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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Who Creates and Destroys Jobs over the Business Cycle?*

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Abstract

Using US annual data spanning four decades and several business cycles, we show that that job flow rates of young firms are more cyclical than those of mature firms and detect no difference between the cyclicality of job flow rates of small and large firms. Further, we find that job flow rates due to contractions and expansions of continuing establishments are more cyclical than those due to entry and exit. At the same time the job flow rates of mature firms provide a larger contribution to the overall variability of aggregate job flow rates with respect to those of young firms. The reason is that mature firms employ the vast majority of US workers, and the fraction of aggregate variability of aggregate job flows explained by the job flow of firms belonging to a specific category is proportional to the category's employment share. On the contrary, there is no relevant difference in the contribution to aggregate fluctuations between the job flow rates of firms of different sizes. Our findings hold independently of whether we focus simply on the Great Recession period or on the full sample.

Keywords: Job Creation, Job Destruction, Business Cycle, Small Firms, Large Firms, Young Firms, Mature Firms

JEL: : D22, E23, E32, J23, L25

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1 Introduction

This paper studies the business cycle properties of job flow rates (JFR) in the US between 1976 and 2013. Each year, many firms expand and many others contract. New businesses enter, while others exit or gradually disappear from the market. These businesses have different features in terms of size, age and number of establishments. In the US, these dynamics lead to high rates of job creation and job destruction in almost every time period. We propose three alternative decompositions of the aggregate Job Creation Rate (JCR), the Job Destruction Rate (JDR) and the Net Job Creation Rate (NJCR). Each decomposition exploits specific features of the firms that generated the JFR under study. The first decomposition exploits the age dimension, distinguishing between young and mature firms, the second one exploits the size dimension, distinguishing between small, medium and large firms, the third one distinguishes between the extensive an intensive margin of job creation. The intensive margin refers to firms that create/destroy jobs by expanding/contracting existing establishments, the extensive margin refers to firms which create/destroy jobs through the creation/destruction of establishments. With the decompositions just described we aim at understanding whether the JFR of young or mature firms comove more markedly with the business cycle, and whether the job flows of young or mature firms contribute more sizable to the overall variability of aggregate job flow rates. We ask the same questions with regard to the size dimension and with respect to the intensive and the extensive margins of job flows. The answers to these questions are central to evaluate the role of different firms in the process of job creation and job destruction and could be used as a set of stylized facts for an industry model with heterogeneous firms and job flows. We uncover three main facts:

Fact 1: Firms Age. Job flow rates of young firms are more cyclically sensitive than those of mature firms. Job flow rates of mature firms provide a larger contribution to the overall variability of aggregate job flow rates.

Fact 2: Firms Size. There is no difference between the cyclicality of firms of different size. Similarly, there is no difference between the contribution of Job flow rates of firms of different sizes to the overall variability of aggregate job flow rates.

Fact 3: Extensive and Intensive Margins of Job Flows. The intensive margin of job flow rates is more cyclical than the extensive one and provides a larger contribution to the overall variability of job flow rates.

To establish these facts we use the Business Dynamics Statistics (BDS) database, provided by the US Census. The BDS database contains information on establishment-level job flows and employment stocks for continuing, entering and exiting establishments at an annual frequency for the period 1976 to 2013.[1] The extended time span of the data set allows the comparison of the dynamics of job flow rates over several business cycles. Our analysis focuses on the Great recession period, but we show that Facts 1-3 extend to the whole sample period. A firm is defined as a collection of all its establishments. The age of a firm is defined by the age of its oldest establishment. We define as YOUNG those firms which are young than five years. Firm size is measured as the sum of all employees in its establishments at the beginning of a given period. Small firms are those with less than 50 employees, medium size firms have between 50 and 1000 employees, finally large firms have more than 1000 employees.

[1]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 an Economic Census year in which the quality of the underlying microdata is higher.

Facts 1 and 2 are at a first glance, inconsistent with each other. While Facts 1 suggest that young firms have job flows which are more variable than those of mature firms over the business cycle, Fact 2 suggests that mature firms contribute the most to the business cycle variability of aggregate job flow rates.

