and arguments start already with defining the "right" measurement of the economic importance of small businesses and the frictions that affect them. Some policy research even demands the end of all subsidies to small businesses (Rugy, 2005). At the same time, ongoing discussions about the impact of political lobbying or the recent focus on tax evasion of multi-national enterprises are related to large corporations. It is argued that policy-makers care too much about big businesses and do not acknowledge the importance of small businesses.

We want to contribute to this discussion by giving a brief overview of current policies in place and relating them to our empirical findings. By doing so we cannot challenge any results related to the innovative capacities of certain groups of firms or their overall contribution to economic growth. Instead we add to the discussion by providing information on the role of different groups of firms for the cyclical behavior of job flows.

An important information to start with is that it is very different what we describe as small and what the political process defines as small. For many industries the threshold of small businesses is set to 500 workers by the Small Business Administration (SBA) and therefore much higher than our size cut-off.

The general belief of advocates of small firms is that these small firms are the engines of (job) growth and the place in which most of innovation takes place.[42] Often mentioned examples are IT companies starting in garages, such as Google or Apple, and then heavily innovate and create jobs and value over time. But due to frictions not enough resources are allocated to these small firms. Potential frictions are the access to credit, externalities of technological spill-overs that are not internalized, and fixed costs due to regulations. That not all small firms are necessarily Google or Apple and could be also the entry of a real estate agent, the coffee shop around the corner, or the opening of a new barber shop is often downplayed.

There are several policies in place to support small businesses in the United States.[43] Many of those are taken care of by the SBA. In general they could be classified into direct and indirect subsidies.

The direct subsidies relate mainly to SBA programs related to the supply of credits. To facilitate the access to credits and help the liquidity constrained firms, the SBA allows credits to small businesses. Other forms of supporting small businesses are preferential treatments. Smaller firms are exempted from taxation or face tax breaks. Many of the regulatory burden is given to bigger firms, trying to lower the fixed costs of very small businesses by exempting them from certain requirements. A non negligible amount of direct spending of public procurement on small firms is also required by law. During the Great Recession various direct policies were implemented to support small businesses. By giving tax cuts to small businesses and increasing their access to finance, these policies should help to dampen the negative shock to small businesses during the Great Recession.[44] The aim of these policies is to fuel the credit supply to small businesses by

[42]That this view on small businesses might have to be revised can be seen from research by Hurst and Pugsley (2011). Based on surveys they find that most small business owners do not have the intention to grow big, but rather serve an existing market with an existing product or service. This questions also the idea of small businesses being the cradle of innovation.

[43]A brief overview of different policies with exact criteria can be found in the discussion of Adam Looney in Hurst and Pugsley (2011).

[44]Policies were for example the "*Small Business Jobs Act*" in 2010, the "*Hiring Incentives to Restore Employment (HIRE) Act*" in 2010, the "*Middle Class Tax Relief and Job Creation Act*" in 2012. The "*Red Tape Reduction and*

giving government-backing for a fraction of the loans that partner banks give to these businesses. The indirect subsidies are mainly non-pecuniary benefits. And they are generally not taxed. For example, small business owners can benefit from being their own boss and have more flexible working hours. There is also evidence that small business owners under-report their income to tax authorities (Hurst, Li, & Pugsley, 2010).
All these aforementioned subsidies are often linked to firm size, based on head-count measures of workers. This could actually inhibit growth by causing new distortions. Firms face additional costs when crossing these size thresholds. Therefore, they might prefer to stay slightly below the threshold and still be eligible to receive certain subsidies instead of growing to their optimal size. But there is also a more fundamental problem with these policies. It seems that many policies are actually set up in the mindset of supporting firms that face frictions when growing or are negatively impacted by aggregate shocks. Whether policies should therefore relate to size or age is not clear. There is little empirical evaluation available to study the effectiveness of current policies. By imprecise targeting, new distortions could arise. Our analysis revealed that the usual size distinction is not the relevant margin for business cycle fluctuations of job flows. Instead, the age of firms is found to be a more relevant margin, independent of size. Young firms are more cyclically sensitive to aggregate fluctuations. Thus, it seems to be a more relevant margin to include the firm age as well.
For policies that target the stabilization of aggregate employment over the business cycle our results from the variance decomposition analysis are relevant.[45] While young firms are more sensitive to the cycle, they contribute only very little to overall fluctuations. During the Great Recession they caused roughly around 20 percent of overall fluctuations. Thus, policies supporting the jobs in mature firms can have more leverage as more than 80 percent of employment is in mature firms.[46]

5 Conclusion

This paper investigates the cyclical behavior of heterogeneous firms in their job flows and their contribution to employment fluctuations. Of particular interest are firms of different size and age as well as the entry and exit margin. The first part of the analysis focuses on the period of the Great Recession, while the second investigates the behavior over multiple business cycles between 1982-2013.
For the period of the Great Recession we document important heterogeneity along the dimension of firm age. We find that firms younger than 5 years are hit harder than mature firms. When investigating the role of firm size, we do not find evidence of a heterogeneous behavior of small and large firms in contrast. However, when measuring the actual contribution to overall employment fluctuations the findings revert. Because of their small employment share, young firms contribute relatively little to overall employment fluctuations. Instead, mature firms contribute the lion's share.
For the period from 1982-2013 results are more dependent on the data treatment. Linearly detrended job flows confirm our findings for the Great Recession and show that young firms are more

Small Business Job Creation Act" of 2012 is a law that puts a stronger emphasis on the regulatory costs for small businesses. The act tries to reduce regulations for small businesses to make it easier for them to hire new workers.

[45]Note that in principle job losses due to aggregate fluctuations could be an efficient outcome as well if they are cleansing.

[46]The results of our variance decomposition are only based on direct effects, while there might well be additional dynamic effect that accumulate over time as shown by Sedlacek and Sterk (2014).

sensitive than mature firms.

In general, we find the job creation and destruction due to actual entry and exit of establishments relatively less important compared to the expansion and contraction of existing establishments.

Our findings underline the importance of firm age for policies and general discussions on cyclical effects on heterogeneous firms. As shown, most policies are centered around the size dimension of firms. The conventional view of economists and policymakers sees small businesses as the engine of growth with an important role for job creation and innovation. The cyclical sensitivity, however, is stronger related to firm age than to firm size. Therefore, it could be instructive to shift the focus more towards the role of small and young firms instead of only small.

This study also questions the argument of granularity, i.e. large firms driving the cycle, on the basis of cyclical job flows. Taking the granular argument literally, we would not only see that large firms are stronger correlated with the business cycle, but also that – as long as there is no further amplification – large firms contribute disproportionately to the aggregate fluctuations (as they are partially caused by them). While we confirm the findings of Moscarini and Postel-Vinay (2012) that large firms are more sensitive to the cycle, we can definitely rule out that large firms contribute disproportionally to aggregate fluctuations. Our variance decomposition shows that large and mature firms contribute the lion's share to aggregate fluctuations, but this is mainly due to their large share in overall employment. Nevertheless, they contribute relatively less compared to small and young firms.

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6 Distribution of Job Creation and Destruction across Firm Groups

To better understand how job creation and destruction is divided across firms, we include the following table. It reports the average shares of job creation and destruction shares due to various size and age categories. The last row reports the shares of small young firms without the new entrant firms.

Table 12: Average Job Creation and Job Destruction Shares of Different Groups

	JOB CREATION			JOB DESTRUCTION		
	NEW	EXP	TOTAL	DEAD	CONT	TOTAL
$YOUNG$	.53	.22	.34	.31	.16	.21
$MATURE$	.46	.78	.66	.69	.84	.79
$YOUNG/SMALL$	.50	.17	.29	.23	.11	.15
$YOUNG/MEDIUM$	.03	.05	.04	.08	.05	.06
$MATURE/SMALL$	.05	.23	.16	.22	.21	.21
$MATURE/MEDIUM$	.12	.21	.17	.18	.23	.21
$MATURE/LARGE$	.30	.34	.33	.29	.40	.36
$YOUNG/SMALL$ without Firm Entry	.03	.17	.12	.23	.11	.15

The table reports the average shares for job creation and destruction as share of the respective column. The underlying data stems from the BDS and the period covers 1982-2013. The last row re-computes the average shares for $YOUNG/SMALL$ firms, deducting the job creation caused by firm entry.

As can be seen from the second line of the table 12, $MATURE$ create (66 percent) and destroy (79 percent) the bulk of all jobs. Most of this creation (74 percent) and destruction (70 percent) of $MATURE$ stems from the intensive margin, i.e. expansion and contraction of already existing establishments, as seen in table 13. In contrast, the creation and destruction shares for $YOUNG$ are almost balanced between the intensive margin – expanding/contracting existing establishments (42 percent / 50 percent) – and the extensive margin – opening/closing establishments (58 percent / 50 percent).
Next, we can look at the shares of different $AGE/SIZE$ groups. For the job creation, mainly $MATURE/LARGE$ (33 percent) and $YOUNG/SMALL$ (29 percent) are important, while for the job destruction $MATURE/LARGE$ (36 percent), $MATURE/MEDIUM$ (21 percent), and $MATURE/SMALL$ (21 percent). The margins of adjustment of table 13 are different across $SIZE$ groups. For job creation, with around 34 percent $LARGE$ firms adjust more on the extensive margin compared to medium (around 25 percent) and small firms (around 10 percent). In contrast, the extensive margin plays a more important role for job destruction at particular $YOUNG/SMALL$ (52 percent) and $YOUNG/MEDIUM$ (44 percent).

In addition to the figures that are visible in the table, we looked into the entry and exit of firms as well. The job creation of new born firms represents 18 percent of total job creation and 47 percent of all jobs created by newly created establishments. Similarly, 48 percent of all jobs destroyed through establishments closing are due to firm closure. 17 percent of all destroyed jobs

Table 13: Distribution of Job Creation and Job Destruction across Extensive and Intensive Margins

	JOB CREATION NEW	JOB CREATION EXP	JOB DESTRUCTION DEAD	JOB DESTRUCTION CONT
TOTAL				
YOUNG	.58	.42	.50	.50
MATURE	.26	.74	.30	.70
YOUNG/SMALL	.63	.37	.52	.48
YOUNG/MEDIUM	.26	.74	.44	.56
MATURE/SMALL	.12	.88	.36	.64
MATURE/MEDIUM	.25	.75	.29	.71
MATURE/LARGE	.34	.66	.28	.72
YOUNG/SMALL without Firm Entry	.09	.91	.52	.48

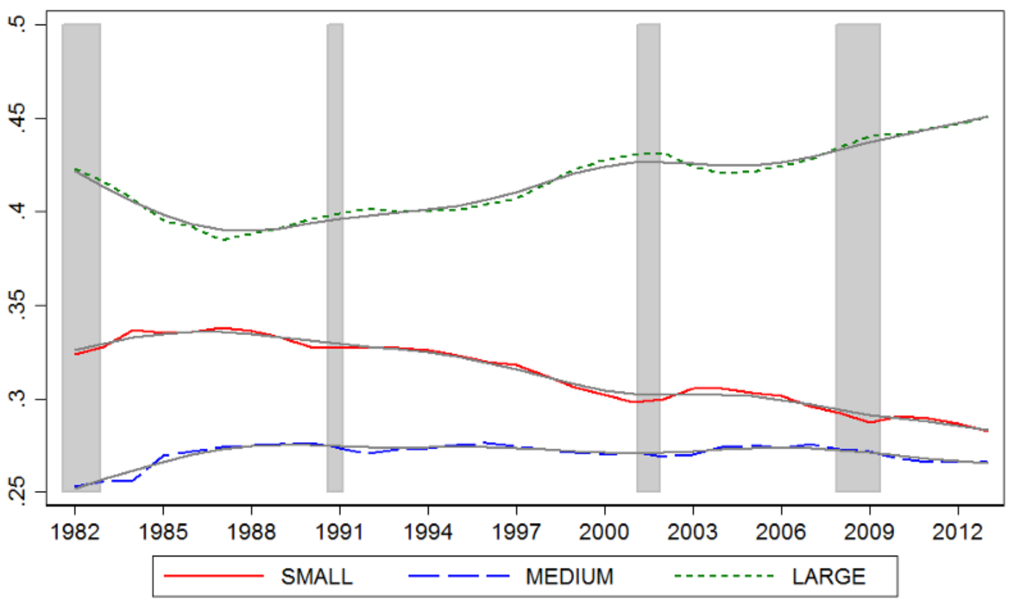
The table reports the distribution of job creation and job destruction across new/expanding and dying/contracting firms respectively. The underlying data stems from the BDS and the period covers 1982-2013.

are caused by exiting firms. In terms of firm age, $YOUNG$ and $MATURE$ exiting firms contribute equally to job destruction. $LARGE$ do not matter much as exit of $LARGE$ is a very rare event. Jobs are mainly destroyed by $SMALL$. The individual contributions to overall job destruction are given by $YOUNG/SMALL$ (6 percent), $MATURE/SMALL$ (6 percent), $YOUNG/MEDIUM$ (2 percent), and $MATURE/MEDIUM$ (3 percent).

7 BDS Employment Shares over Time

A glance at the time series shows that the employment share of large firms is constantly increasing over time, while the share of small firms is decreasing. Pugsley and Şahin (2015) show that the increase in employment of $LARGE$ – and particularly $MATURE/LARGE$ – firms is likely a consequence of a decline in the startup rate.
Besides these obvious trends in the data, there is a visible cyclicality in the employment shares. When focusing only on the NBER recession periods, shaded in gray, the importance of large firms for the aggregate employment seems to increase, while the one for small firms decreases.

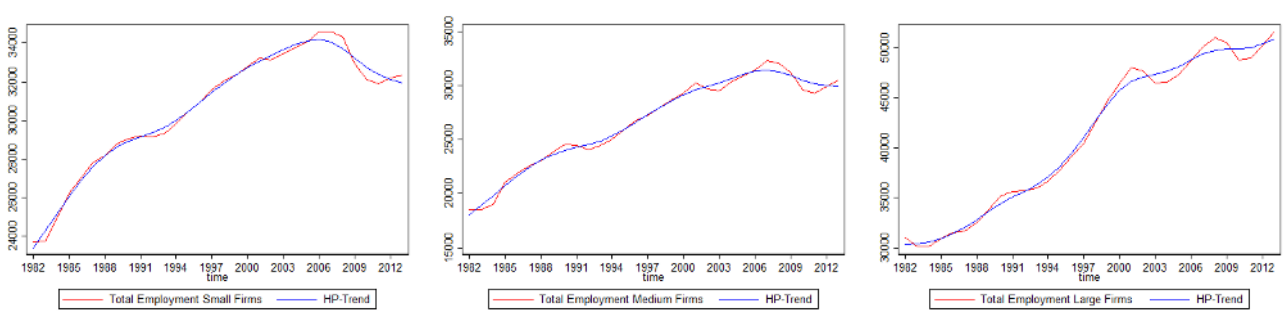
Figure 17: Employment Share by $SIZE$



The gray lines represent the HP-trends of the data series. The shaded gray areas represent NBER recession periods. Data stems from the BDS.

Even though, employment shares shifted towards more mature and large firms, one can observe from the following graphs that employment of all firm sizes increased during the observed period. So the decline of small firms is only a relative trend.

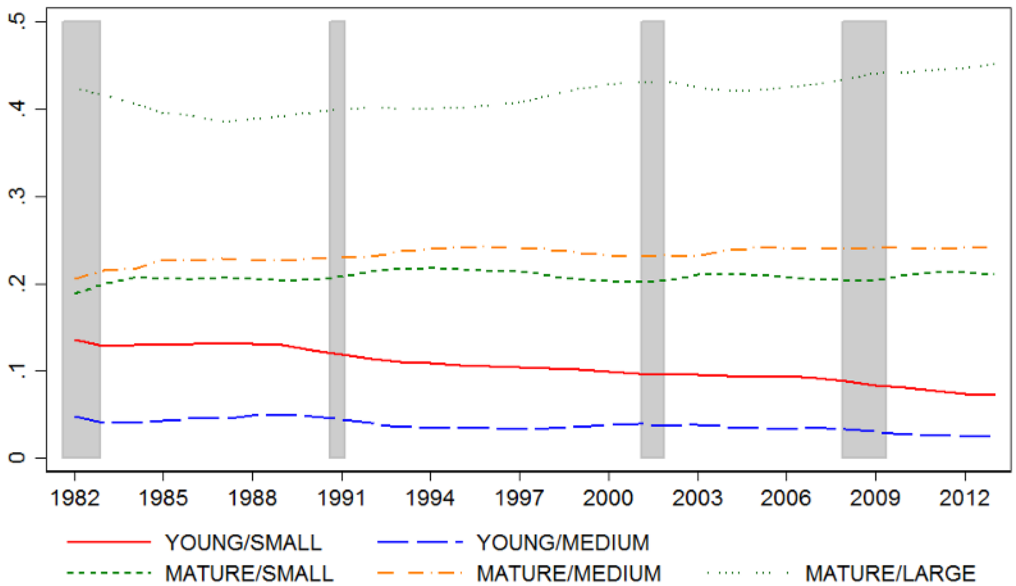
Figure 18: Employment Levels by $SIZE$



Employment is measured in thousands of workers. Data stems from the BDS.

The employment shares of different $AGE/SIZE$ groups seems more stable over time, but reveals opposing trends for young and mature firms. Between 1982 and 2013 the employment share of young firms decreased from overall 19.1 percent to 10.2 percent. Most of this change is due to a decline of employment in $YOUNG/SMALL$, which decreased from 13.6 percent to 7.3 percent, which is related to a decline in entry as well as average entry size over time. All these findings are in line with Pugsley and Şahin (2015), even though they use a different size and age cut-off.

Figure 19: Employment Share by $AGE/SIZE$

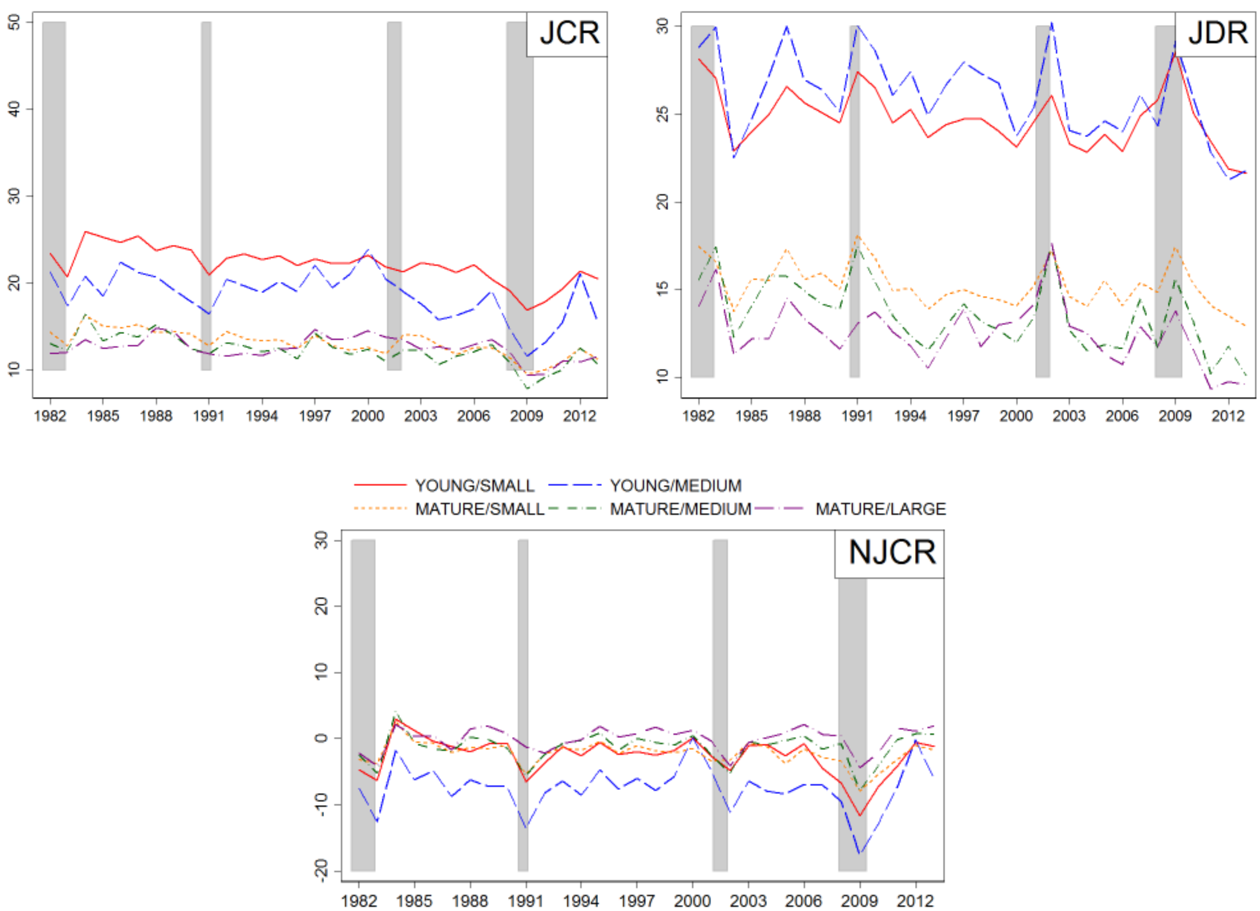


The gray lines represent the HP-trends of the data series. The shaded gray areas represent NBER recession periods. Data stems from the BDS.

8 Job Flows without Firm Entry

This section is plotting the three different job flow rates over time, neglecting the existence of firm entry, i.e. 0 age firms from the BDS dataset. Obviously, the JDR is identical with the one shown in figure 1 in the main text. The JCR of $YOUNG/SMALL$, however, is dropping strongly. This unterlines the importance of the entry margin for the job creation. However, these plots only describe the behavior of job flow rates over time and do not indicate the cyclicality, which is our research focus.

Figure 20: Job Flow Rates by AGE/SIZE over Time without Firm Entry



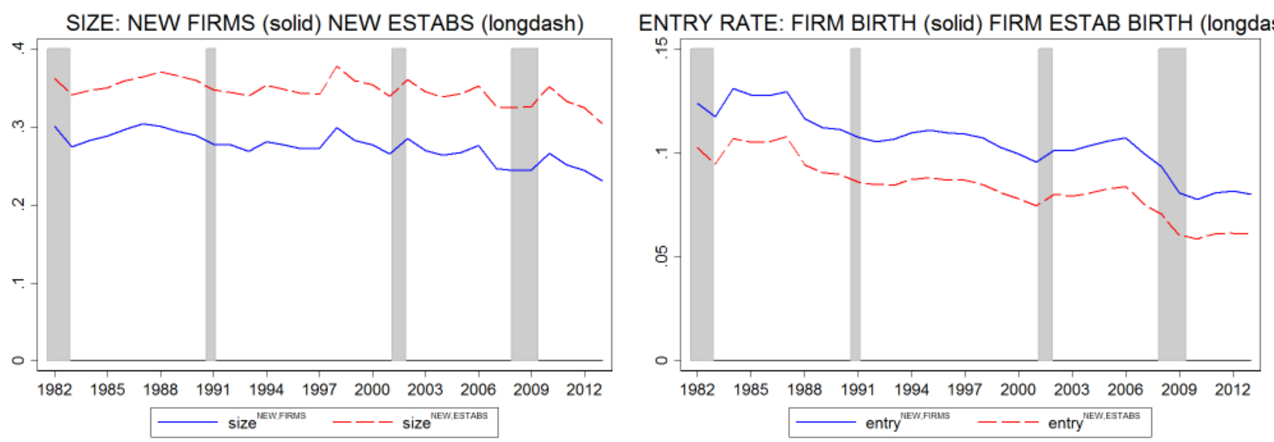
The graph plots the BDS job flow rates by AGE/SIZE. NBER recessions are plotted in shaded gray areas. The group of $YOUNG/LARGE$ firms is dropped from the analysis.

9 Entry/Exit at the Firm Level

In this section we plot the decomposition of the the job creation and destruction rate of new firms on the firm level, similar to Pugsley and Şahin (2015). The plots show that the pattern of entry and exit rates as well as size is the same for the firm and establishment level. Only the size differs slightly, because the number of establishments of new firms is larger than the number of new firms itself and the same for exiting firms.
The job creation rate of new firms is decomposed into the firm entry rate and the relative firm size:

$$JCR_t^{NEW,FIRMS} = \underbrace{\frac{\#FIRMS_t^{NF}}{\#FIRMS_t}}_{\text{Firm Entry Rate NF}} \times \underbrace{\frac{\frac{JC_t^{NF}}{\#FIRMS_t^{NF}}}{\frac{EMP_t}{\#FIRMS_t}}}_{\text{Relative Firm Size NF}} \tag{19}$$

Figure 21: Decomposing $JCR^{NEW,FIRMS}$ on the Firm and Establishment Level

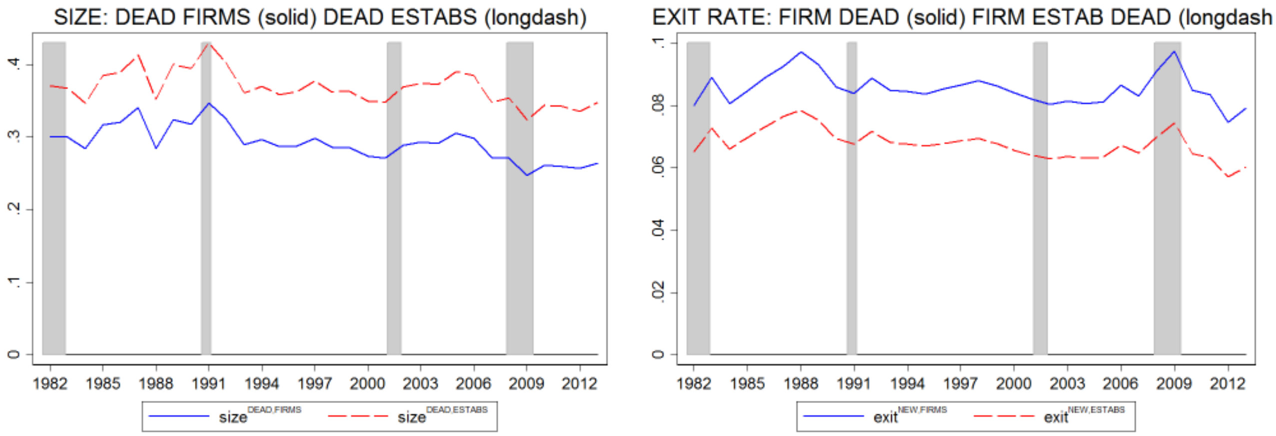


The graph shows the relative firm and establishment size as well as the firm and establishment entry rates. The vertical line in 2009 represents the trough of the Great Recession.