The reason is that mature firms employ the vast majority of US workers. We find that the the employment share of young firms is, on average over the sample considered, about 30%, while the remaining 70% of workers are employed at mature firms. The fraction of aggregate variability explained by a firm category is proportional to its employment share. Employment shares are, thus, crucial in understanding the contribution of alternative categories of firms to aggregate fluctuations in JFRs. Facts 1 and 2 suggest that the key dimension to consider in order to understand the business cycle properties of JFRs of alternative firms is age and not size. This is so when it comes to understand both the cyclicality of job flows over the business cycle and the contribution to aggregate fluctuations.

Common wisdom suggests JFRs due to opening and closing of establishments to comove markedly with the business cycle. Fact 3 suggests the contrary. JFRs of incumbent firms which expand and contract existing establishments are more cyclical than JFRs due to the entry and exit of establishments. The intensive margin also contribute the most to explain the business cycle variability of aggregate JFRs. This is so since the employment share of continuing firms, those which expand or contract existing establishments, is much larger than the employment shares of entrants or exiters. Our results hold independently of whether we focus simply on the Great Recession period or on the full sample available.

There is, however, one relevant aspect which suggests that the great recession was different with respect to other recessions. The Great recession is in fact the only recession episode, among those we study, where the extensive margin of the NJCR assumed a negative value. In other words, during the great recession job destruction due to exit of establishments was larger than job creation due to the opening of new establishments. During previous recession episodes the extensive margin of job creation consistently offered a positive contribution to employment growth.[2]

To thoroughly investigate this aspect, we propose a further decomposition of the extensive margin of job creation. Namely, we distinguish between establishments creation and destruction due to entry and exit of firms and that due to expansions and contractions of continuing firms. The literature usually neglects this distinction. However, there are good reasons to draw it, specially if we consider the creation channel. Startups, i.e. newly created firms, have a narrower set of instruments through which they receive credit with respect to incumbent firms. Fort et al. (2013)(FHJM (2013) henceforth) point out that startups do not have access to commercial paper or corporate bonds, but often rely on personal sources of finance to establish credit lines. For this reason a reduction in available credit, as that observed during the Great Recession, may be particularly harsh on startup creation and thus on job creation by startups.

The proposed decomposition of the extensive margin suggests that there are both differences and similarities between the two dimension of the extensive margin of JFRs. Among the differences we find that incumbent firms tend to create and to close establishments that are larger with respect to those of startups. Entry an exit rates of establishment due to entry/exit of firms are instead higher. The business cycle analysis suggests there is no statistically relevant difference between the cyclicality of JFRs due to entry and exit of firms and that due to creation and destruction of establishments by continuing firms. The analysis of JFRs during the Great Recession shows that the negative contribution to employment growth coming from the extensive margin described above is entirely due to entry and exit and not to the JFRs coming from establishments opened and closed by continuing firms.

[2]Notice that the NJCR is the difference between the JCR and the JDR. The NJCR is, by definition and in any given period, identical to the change in employment.

There is a growing scientific interest in determining the cyclicality of large versus small and of young versus mature firms. Papers closely related to ours are Moscarini and Postel-Vinay (2012) (MPV (2012) henceforth), FHJM (2013) and Pugsley and Sahin (2019). While MPV (2012) show that large firms are more cyclically sensitive compared to small firms in periods of high and low unemployment, FHJM (2013) highlight the importance of firm age and argue that small-young firms were hit particularly severely during the Great Recession. Pugsley and Sahin (2019) document a strong decline in firm entry and a shift of employment toward older firms since 1980. They argue that these two facts explain the jobless recoveries in the U.S. economy in the aftermath of the Great Recession. Our findings are closer to those of FHJM (2013). With respect to theirs, our analysis suggests that young firms are more cyclical than mature ones independently of size, but that mature firms are key when it comes to explain aggregate fluctuations. Our results differ from MPV (2012) mainly for the two following reasons:[3] First, the updated 2013 version of the BDS weakens the results of MPV (2012). In particular, the correlations with cyclical GDP do not turn out significant any more. Cyclical job flows of large firms are still strongly correlated with the cyclical unemployment rate. Second, results are estimated with lower magnitudes and insignificant when the sample period is adjusted to our sample period 1982-2013. This indicates that the results of MPV (2012) vanish once the analysis is extended to more recent data.

The remainder of the paper is organized as follows. Section 2 describes the data set and outlines the age and size categories we adopt. Section 3 defines the decompositions of aggregate JFRs used in the analysis. Section 4 outlines the empirical methodology. Section 5 contains results relative to the period of the Great Recession, while Section 6 extends the analysis to the period 1982-2013. Section 7 concludes.