Similarly, the job destruction rate of dying firms is decomposed into the firm exit rate and the relative firm size:

$$JDR_t^{DEAD,FIRMS} = \underbrace{\frac{\#FIRMS_t^{DF}}{\#FIRMS_t}}_{\text{Exit Rate DF}} \times \underbrace{\frac{\frac{JD_t^{DF}}{\#FIRMS_t^{DF}}}{\frac{EMP_t}{\#FIRMS_t}}}_{\text{Relative Firm Size DF}} \tag{20}$$

Figure 22: Decomposing $JDR^{DEAD,FIRMS}$ on the Firm and Establishment Level

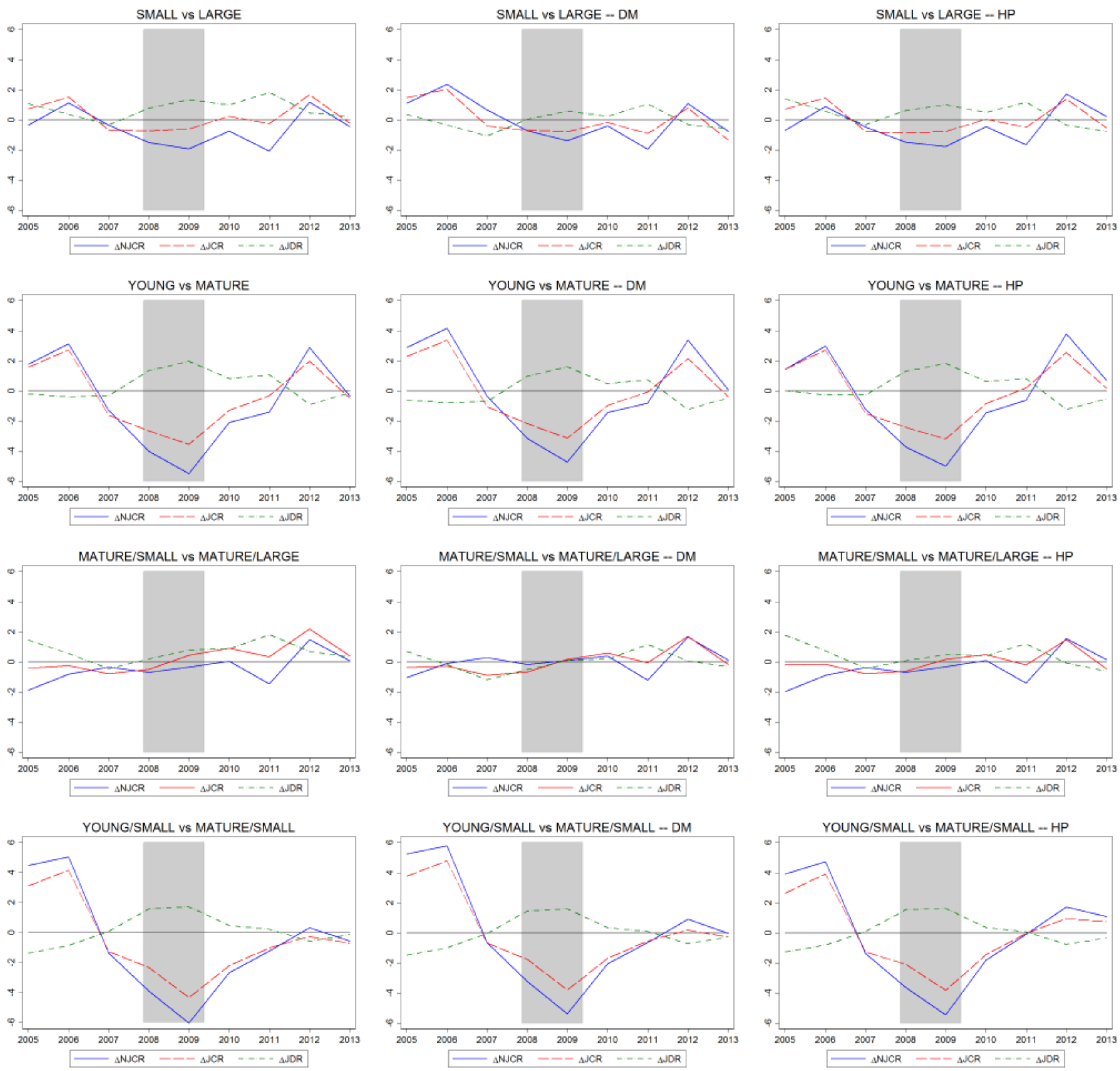


The graph shows the relative firm and establishment size as well as the firm and establishment entry rates. The vertical line in 2009 represents the trough of the Great Recession.

10 Differential Job Flows during the Great Recession – Alternative Filters

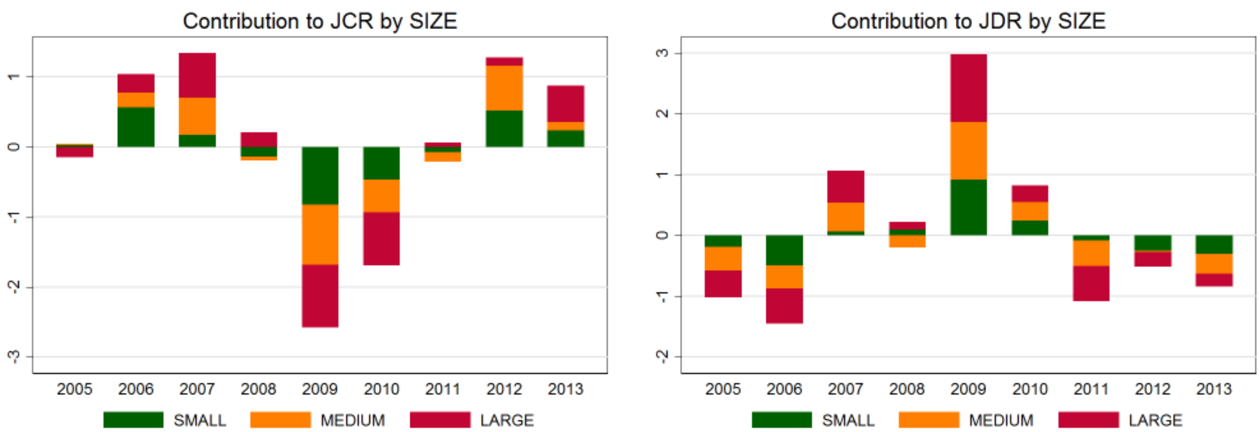
Figure 23: Differential Job Flows during the Great Recession – Alternative Filters

Linear Trend | **De-Meaned** | **HP-filtered (390.625)**



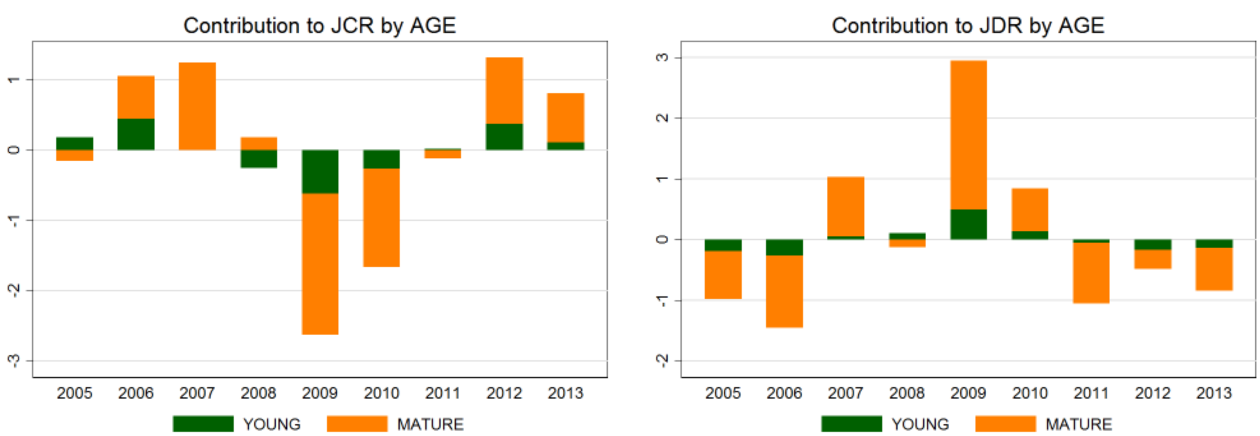
11 Contributions to JCR and JDR during the Great Recession

Figure 24: Contribution to JCR and JDR by $SIZE$ – Great Recession



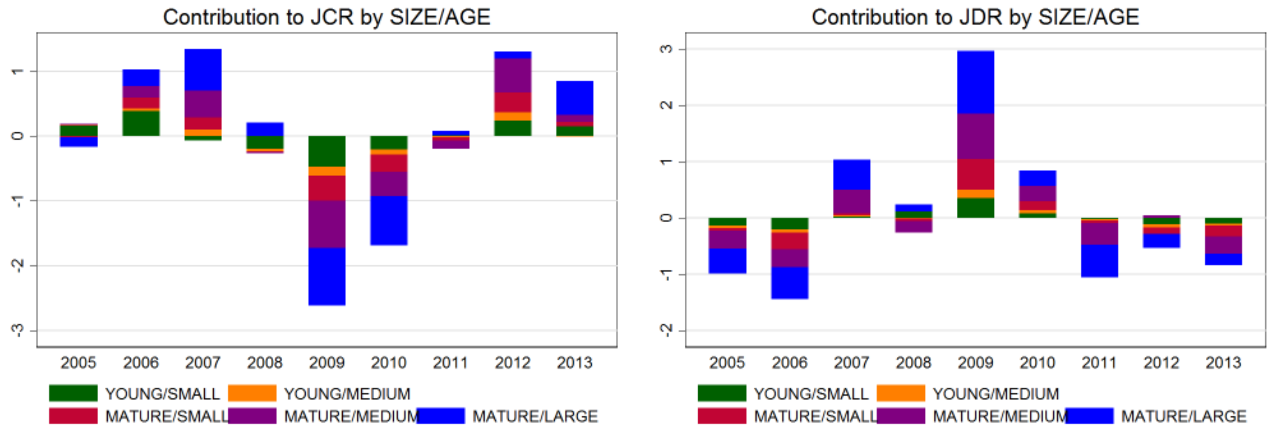
The graph plots the weighted contributions of individual job flow rates to overall JCR and JDR. The procedure follows equation (17).

Figure 25: Contribution to JCR and JDR by AGE – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall JCR and JDR. The procedure follows equation (17).

Figure 26: Contribution to JCR and JDR by $AGE/SIZE$ – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall JCR and JDR. The procedure follows equation (17).

In addition, we decompose the variance as outlined in section 2.5 even though we base the analysis on only nine data points.

Table 14: Variance Decomposition – Great Recession

Decomposed Rate	$SIZE$ S	M	L	AGE Y	M	$AGE/SIZE$ YS	YM	MS	MM	ML
$NJCR$	0.322	0.307	0.371	0.203	0.797	0.155	0.048	0.167	0.259	0.371
JCR	0.342	0.304	0.354	0.239	0.761	0.190	0.049	0.152	0.255	0.354
JDR	0.302	0.310	0.387	0.168	0.832	0.121	0.047	0.182	0.263	0.387
JCR^{EXP}	0.267	0.350	0.383	0.152	0.848	0.096	0.055	0.171	0.295	0.383
JCR^{NEW}	0.550	0.176	0.275	0.481	0.519	0.450	0.031	0.099	0.145	0.275
JDR^{CONT}	0.269	0.350	0.381	0.132	0.868	0.081	0.051	0.187	0.299	0.381
JDR^{DEATH}	1.400	-1.000	0.600	1.333	-0.333	1.400	-0.067	0.000	-0.933	0.600

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

Table 15: Variance Decomposition of JCR^{NEW} and JDR^{DEAD} – Great Recession

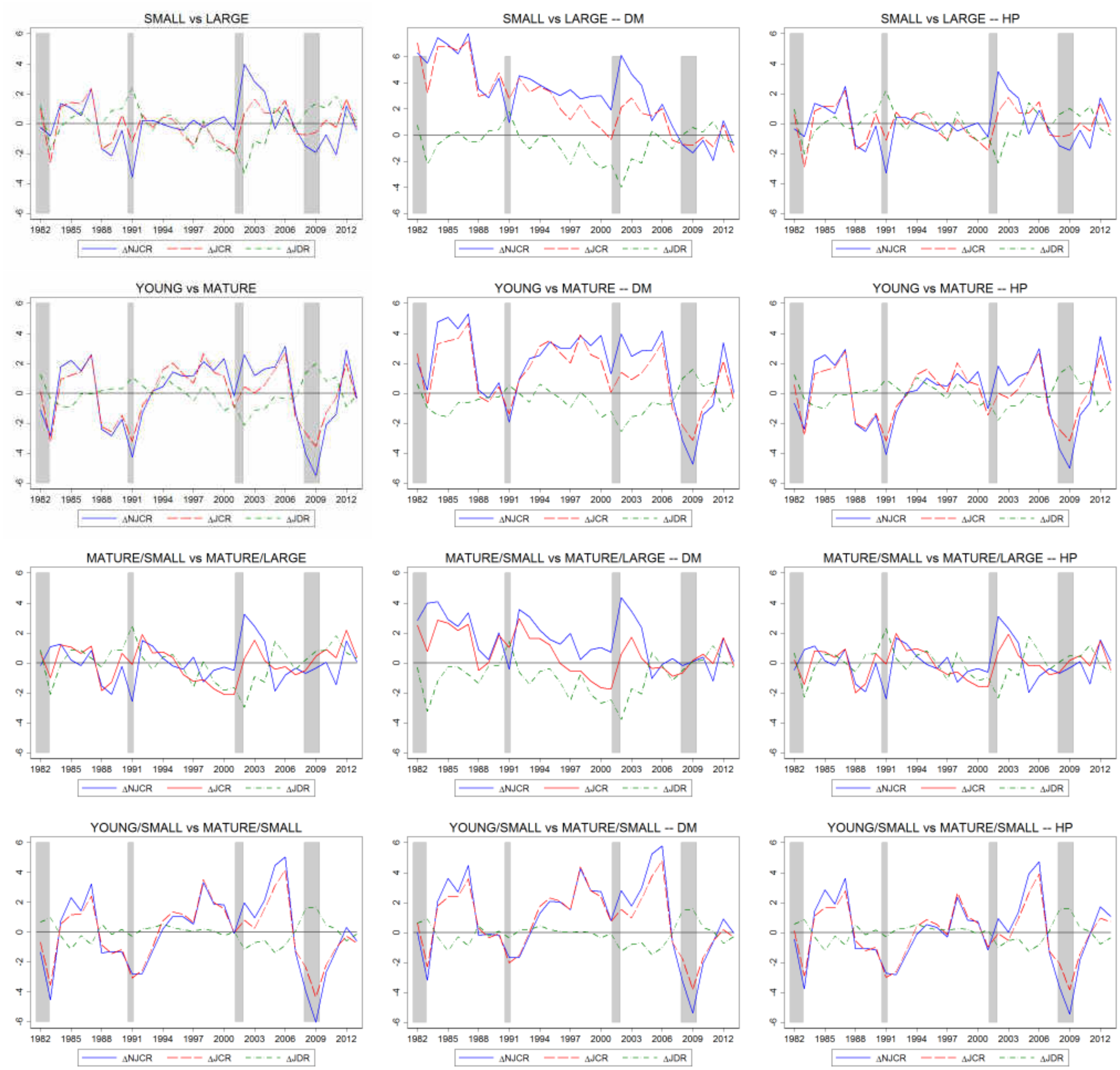
	size	*entry / exit*
$JCR^{NEW,ESTABS}$	0.005	0.632
$JCR^{NEW,FIRMS}$	-0.037	0.386
$JDR^{DEATH,ESTABS}$	0.542	0.649
$JDR^{DEATH,FIRMS}$	-0.232	-0.008

The table reports the contributions of the the Size and the Entry/Exit Rates to JCR^{NEW} and JDR^{DEAD}. The four components for each, JCR^{NEW} and JDR^{DEAD}, sum to one with some approximation error. The methodology is described in section 2.5.

12 Differential Job Flows over the Business Cycle – Alternative Filters

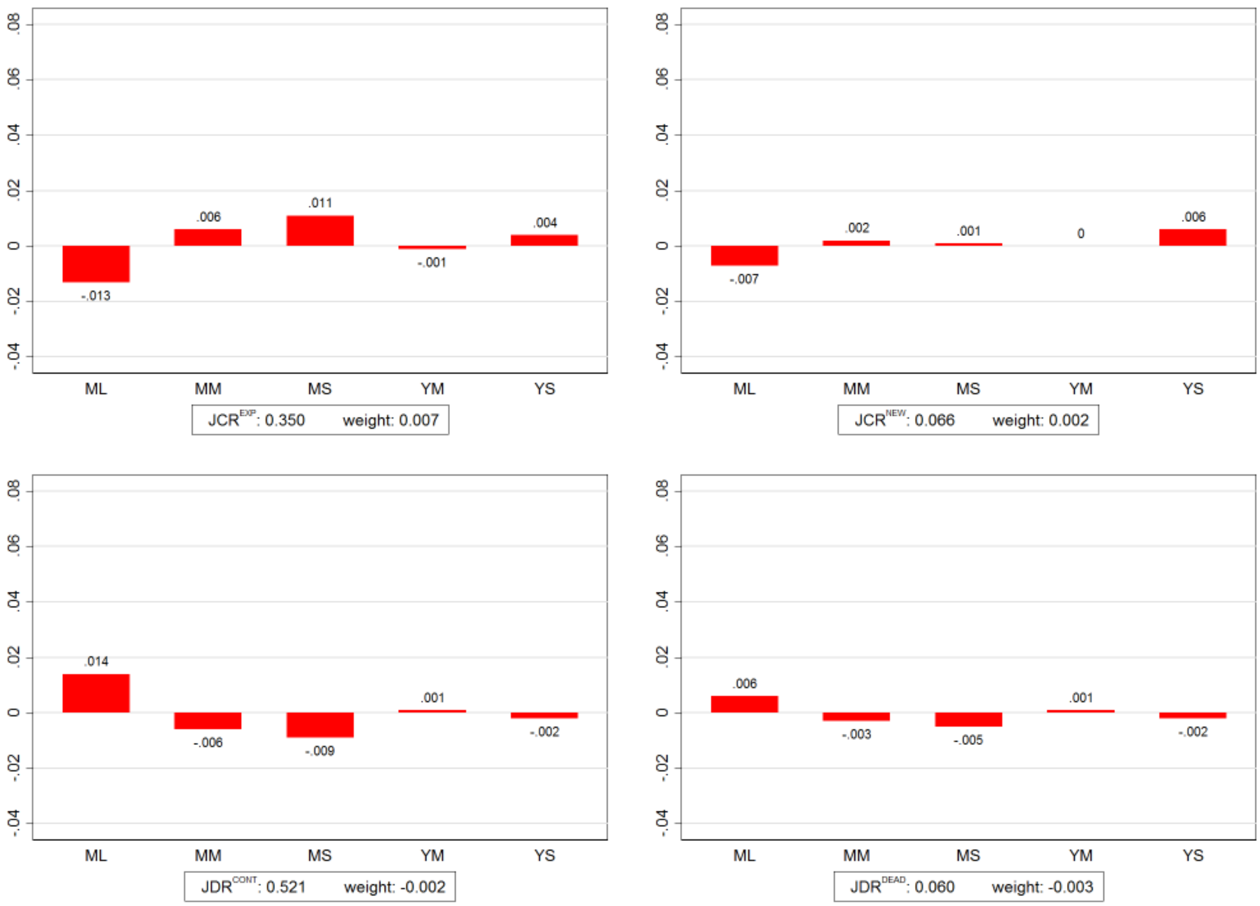
Figure 27: Differential Job Flows over the Business Cycle – Alternative Filters

Linear Trend | **De-Meaned** | **HP-filtered (390.625)**



13 Contribution of Employment Weights to Variance Decomposition

Figure 28: Variance Decomposition according to $AGE/SIZE$ – Weighted Results for Weights



The bar charts report the weighted results of the variance decomposition, which is described in section 2.5. The weight consists of the trend of the $NJCR$ of the respective group. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are linearly de-trended.

14 Robustness – HP-Filtered Aggregates

In this section we investigate the correlation patterns between linearly de-trended job flow rates and HP-filtered aggregate measures.

Table 16: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.00	0.07	-0.28	0.20
		(0.98)	(0.71)	(0.13)	(0.28)
	U	0.15	0.13	0.32*	-0.01
		(0.41)	(0.48)	(0.08)	(0.95)
JDR	GDP	0.22	0.10	0.20	-0.02
		(0.23)	(0.60)	(0.27)	(0.91)
	U	-0.16	-0.16	-0.12	-0.14
		(0.38)	(0.37)	(0.53)	(0.45)
$NJCR$	GDP	-0.17	0.01	-0.44**	0.17
		(0.34)	(0.94)	(0.01)	(0.37)
	U	0.25	0.17	0.39**	0.03
		(0.17)	(0.36)	(0.03)	(0.88)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flow rates are linearly de-trended, GDP (parameter 6.25) and the unemployment rate (parameter 390.625) are HP-filtered.

Table 17: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	JCR		JDR	
	EXP $-NEW$	$NEW:$ $FIRMS$ $-ESTABS$	$CONT$ $-DEAD$	$DEAD:$ $FIRMS$ $-ESTABS$
GDP	-0.03	-0.28	-0.27	-0.01
	(0.89)	(0.12)	(0.13)	(0.94)
U	0.16	0.39**	0.06	0.04
	(0.38)	(0.03)	(0.73)	(0.83)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flow rates are linearly de-trended, GDP (parameter 6.25) and the unemployment rate (parameter 390.625) are HP-filtered.

Table 18: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

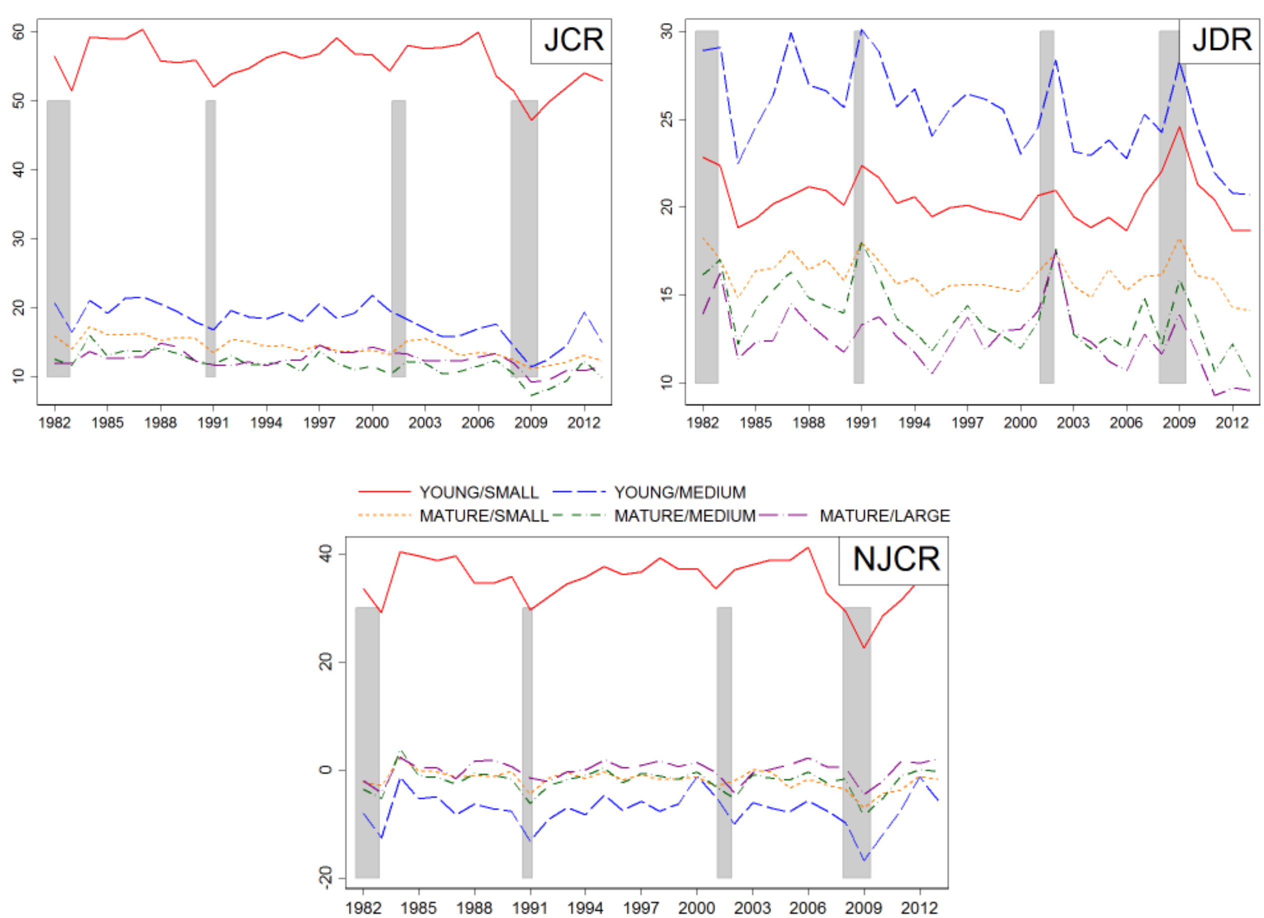
	$NEW:$ $FIRMS - ESTABS$		$DEAD:$ $FIRMS - ESTABS$	
	size	*entry*	*size*	*exit*
GDP	-0.09	-0.04	0.04	-0.06
	(0.61)	(0.81)	(0.82)	(0.75)
U	0.15	0.14	0.01	0.01
	(0.41)	(0.44)	(0.95)	(0.96)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flow rates are linearly de-trended, GDP (parameter 6.25) and the unemployment rate (parameter 390.625) are HP-filtered.