2 Data

As mentioned in the Introduction, the analysis is based on the Business Dynamics Statistics (BDS) database. The BDS dataset is often used to analyze cyclical labor flows despite being on an annual frequency. Since it covers a long period, starting from the late 1970's, it allows to analyze several business cycles.[4] It is provided by the US Census and covers approximately 98 percent of the nonfarm private-sector employment in the United States.[5] 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. 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. The first one is *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*.[6] The second measure reported is the *average firm size* between year

[3] We discuss all relevant differences extensively in Appendix B.

[4] 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.

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

[6] 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 et al. (1996, p. 62ff.) provide a further discussion including numerical examples of this issue.

$t-1$ and year t.[7]

Employment for an 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 $t-1$ and 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. Since in the remainder we distinguish between firms which are 6 years or older from younger ones, we can start our analysis only in 1982. Our sample period is, thus, restricted to the years from 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 MPV (2012) and re-classify new firms according to their 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.[8]

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.

2.1 Size, Age and Employment Shares

We classify firms according to age and size. We define size categories as follows: small firms are those with less than 50 employees, medium size firms have between 50 and 1000 employees, finally large firms have more than 1000 employees. Our classification is in line with the size classification applied by MPV (2012). FHJM (2013), in contrast, define small firms more restrictively by applying lower size cut-offs. We define as young firms those with 5 years or less, while mature firms are 6 years or older. Clearly new firms, those with zero age, are classified as young firms. Throughout the analysis we use three groups, $GROUPS = \{AGE, SIZE, AGE/SIZE\}$, to investigate the role of age and size. The individual groups are composed of the following set of firms:

- $AGE = \{YOUNG, MATURE\}$

[7]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. MPV (2012) have shown that this bias is not strongly pronounced for the BDS at the cyclical frequency.

[8]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.

- $SIZE = \{SMALL, MEDIUM, LARGE\}$
- $AGE/SIZE = AGE \times SIZE$[9]

Figure 1 provides a concise description of the data in terms of the *AGE/SIZE* categories we have introduced. The left panel displays the distribution of the number of firms according to *AGE/SIZE* categories. The right panel instead reports the distribution of employment shares using the same classification. The figures represent averages over the full sample. Small firms are predominant. Although, *MATURE/LARGE* firms represent just a small fraction of firms, they employ more than 40 percent of workers in the US.
The left panels of figure 2 display the dynamics of the share of firms over time. In line with Pugsley and Sahin (2019), the plots suggests that the share of mature firms in the US economy has increased over time at the expenses of the share of young firms. This is mainly due to an increase in the share of *MATURE/SMALL* firms. The distribution of firms in terms of the three size bins we consider has instead been constant over time. The right panels of figure 2 provides, instead, the evolution over time of employment shares. These will prove useful in the remainder. The top left panel focuses on *AGE*, the top right panel on *SIZE*, and the bottom panel on *AGE/SIZE* categories. The Employment shares of mature firms increased by about 8 percentage point from 1987 to 2013.[10] Considering size we observe an increase of the employment share of large firms in the last decade together with a decline in the employment share of small firms. *AGE/SIZE* categories show instead a mild upward trend for *MATURE/LARGE* and a mildly negative one for *YOUNG/SMALL*. Thus, the employment shares of *AGE/SIZE* categories are quite stable over time.

3 Job Flow Rates

There is no dominant measure for cyclical job flows in the literature: both, levels and rates are adopted. Since our purpose is that of studying the cyclical behavior of the employment growth of different firms, we will consider job flow rates as defined below. This allows comparison with the recent studies by MPV (2012) and FHJM (2013). The net job creation rate ($NJCR_t^s$) of firms category s between time $t-1$ and t, for $s = SIZE, AGE, AGE/SIZE$, is defined as the difference between the job creation rate (JCR_t^s) and the job destruction rate (JDR_t^s)

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

where $E_{e,t}^s$ represents the employment at time t of an establishment that belongs to group s.[11] Subset s^+ collects establishments which created jobs between $t-1$ and t, while subset s^- those which destroyed jobs in the same period.
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.

[9] The group of *YOUNG/LARGE* is dropped from the analysis as will be discussed in section 3.
[10] Pugsley and Sahin (2019) identify a much larger increase, about 12 percentage points, due to the different definition of matures firms. Their mature firms are 11 years or older.
[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.