15 Robustness – Alternative Size Cut-off

While we follow Moscarini and Postel-Vinay (2012) in defining small, medium, and large firms, Fort et al. (2013) as well as Pugsley and Şahin (2015) use different size cut-offs. Compared to our definition (small: less than 50; medium: 50-1000; large: more than 1000), we apply the alternative size cut-off in this section (small: less than 20; medium: 20-500; large: more than 500).
Note that the aggregate job flow rates are the same as in the baseline case, i.e. all values from firms with more than 1000 employees and less than 5 years of age are dropped from the sample. Thus, the category of young large firms is only composed of young firms with 500-1000 employees.

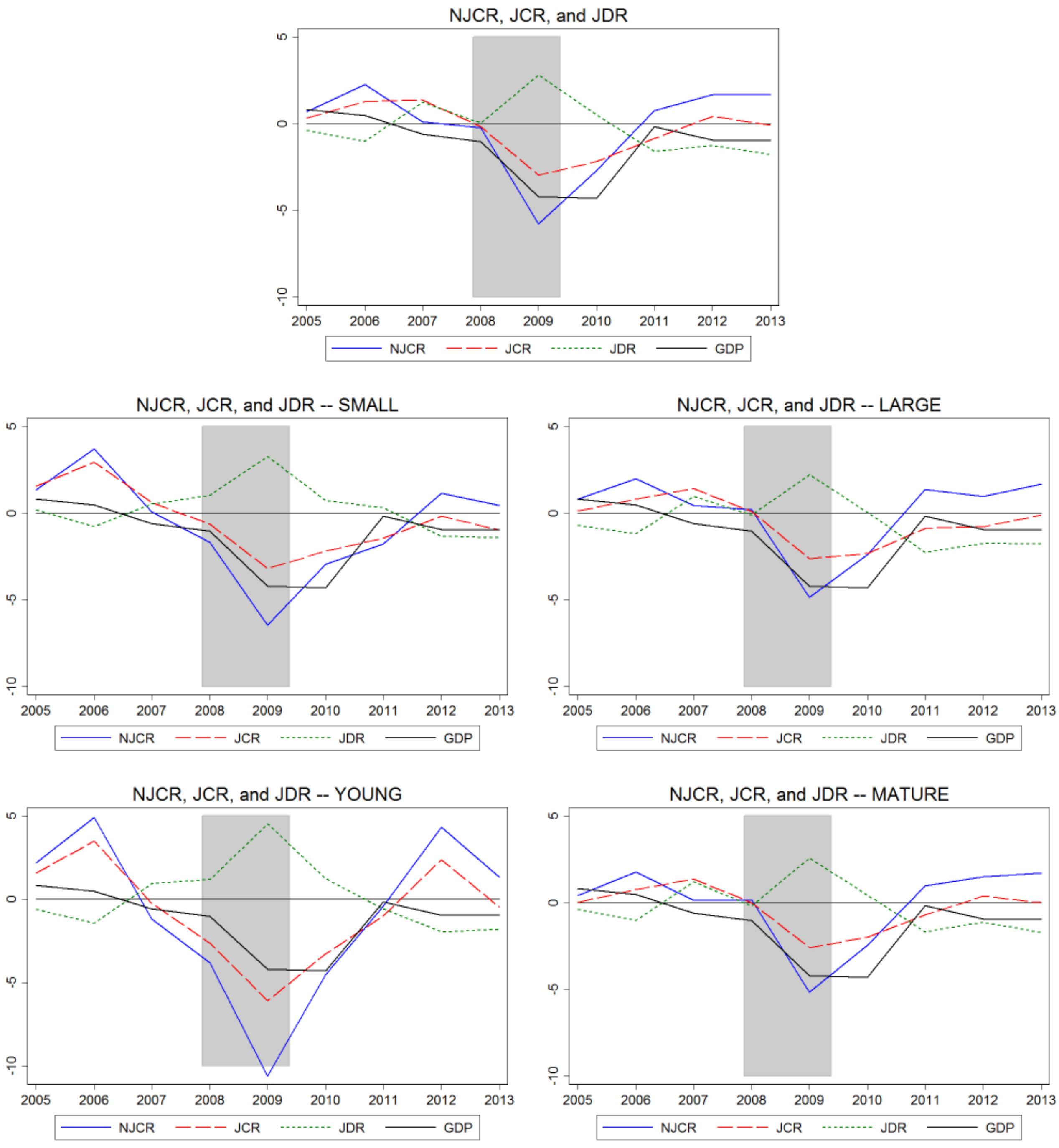
Figure 29: Job Flow Rates by AGE/SIZE over Time – Alternative Size Cut-off



The graph plots the BDS job flow rates by AGE/SIZE. NBER recessions are plotted in shaded gray areas. The group of $YOUNG/LARGE$ firms is dropped from the analysis.

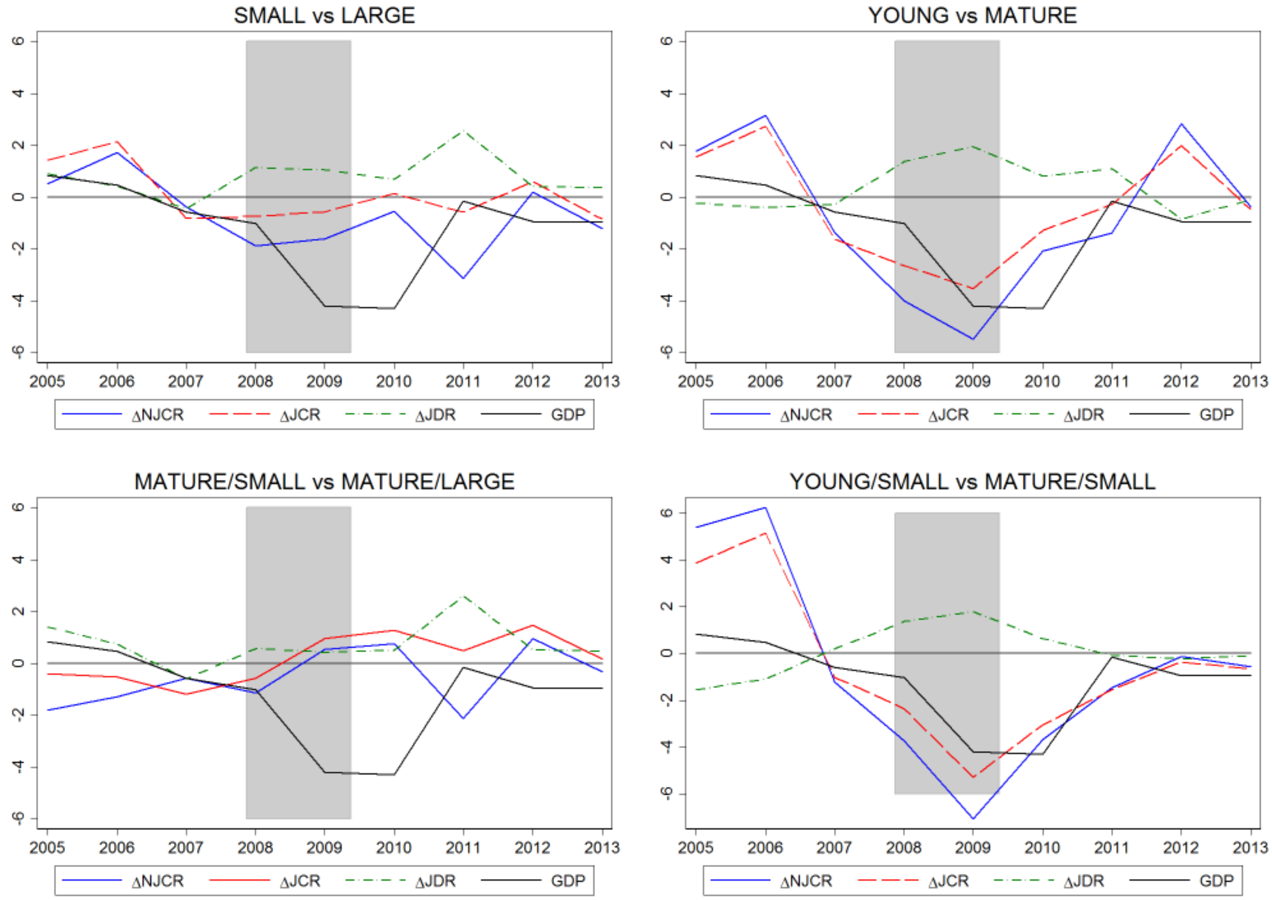
15.1 Cyclicality in the Great Recession

Figure 30: Job Creation Rate during the Great Recession



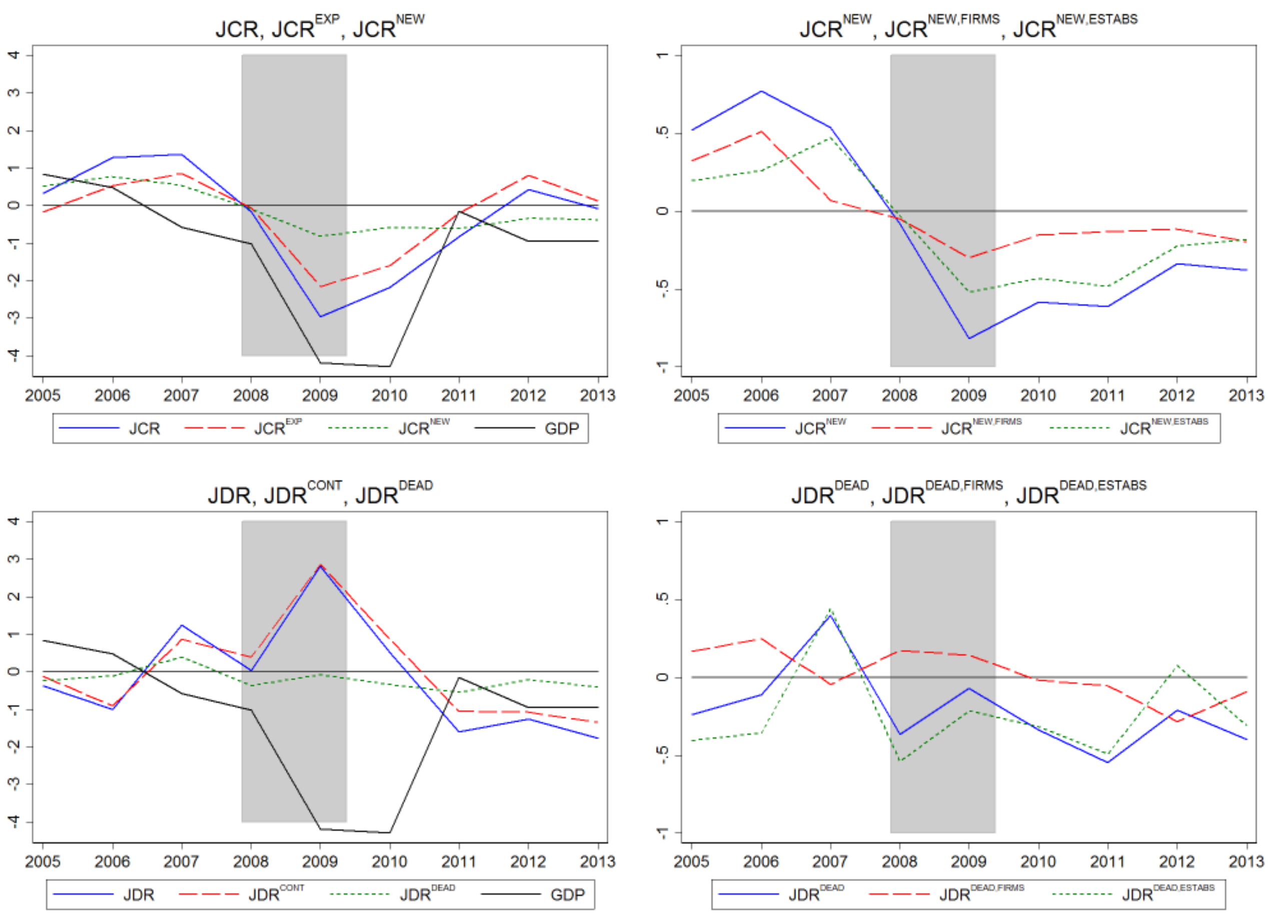
The graph plots the Job Creation Rate of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. All series are linearly de-trended.

Figure 31: Differential Job Flows during the Great Recession



The graph plots the Differential Job Flows of different groups of firms. From the first top left to bottom right panel we look at $SIZE$, AGE, $SIZE$ conditional on $AGE = MATURE$, AGE conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. Differentials are computed by subtracting the respective series. The differentials for JCR, and $NJCR$ can be read in the same way, the one for JDR is consistent when going in the opposite direction. All series are linearly de-trended.

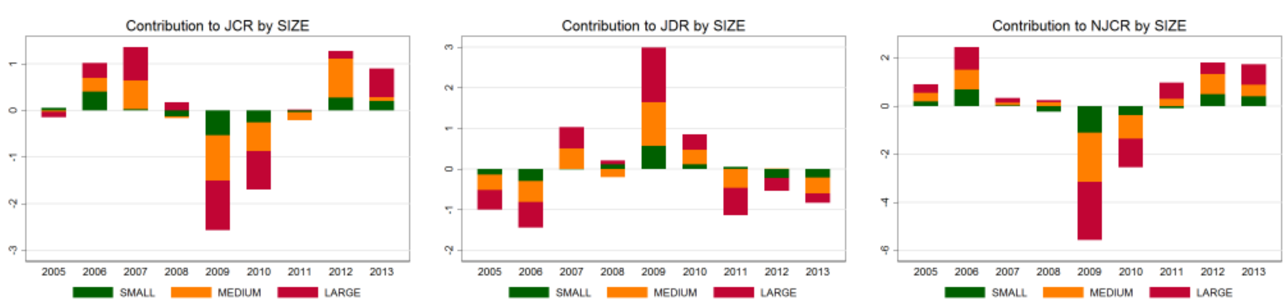
Figure 32: Job Creation and Job Destruction during the Great Recession by Entry and Exit



The plots show the job creation and destruction rates by expanding/contracting establishments of existing firms, new or dying establishments of continuing firms, and new or dying establishments of those firms that enter or exit the market. All rates are linearly de-trended.

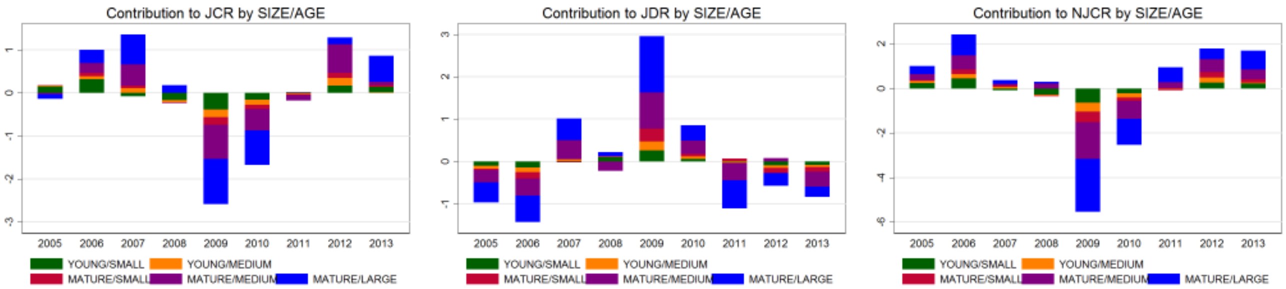
15.2 Contribution to Aggregate Fluctuations in the Great Recession

Figure 33: Contribution to Job Flows by $SIZE$ – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall JCR, JDR, and $NJCR$ respectively. The procedure follows equation (17).

Figure 34: Contribution to Job Flows by $AGE/SIZE$ – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall JCR, JDR, and $NJCR$ respectively. The procedure follows equation (17).

15.3 Cyclicality over the Business Cycle

Table 19: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate – Alternative Size

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.18	0.54***	-0.31*	0.65***
		(0.32)	(0.00)	(0.09)	(0.00)
	U	-0.14	-0.48**	0.30	-0.58***
		(0.44)	(0.01)	(0.10)	(0.00)
JDR	GDP	-0.00	-0.34*	0.11	-0.54***
		(1.00)	(0.06)	(0.54)	(0.00)
	U	-0.17	0.19	-0.28	0.49***
		(0.35)	(0.30)	(0.13)	(0.00)
$NJCR$	GDP	0.13	0.56***	-0.34*	0.64***
		(0.46)	(0.00)	(0.06)	(0.00)
	U	0.02	-0.45**	0.47**	-0.57***
		(0.93)	(0.01)	(0.01)	(0.00)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are either linearly de-trended or HP-filtered with parameter 6.25.

Table 20: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle – Alternative Size

	JCR		JDR	
	EXP $-NEW$	$NEW:$ $FIRMS$ $-ESTABS$	$CONT$ $-DEAD$	$DEAD:$ $FIRMS$ $-ESTABS$
GDP	0.58***	0.15	-0.81***	-0.09
	(0.00)	(0.41)	(0.00)	(0.61)
U	-0.51***	-0.11	0.77***	0.03
	(0.00)	(0.56)	(0.00)	(0.88)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are either linearly de-trended or HP-filtered with parameter 6.25.

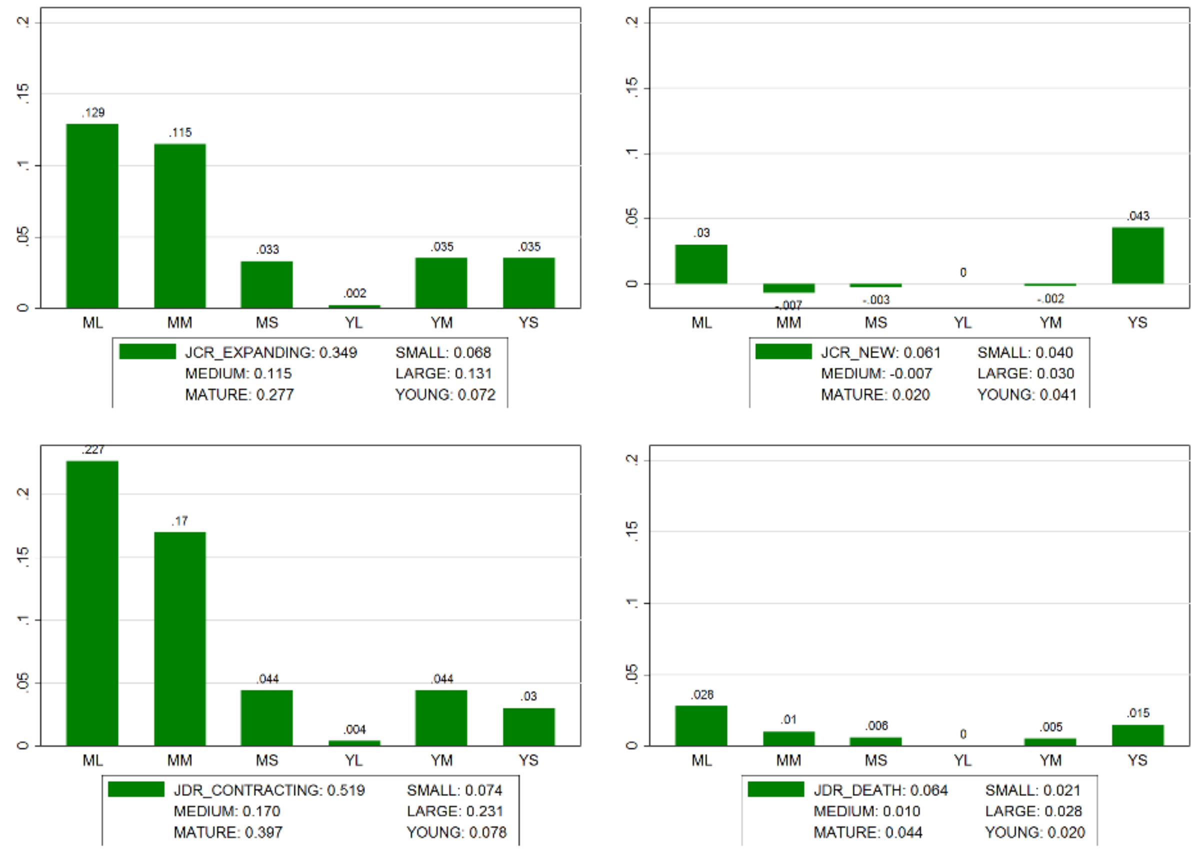
Table 21: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	$NEW:$ $FIRMS-ESTABS$		$DEAD:$ $FIRMS-ESTABS$	
	$size$	$entry$	$size$	$exit$
GDP	-0.32*	0.51***	-0.31*	0.03
	(0.07)	(0.00)	(0.08)	(0.88)
U	0.18	-0.41**	0.24	-0.06
	(0.33)	(0.02)	(0.19)	(0.76)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are either linearly de-trended or HP-filtered with parameter 6.25.

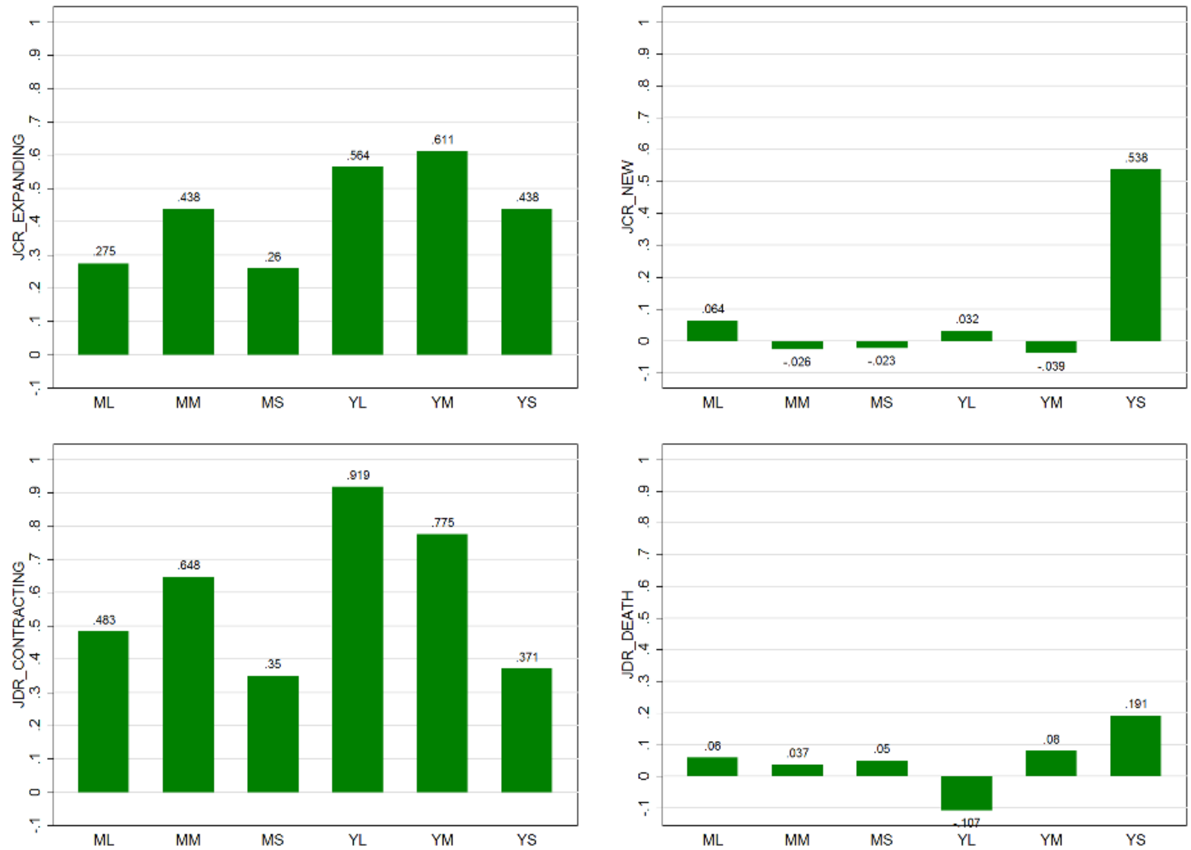
15.4 Contribution to Aggregate Fluctuations over the Business Cycle

Figure 35: Variance Decomposition according to $AGE/SIZE$ – Weighted Results



The bar charts report the weighted results of the variance decomposition, which is described in section 2.5. The weight consists of the trend of the employment share of the respective group. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are Linearly De-Trended.

Figure 36: Variance Decomposition according to $AGE/SIZE$ – Unweighted Results



The bar charts report the results of the variance decomposition, which is described in section 2.5. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are Linearly De-Trended. Actual contributions are unweighted as the weighted contributions are divided by the average employment share over the observation period, shown in table 9.