3.1 Age and Size

The dynamics of job flows rates for each category of firms over the relevant sample are depicted in Figure 3. Panels in the left side of the figure depict job flow rates of young firms according to size, while those on the right side refer to mature firms. We do not consider the group of *YOUNG/LARGE* firms. Their rates are very erratic, because there are not many firms entering the market with more than 1000 workers. Further, BDS does not disclose information in many years, since 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. For this reason, all aggregates have been re-computed neglecting the existence of *YOUNG/LARGE* firms in the economy. However, notice that *YOUNG/LARGE* firms account for only about 1 percent of overall job flows and employment.

Figure 3 shows that the job flow rates of young firms do not show visible time trends, but mostly business cycle variations. It also shows a large difference between the level of job flow rates of young firms of different sizes. *YOUNG/SMALL* firms have a much higher JCR than *YOUNG/MEDIUM* and at the same time a much lower JDR. This results in a NJCR of *YOUNG/SMALL* firms which is persistently positive over the period considered, as opposed to that of *YOUNG/MEDIUM* which is persistently negative.

However, when we investigate this issue further by dropping the job flows due to entering firms, represented in panels a) and b) with a dotted line, we find that also the net job creation rate of *YOUNG/SMALL* is on average negative. This finding highlights the importance of the entry margin for overall job creation.

Turning to mature firms, there appears to be a downward trend in their JCRs. Further, and contrary to what we observed for *YOUNG* firms, there are no major differences between the levels of the job flow rates of mature firms of different sizes. They are within a small bandwidth and are lower with respect to those of *YOUNG* firms. Importantly, the NJCRs of mature firms take negative values for prolonged periods of time. This suggests that employment decreases as firms grow older.[12]

3.2 Intensive and Extensive Margins of Job Flows

In this section we decompose the aggregate JCR, JDR and NJCR into an extensive and an intensive margin at the establishment level. To understand this decomposition, consider aggregate job creation. The latter can be decomposed into job creation by new establishments, the extensive margin of job creation, and job creation by expanding establishments, the intensive margin. Expanding establishments are those which where already existing at time $t-1$, and increase their workforce between time t and time $t-1$. Formally, aggregate job creation can be written as

$$JC_t = JC_t^{new} + JC_t^{exp}$$

where JC_t^{new} is the number of jobs created by new establishments, and JC_t^{exp} that created by expanding establishments. Dividing both sides by E_t we obtain the desired decomposition of the aggregate JCR_t in an extensive and an intensive margin[13]

$$JCR_t = \underbrace{\frac{JC_t^{new}}{E_t}}_{\text{extensive margin}} + \underbrace{\frac{JC_t^{exp}}{E_t}}_{\text{intensive margin}} \tag{2}$$

An equivalent decomposition, and interpretation, applies to job destruction. To see this, notice that jobs can be destroyed because establishments go out of the market or because firms contract the size of their existing establishments. We denote the number of jobs destroyed due to establishment exit by JD_t^{death}, while the

[12] This finding is not dependent on the size cut-offs and we find the same patterns for the size cut-offs of FHJM (2013).

[13] Notice that the ratios at the RHS do not represent rates. However, our interest is that of proposing a decomposition of JFRs in an extensive and in an intensive margin and not necessarily that of decomposing aggregate JFRs into rates.

number of job destroyed because of contraction by existing establishments by JD_t^{cont}. As a result we can decompose the aggregate job destruction rate as

$$JDR_t = \underbrace{\frac{JD_t^{death}}{E_t}}_{\text{extensive margin}} + \underbrace{\frac{JD_t^{cont}}{E_t}}_{\text{intensive margin}} . \tag{3}$$

Finally we use the decompositions just provided to decompose the $NJCR_t$ into an extensive and an intensive margin as well. Indeed:

$$NJCR_t = \underbrace{\frac{JC_t^{new}}{E_t} - \frac{JD_t^{death}}{E_t}}_{\text{extensive margin}} + \underbrace{\frac{JC_t^{exp}}{E_t} - \frac{JD_t^{cont}}{E_t}}_{\text{intensive margin}}$$

Figure 4 exploits the decompositions of job flows into extensive and intensive margins. Panel (a) displays the decomposition of the job creation rate; panel (b) does the same for the job destruction rate and panel (c) for the net job creation rate. The intensive margin of both, the JCR and the JDR, is quantitatively more sizable than the extensive margin. More importantly for our purposes is to notice that the intensive margin contributes negatively to net job creation during all the recession episodes included in the sample. On the contrary, the extensive margin provides a positive contribution to net job creation even during recessions, with the notable exception of the Great Recession. To thoroughly investigate this aspect, in the next section we propose two additional decomposition of the extensive margin of the job creation rate.