Table 22: Variance Decomposition – Alternative Size Cut-Off

Decomposed Rate	*SIZE* S	M	L	*AGE* Y	M	*AGE/SIZE* YS	YM	YL	MS	MM	ML
$NJCR$	0.204	0.373	0.423	0.212	0.788	0.124	0.083	0.006	0.081	0.290	0.417
JCR	0.263	0.344	0.393	0.276	0.724	0.190	0.080	0.005	0.073	0.263	0.388
JDR	0.163	0.393	0.444	0.168	0.832	0.077	0.084	0.007	0.086	0.309	0.437

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

Table 23: Variance Decomposition – Alternative Size Cut-Off

Decomposed Rate	*SIZE* S	M	L	*AGE* Y	M	*AGE/SIZE* YS	YM	YL	MS	MM	ML
JCR^{EXP}	0.195	0.430	0.375	0.206	0.794	0.100	0.100	0.006	0.095	0.330	0.370
JCR^{NEW}	0.656	-0.148	0.492	0.672	0.328	0.705	-0.033	0.000	-0.049	-0.115	0.492
JDR^{CONT}	0.143	0.412	0.445	0.150	0.850	0.058	0.085	0.008	0.085	0.328	0.437
JDR^{DEATH}	0.328	0.234	0.438	0.313	0.688	0.234	0.078	0.000	0.094	0.156	0.438

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

16 Robustness - Alternative Age Cut-Off

16.1 $YOUNG$ (0-4 years); $MATURE$ (5+ years)

In this robustness sectoin we follow the AGE definition of Fort et al. (2013). This allows us to cover the time period 1981-2013. 12% of the workers are employed in $YOUNG$ firms, 88% in $MATURE$ firms.

Table 24: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.21	0.51***	-0.08	0.62***
		(0.25)	(0.00)	(0.65)	(0.00)
	U	-0.21	-0.44**	0.05	-0.53***
		(0.24)	(0.01)	(0.79)	(0.00)
JDR	GDP	-0.20	-0.38**	-0.14	-0.39**
		(0.26)	(0.03)	(0.44)	(0.02)
	U	0.00	0.23	-0.05	0.32*
		(0.99)	(0.21)	(0.78)	(0.07)
$NJCR$	GDP	0.31*	0.57***	0.05	0.59***
		(0.08)	(0.00)	(0.77)	(0.00)
	U	-0.15	-0.45**	0.08	-0.51***
		(0.40)	(0.01)	(0.66)	(0.00)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

Table 25: Variance Decomposition of Job Flows

Decomposed	$SIZE$			AGE		$AGE/SIZE$				
Rate	S	M	L	Y	M	YS	YM	MS	MM	ML
$NJCR$	0.338	0.312	0.349	0.192	0.808	0.147	0.045	0.191	0.267	0.349
JCR	0.383	0.296	0.322	0.253	0.747	0.208	0.045	0.175	0.251	0.322
JDR	0.305	0.325	0.370	0.147	0.853	0.102	0.046	0.204	0.279	0.370

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

16.2 $YOUNG$ (0-10 years); $MATURE$ (11+ years)

In this robustness sectoin we follow the AGE definition of Pugsley and Şahin (2015). This allows us to cover the time period 1987-2013. 24% of the workers are employed in $YOUNG$ firms, 76% in $MATURE$ firms.

Table 26: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	-0.14	0.48**	-0.54***	0.75***
		(0.50)	(0.01)	(0.00)	(0.00)
	U	0.09	-0.31	0.40**	-0.50**
		(0.67)	(0.12)	(0.04)	(0.01)
JDR	GDP	-0.28	-0.38*	-0.24	-0.22
		(0.16)	(0.05)	(0.23)	(0.28)
	U	0.05	0.20	0.01	0.22
		(0.81)	(0.31)	(0.95)	(0.27)
$NJCR$	GDP	0.12	0.49**	-0.25	0.61***
		(0.54)	(0.01)	(0.21)	(0.00)
	U	0.02	-0.30	0.33*	-0.45**
		(0.92)	(0.12)	(0.09)	(0.02)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Data series are linearly de-trended.

Table 27: Variance Decomposition of Job Flows

Decomposed	$SIZE$			AGE		$AGE/SIZE$				
Rate	S	M	L	Y	M	YS	YM	MS	MM	ML
$NJCR$	0.311	0.323	0.367	0.303	0.697	0.201	0.102	0.110	0.221	0.367
JCR	0.326	0.296	0.378	0.366	0.634	0.261	0.105	0.065	0.190	0.378
JDR	0.300	0.341	0.359	0.260	0.740	0.161	0.099	0.139	0.242	0.359

The table reports the contributions of the individual set of firms in each $SIZE$, AGE, or $AGE/SIZE$ group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

17 Robustness - HP-Filtered Job Flow Rates

17.1 Cyclicality over the Business Cycle

17.1.1 Standard Aggregate Measures

Table 28: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate – HP (390.625)

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.19	0.50***	-0.15	0.62***
		(0.31)	(0.00)	(0.40)	(0.00)
	U	-0.18	-0.48**	0.16	-0.60***
		(0.33)	(0.01)	(0.39)	(0.00)
JDR	GDP	-0.01	-0.31*	0.08	-0.40**
		(0.96)	(0.08)	(0.65)	(0.02)
	U	-0.12	0.20	-0.21	0.38**
		(0.50)	(0.26)	(0.25)	(0.03)
$NJCR$	GDP	0.16	0.53***	-0.19	0.60***
		(0.39)	(0.00)	(0.30)	(0.00)
	U	-0.06	-0.47**	0.30	-0.58***
		(0.76)	(0.01)	(0.10)	(0.00)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows are HP-filtered with parameter 390.625, while aggregate cyclical measures are not HP-filtered.

Table 29: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle – HP (390.625)

	JCR		JDR	
	EXP $-NEW$	$NEW:$ $FIRMS$ $-ESTABS$	$CONT$ $-DEAD$	$DEAD:$ $FIRMS$ $-ESTABS$
GDP	0.59***	0.22	-0.80***	-0.03
	(0.00)	(0.23)	(0.00)	(0.89)
U	-0.50***	-0.12	0.77***	0.02
	(0.00)	(0.50)	(0.00)	(0.93)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows are HP-filtered with parameter 390.625, while aggregate cyclical measures are not HP-filtered.

Table 30: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle – HP (390.625)

	$NEW:$ $FIRMS-ESTABS$		$DEAD:$ $FIRMS-ESTABS$	
	$size$	$entry$	$size$	$exit$
GDP	-0.24	0.50***	-0.20	0.02
	(0.18)	(0.00)	(0.27)	(0.91)
U	0.18	-0.42**	0.22	-0.04
	(0.34)	(0.02)	(0.23)	(0.84)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows are HP-filtered with parameter 390.625, while aggregate cyclical measures are not HP-filtered.

17.1.2 HP-Filtered Aggregate Measures

Table 31: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate – HP (390.625)

		$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.00	0.07	-0.30*	0.22
		(0.98)	(0.69)	(0.09)	(0.23)
	U	0.16	0.17	0.46**	-0.08
		(0.38)	(0.34)	(0.01)	(0.67)
JDR	GDP	0.27	0.12	0.25	-0.01
		(0.13)	(0.52)	(0.16)	(0.94)
	U	-0.08	-0.04	-0.03	-0.03
		(0.67)	(0.81)	(0.85)	(0.88)
$NJCR$	GDP	-0.20	0.01	-0.45**	0.18
		(0.28)	(0.94)	(0.01)	(0.34)
	U	0.19	0.16	0.40**	-0.05
		(0.30)	(0.39)	(0.02)	(0.77)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows and the unemployment rate are HP-filtered with parameter 390.625, GDP is HP-filtered with parameter 6.25.

Table 32: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle – HP (390.625)

	JCR		JDR	
	EXP $-NEW$	$NEW:$ $FIRMS$ $-ESTABS$	$CONT$ $-DEAD$	$DEAD:$ $FIRMS$ $-ESTABS$
GDP	-0.02	-0.28	-0.29	-0.01
	(0.91)	(0.11)	(0.11)	(0.95)
U	0.19	0.44**	0.10	0.07
	(0.30)	(0.01)	(0.59)	(0.70)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows and the unemployment rate are HP-filtered with parameter 390.625, GDP is HP-filtered with parameter 6.25.

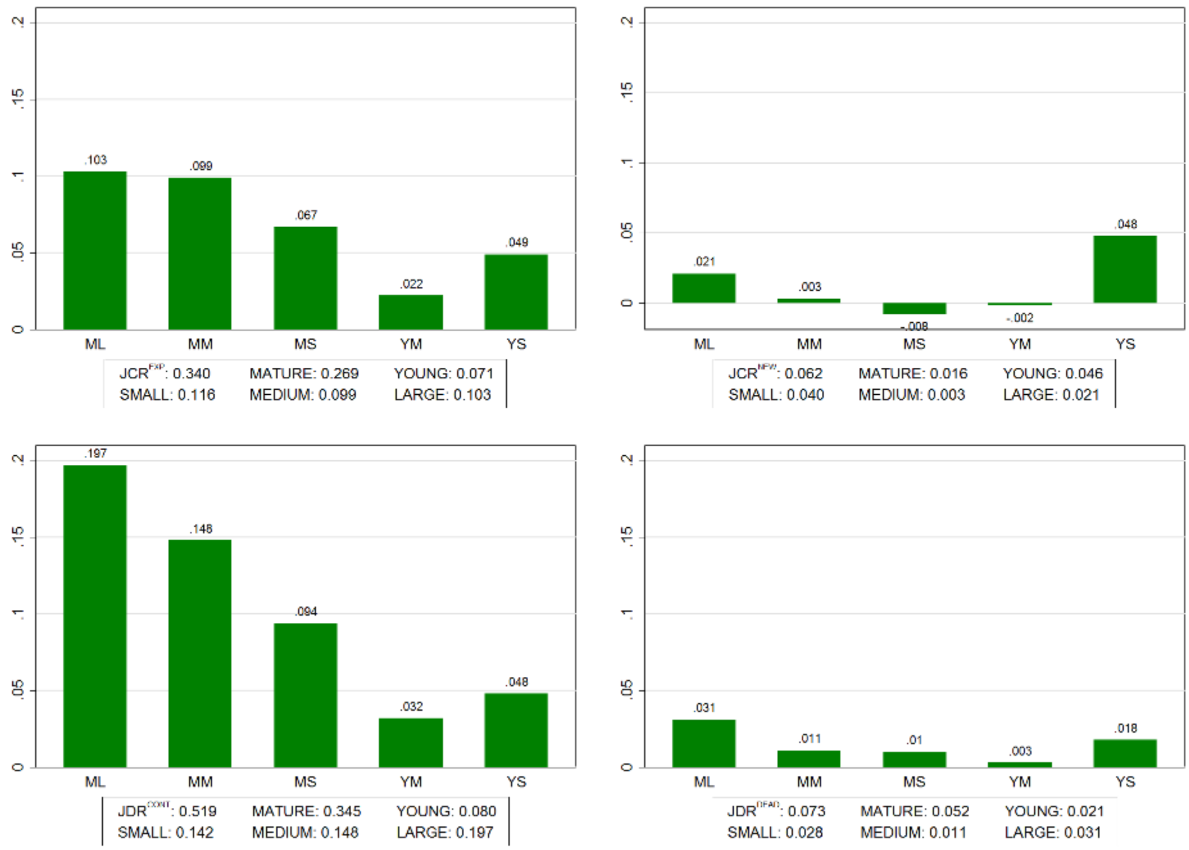
Table 33: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle – HP (390.625)

	$NEW:$ $FIRMS-ESTABS$		$DEAD:$ $FIRMS-ESTABS$	
	size	*entry*	*size*	*exit*
GDP	-0.10	-0.05	0.06	-0.07
	(0.58)	(0.78)	(0.73)	(0.72)
U	0.25	0.10	0.12	-0.04
	(0.16)	(0.59)	(0.51)	(0.83)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flows and the unemployment rate are HP-filtered with parameter 390.625, GDP is HP-filtered with parameter 6.25.