3.2.1 The Extensive Margin: Firms and Establishments

Entry or exit of establishments are often associated with the entry or exit of a firm. However, establishment creation (destruction), is also a job creation (destruction) channel for incumbent firms that expand (contract). In this section we distinguish between establishments creation and destruction due to entry and exit and that due to expansions and contractions of incumbent firms.[14]

The literature usually neglects this distinction and looks at the job flows of all entrants or exiters.[15] However, there are good reasons to make this distinction, specially if we consider the creation channel. Startups have a narrower set of instruments through which they receive credit with respect to incumbent firms. FHJM (2013) point out that startups do not have access to commercial paper or corporate bonds, but often rely on personal sources of finance to establish credit lines. For this reason a reduction in available credit, as that observed during the Great Recession, may be particularly harsh for job creation by startups.

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 incumbent firms are labeled with *Estabs*. As a result we can write the extensive margin of job creation as the sum of two components as follows:

$$\frac{JC_t^{new}}{E_t} = \frac{JC_t^{Firms}}{E_t} + \frac{JC_t^{Estabs}}{E_t}$$

The first term at the right hand side is the employment fraction of new firms, while the second term represents the fraction of employment hired at new establishments of expanding firms. We can similarly decompose the

[14]An alternative decomposition is to decompose the job creation of NEW and $DEAD$ firms at the firm level, similar to Pugsley and Sahin (2019). 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. Note further that when computing the contribution to employment growth, Pugsley and Sahin (2019) 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.

[15]A notable exception is the work of Pugsley and Sahin (2019). 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".

extensive margin of the job destruction rate

$$\frac{JD_t^{death}}{E_t} = \frac{JD_t^{Firms}}{E_t} + \frac{JD_t^{Estabs}}{E_t}$$

and the extensive margin of the net job creation rate

$$\underbrace{\frac{JC_t^{new}}{E_t} - \frac{JD_t^{death}}{E_t}}_{\text{extensive margin of NJCR}} = \left(\underbrace{\frac{JC_t^{Firms}}{E_t} - \frac{JD_t^{Firms}}{E_t}}_{\text{extensive margin: firms}}\right) + \left(\underbrace{\frac{JC_t^{Estabs}}{E_t} - \frac{JD_t^{Estabs}}{E_t}}_{\text{extensive margin: establishments}}\right)$$

Figure 5 displays the decompositions of the extensive margins just presented. Panel (a) refers to the JCR, panel (b) to the JDR and panel (c) to the NJCR. Panel (a) and (b) show a lower job creation and higher job destruction from new firms. Panel (c) shows that the negative contribution of the extensive margin to the aggregate NJCR during the Great Recession is entirely due to new firms. That is, net job creation by new firms during the Great Recession was negative to an extent that prevailed over the positive net job creation coming from new establishments of expanding firms.

3.2.2 Relative Size, Entry and Exit Rates of New Establishments

In order to understand what drives the different behavior in job creation between New Establishments and New Firms we propose a final decomposition of the job creation and destruction by new establishments. Specifically, the ratio $\frac{JC_t^{new}}{E_t}$ can be written as

$$\frac{JC_t^{new}}{E_t} = s_t^{new} entry_t, \tag{4}$$

where $s_t^{new} = \frac{\frac{JC_t^{new}}{N_t^{new}}}{\frac{E_t}{N_t}}$ is the relative size of new establishments and $entry_t = \frac{N_t^{new}}{N_t}$ is the entry rate of new establishments. The suggested decomposition highlights the role of entry in the job creation process. Further, it emphasizes that, aggregate job creation as well as job creation by new establishments is characterized by two dimensions. An intensive one related to the relative size of new establishments, and an extensive one, connected to the entry rate of new establishments. Both dimensions can vary over the business cycle, affecting the cyclical properties of job creation by new entrants. Notice that we can compute entry rates and average sizes for both establishments created by new firms and establishments created by expanding firms such that

$$\frac{JC_t^{new}}{E_t} = s_t^{new,firms} entry_t^{new,firms} + s_t^{new,estabs} entry_t^{new,estabs}$$

Similar decompositions apply to the Job destruction by dying establishments

$$\begin{aligned} \frac{JD_t^{death}}{E_t} &= s_t^{death} exit_t \\ &= s_t^{death,firms} exit_t^{death,firms} + s_t^{death,estabs} \end{aligned} \tag{5}$$

Symmetrically with respect to the case of job creation, the latter decomposition highlights that the role of exit for job destruction, decomposing it into an intensive and an extensive dimension.

Figure 6 shows the dynamics of the relative sizes and the entry rate of new establishments also distinguishing between firms and establishments belonging to incumbent firms. Incumbent firms create larger establishments with respect to new firms, while the entry rate of establishments created by new firms is larger than that of incumbent firms. Similarly, establishments closed by incumbent firms are larger than those belonging to firms going out of the market and the exit rate of establishments belonging to firms going out of the market is higher than that of establishment belonging to contracting firms. The negative contribution to the extensive margin of net job creation coming from firms during the Great Recession is due to a combined increase in the exit rate of firms and to a decrease in their entry rate. On the contrary the relative size of establishment created and closed by new firms and by firms going out of the market do not display relevant variations during the Great Recession.

4 Methodology

4.1 Comovement

In this section we study the business cycle dynamics of the job flows of the categories of firms, in terms of *AGE* and *SIZE*, that we have outlined. We take real GDP growth and changes in the unemployment rate as our cyclical indicators. For output we use the seasonally adjusted GDP in chained 2005 prices from FRED.[16] Data are 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). Following MPV (2012), the unemployment rate at time t is defined over the period March $t-1$ to February in period t. Again, the data comes from FRED and is averaged over the year.[17] The cyclical unemployment rate is described by the first differenced data series. Cyclical indicators are plotted in figure 7. 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 adopted to define turning points of NBER recessions. The dynamic correlations between the unemployment rate and GDP uncovers 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).
As mentioned above job flow rates are characterized by, albeit slight, long run trends. For this reason we de-trend job flow rates using a linear time trend.[18] We denote with $\overline{X_t}$ the trend component of each series, and with $\widetilde{X_t}$ the cyclical component measured as the deviation from the trend

$$\widetilde{X_t} = X_t - \overline{X_t} \tag{6}$$

We then compute the contemporaneous correlation, and its statistical significance, between the cyclical components of job flows and the cyclical indicators described above.
An implicit assumption is that the life-cycle dynamics and the business cycle properties of our groups of firms are essentially unchanged over the time period considered. Pugsley and Sahin (2019) show that this is indeed the case.

4.2 Contribution to Aggregate Fluctuations

In the remainder we study the relative contribution to aggregate fluctuations in job flows by the different groups of firms. We will do this resorting to two complementary methodologies. The first one simply

[16]Series code: GDPC96. Available at `https://research.stlouisfed.org/fred2/series/GDPC96`
[17]Series code: UNRATE. Available at: `https://research.stlouisfed.org/fred2/series/UNRATE`
[18]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. Appendix figure A.2 plots the job flow rates according to the linear de-trended, HP-filtered, and de-meaned data series. A visual inspection shows that there are no major differences between the de-trending methods. The cyclical correlations, however, give different predictions as we will discuss later on.

decomposes the deviations from the trend of an aggregate job flow into the components due to each category of firms under analysis. The second one is, instead, a variance decomposition. The first methodology amounts, thus, to a decomposition of the level of the deviations, while the second one is a decomposition of the variance of the deviations.

We will illustrate both methodologies through an example, starting from the first one. Consider the aggregate JCR_t. The latter can be decomposed using the job creation rate of the $AGE/SIZE$ categories we have considered as follows

$$JCR_t = \sum_{s=1}^{n} \omega_{st} JCR_t^s,$$

where ω_{st} are the employment shares of each category. In order to recover cyclical components we apply a first order Taylor expansion of JCR_t around its trend $\overline{JCR_t}$. The JCR_t is, up to first order, equal to

$$JCR_t = \overline{JCR_t} + \sum_{i=1}^{n} \left[\overline{\omega_{i,t}}(JCR_t^i - \overline{JCR_t^i}) + \overline{JCR_t^i}(\omega_{i,t} - \overline{\omega_{i,t}}) \right] \tag{7}$$

rearranging

$$\widetilde{JCR}_t = \sum_{i=1}^{n} \left[\overline{\omega_{i,t}} \widetilde{JCR}_t^i + \overline{JCR_t^i} \widetilde{\omega_{i,t}} \right] \tag{8}$$

Using the latter decomposition we can identify the contribution of each $AGE/SIZE$ group to the deviation of the aggregate rate in each individual time period.