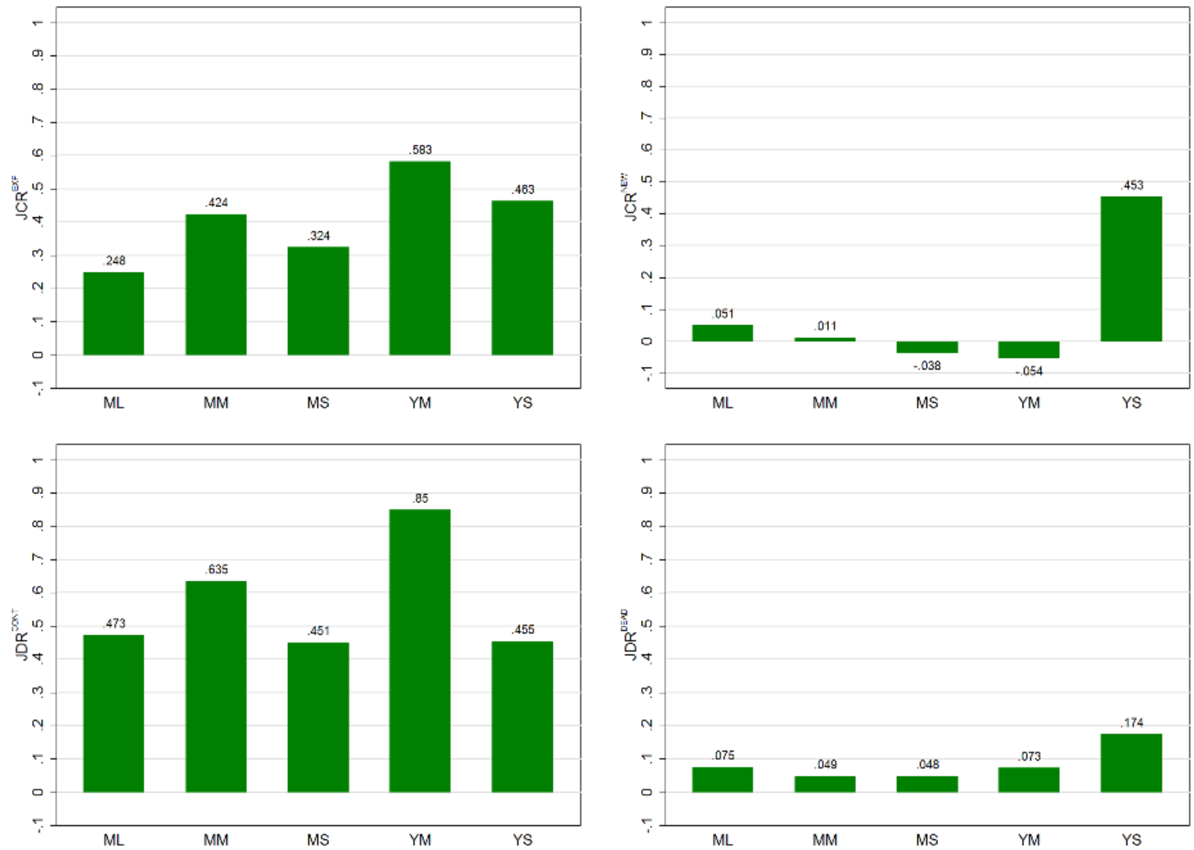
17.2 Contribution to Aggregate Fluctuations over the Business Cycle

Figure 37: Variance Decomposition according to $AGE/SIZE$ – Weighted Results – HP (390.625)



The bar charts report the weighted results of the variance decomposition, which is described in section 2.5. The weight consists of the trend of the employment share of the respective group. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are HP-filtered with parameter 390.625.

Figure 38: Variance Decomposition according to $AGE/SIZE$ – Unweighted Results – HP (390.625)



The bar charts report the results of the variance decomposition, which is described in section 2.5. The period is 1982-2013 and the underlying dataset is from the BDS. The job flow rates are HP-filtered with parameter 390.625. Actual contributions are unweighted as the weighted contributions are divided by the average employment share over the observation period, shown in table 9.

Table 34: Variance Decomposition – HP-Filtered (390.625)

Decomposed Rate	$SIZE$ S	M	L	AGE Y	M	$AGE/SIZE$ YS	YM	MS	MM	ML
$NJCR$	0.322	0.312	0.367	0.214	0.786	0.161	0.053	0.161	0.258	0.367
JCR	0.380	0.295	0.325	0.283	0.717	0.236	0.047	0.144	0.248	0.325
JDR	0.282	0.323	0.395	0.167	0.833	0.110	0.057	0.172	0.265	0.395
JCR^{EXP}	0.335	0.347	0.318	0.203	0.797	0.141	0.062	0.194	0.285	0.318
JCR^{NEW}	0.619	0.016	0.365	0.714	0.286	0.746	-0.032	-0.127	0.048	0.365
JDR^{CONT}	0.270	0.344	0.386	0.151	0.849	0.091	0.060	0.179	0.283	0.386
JDR^{DEAD}	0.364	0.182	0.455	0.273	0.727	0.234	0.039	0.130	0.143	0.455

The table reports the contributions of the individual set of firms in each SIZE, AGE, or AGE/SIZE group to the overall variance of the decomposed rate. For each of the groups, the rows sum to one with some approximation error. The methodology is described in section 2.5.

Table 35: Variance Decomposition of JCR^{NEW} and JDR^{DEAD} – HP-Filtered (390.625)

	size	*entry / exit*
$JCR^{NEW,ESTABS}$	0.096	0.604
$JCR^{NEW,FIRMS}$	0.083	0.201
$JDR^{DEAD,ESTABS}$	0.252	0.576
$JDR^{DEAD,FIRMS}$	0.060	0.069

The table reports the contributions of the the Average Size and the Entry/Exit Rates to JCR^{NEW} and JDR^{DEAD}. The four components for each, JCR^{NEW} and JDR^{DEAD}, sum to one with some approximation error. The methodology is described in section 2.5.

18 Relation to Moscarini and Postel-Vinay (2012)

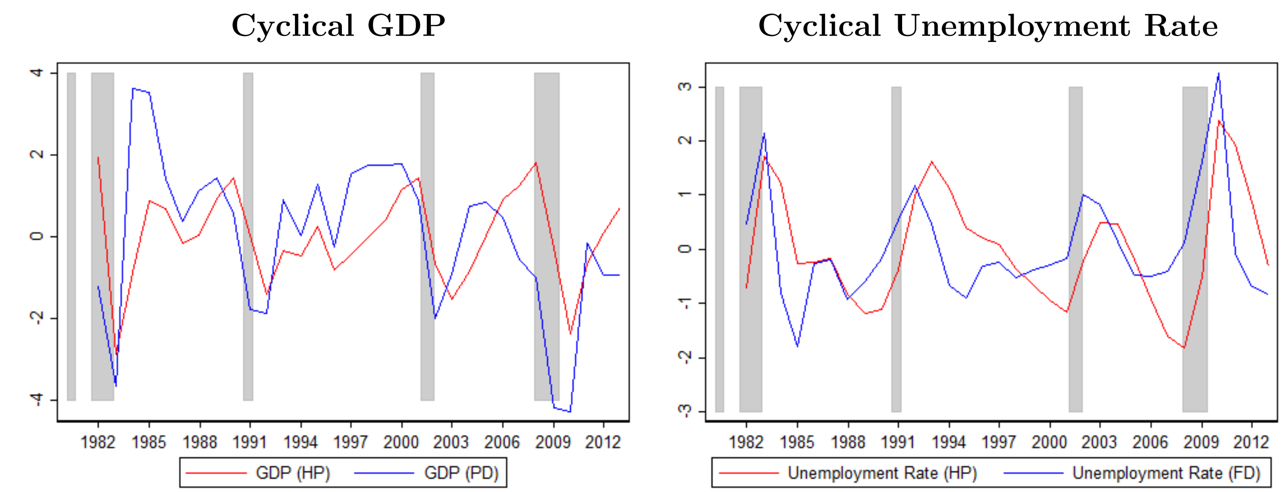
In this section we investigate in detail the correlation analysis of Moscarini and Postel-Vinay (2012) and highlight and explain differences between our results and theirs. In order to do so we start out by highlighting deviations in the set up of the sample, related to the de-trending, the sample period, and the BDS edition.

- First of all, we do not use the HP-filter to de-trend our data series. Neither for the job flow rates nor the cyclical measures. In our baseline specification we investigate deviations from a linear trend instead. However, this change does not turn out to matter much as can be seen in appendix 17.1.1, because the high smoothing parameter of Moscarini and Postel-Vinay (2012) leads to an HP-trend that is very close to a linear trend. Instead, what really changes results are the different cyclical measures as already seen in appendix 17.1.2. While we focus on growth rates of real GDP and first differences of the unemployment rate, Moscarini and Postel-Vinay (2012) measure the business cycle conditions by HP-filtering GDP and unemployment. To be more precise, they HP-filter the log of real GDP with the common smoothing parameter and the unemployment rate with the high smoothing parameter suggested by Shimer.[47]. Figure 39 shows that the timing of the aggregate cyclical

[47] Their parameter for quarterly GDP is 1600, which corresponds to our annual parameter of 6.25. The high

indicators is different.

Figure 39: Comparing the De-Trending of Aggregate Cyclical Indicators



The left graph plots the HP-filtered real GDP (parameter 6.25) as well as the growth rates of real GDP. The growth rates are de-meaned. The right graph shows the HP-filtered unemployment rate (parameter 390.625) as well as the first differences of the unemployment rate. Data are annual and downloaded from FRED.

- A further difference stems from the fact that Moscarini and Postel-Vinay (2012) do not investigate the role of firm AGE. Therefore, they start already in 1979 instead of 1982 and do not exclude the group of $YOUNG/LARGE$ firms from the sample.

- The last difference is related to the edition of the BDS. While all their results are based on the 2009 edition of the BDS, we rely on the updated 2013 edition. As we described in section 2.1, there are possible differences between editions due to further knowledge of links over time as well as re-balancing in census years.

In table 36 we report the coefficients of correlations with the HP-filtered cyclical measures in the same way as Moscarini and Postel-Vinay (2012), i.e. high smoothing parameter for the unemployment rate and the standard parameter for real GDP. We start out from our baseline sample in column (1) in which we use our linear detrended job flow rates, but HP-filtered cyclical measures. The results are very similar to the ones for the HP-filtered job flow rates in column (2), underlining that the de-trending does not matter much for the job flow rates. But at the same time the results show that the findings of Moscarini and Postel-Vinay (2012) are not valid for our sample. The main coefficient of interest for Moscarini and Postel-Vinay (2012) is the correlation coefficient between the cyclical size differential and the cyclical unemployment rate. In our case this correlation is estimated insignificant with a coefficient of 0.19, which at least goes in the right direction, but still shows that their result is not found in our sample. In general, we do not find any significant differences in the cyclical sensitivity of large and small firms independent of the cyclical measure or the specific job flow rate.
It turns out that the result is highly dependent on the period of observation. If we constrain our sample to the sample period of (Moscarini & Postel-Vinay, 2012), i.e. 1979-2009, in column (3) we find support for their result. And even more so when we also include the $YOUNG/LARGE$

monthly smoothing parameter of 8.1E6, which was suggested by Shimer, corresponds to 390.625 on an annual level.

firms in column (4). However, even then the correlations with GDP are not statistically significant. Only when we move to the old 2009-edition of the BDS, we find stronger support for their results. In column (6) we redo their correlation analysis and find, as expected, almost exactly the same coefficients. They estimate this correlation to be highly significant with a coefficient of 0.52.[48] The only differences between column (3) and (5) as well as (4) and (6) are the BDS editions. Therefore, the results highlight that with the update of the BDS, the results of Moscarini and Postel-Vinay (2012) are weakened.

Table 36: Correlations of $SMALL - LARGE$-Differential with GDP and Unemployment Rate

Period		(1) 1982-2013	(2) 1982-2013	(3) 1979-2009	(4) 1979-2009	(5) 1979-2009	(6) 1979-2009	(7) 1979-2009
$YOUNG/LARGE$ firms included		NO	NO	NO	YES	NO	YES	YES
De-Trending of Flows		LT	HP	HP	HP	HP	HP	HP
Cyclical Indicator		HP	HP	HP	HP	HP	HP	Standard
BDS Edition		2013	2013	2013	2013	2009	2009	2009
JCR	GDP	0.00	0.00	-0.01	-0.01	0.03	0.06	0.20
		(0.98)	(0.98)	(0.95)	(0.95)	(0.89)	(0.75)	(0.29)
	U	0.15	0.16	0.26	0.25	0.13	0.08	-0.21
		(0.41)	(0.38)	(0.15)	(0.17)	(0.49)	(0.65)	(0.26)
JDR	GDP	0.22	0.27	0.36*	0.42**	0.48**	0.53***	0.08
		(0.23)	(0.13)	(0.05)	(0.02)	(0.01)	(0.00)	(0.67)
	U	-0.16	-0.08	-0.30	-0.36*	-0.45**	-0.49**	-0.29
		(0.38)	(0.67)	(0.10)	(0.05)	(0.01)	(0.01)	(0.11)
$NJCR$	GDP	-0.17	-0.20	-0.24	-0.29	-0.35*	-0.39**	0.07
		(0.34)	(0.28)	(0.19)	(0.11)	(0.05)	(0.03)	(0.69)
	U	0.25	0.19	0.38**	0.42**	0.43**	0.47**	0.10
		(0.17)	(0.30)	(0.03)	(0.02)	(0.01)	(0.01)	(0.61)

The table reports correlation coefficients and p-values of differential job flow rates with the cyclical aggregate measure (Unemployment Rate or GDP). The differential is computed by simply subtracting the two respective job flow rates. Job flow rates as well as the unemployment rate are HP-filtered with parameter 390.625. log(GDP) is HP-filtered with the standard parameter 6.25.

[48]Keep in mind that we defined the size differential in the opposite way, i.e. $SMALL$ - $LARGE$, while Moscarini and Postel-Vinay (2012) defined it as $LARGE$ - $SMALL$. Therefore, we flipped the signs of their correlation coefficients. The remaining slight differences in the correlation coefficients could stem from the fact that we use more recent time series for the aggregate variables from FRED. Furthermore, Moscarini and Postel-Vinay (2012) HP-filter the entire available time series for the aggregate variables and not only the sample period.