The terms $\overline{\omega_{s,t}} \widetilde{JCR}_t^s$ identifies the deviation due to the variability of the job creation rate of firm category s, weighted by the trend value of the employment share. The term $\overline{JCR_t^i} \widetilde{\omega_{i,t}}$ gives the amount of the deviation explained by the variability of the employment weight of firms category s, weighted by the trend value of the corresponding JCR.

Next we outline the variance decomposition. Consider again the decomposition in (8). The variance of $\widetilde{JCR}_t$ is then:

$$Var(\widetilde{JCR}_t) = \sum_{i=1}^{n} Cov(\widetilde{JCR}_t, \overline{\omega_{i,t}} \widetilde{JCR}_t^i) + Cov(\widetilde{JCR}_t, \overline{JCR_t^i} \widetilde{\omega_{i,t}}) \tag{9}$$

the term $Cov(\widetilde{JCR}_t, \overline{\omega_{s,t}} \widetilde{JCR}_t$ gives the amount of variation in $\widetilde{JCR}_t$ which is explained by $\overline{\omega_{s,t}} \widetilde{JCR}_t^s$, while the term $Cov(\widetilde{JCR}_t, \overline{JCR_t^s} \widetilde{\omega_{s,t}})$ provides the amount of variation in $\widetilde{JCR}_t$ explained by $\overline{JCR_t^s} \widetilde{\omega_{s,t}}$.

The variance decomposition allows to understand which categories of firms, in terms of AGE and $SIZE$, contribute the most to the variability of aggregate fluctuations on average over a given time period. The first methodology we propose, instead, suggests which category of firms is more important when it comes to understand the amplitude of fluctuations at each point in time. Equations (8) and (9) highlights the importance of the employment shares , ω_{st} , when it comes to explain the variability of an aggregate JFR under both methodologies.

5 The Great Recession

We conduct our analysis in two steps. In the first one we focus on the period of the Great Recession, then we extend the analysis to the full sample period.

During the Great Recession many jobs were destroyed and fewer jobs than usual were created, leading to a net loss of jobs. We wish to understand whether different firms were hit asymmetrically in terms of the net job creation rate, the job creation rate, and the job destruction rate. To answer this question we plot differential job flow rates between different groups of firms and compute the correlation of the differentials with our cyclical indicators.

The data allows us to distinguish effects of age and size so that we can contribute to the discussion on whether small firms or rather young firms are hit harder.[19] In addition, we will investigate the behavior of the extensive and intensive margins of job creation and destruction. Unfortunately, the empirical analysis is limited to few annual observations available for the period of the Great Recession. A potentially more interesting question is how much the different groups of firms contribute to the aggregate employment fluctuations during the Great Recession. Since the Great Recession period is composed just of nine quarters, a variance decomposition is not the appropriate tool to study the contribution of different categories of firms to aggregate fluctuations. For this reason, in this section we just resort to the first methodology explained in section 4.2, namely the decomposition of the deviations of aggregate jobs flows into the deviations of individual job flows and employment weights.

5.1 The Role of Age and Size

5.1.1 Comovement

Figure 8 displays job flow rates during the period 2005-2013. We report deviations of the job flow rates from their linear trend, computed over the entire sample period from 1982 to 2013. The official NBER recession period is graphed by a shaded gray area and lasts from December 2007 to June 2009. Panel (a) reports aggregate job flows rates, panel (b) refers to rates of small firms and panel (c) to that of large firms. Panel (d) and (e) report, respectively, job flow rates of young and mature.

Figure 8 shows that the business cycle dynamics of job flow rates broken down by AGE and $SIZE$ are in line with those of corresponding aggregate job flow rates, reported in panel (a) of the figure. Job creation rates as well as net job creation rates are pro-cyclical, while job destruction rates are counter-cyclical.

Job flows of *SMALL* seem to have a marginally stronger reaction during the Great Recession with respect to those of *LARGE*. However, a much more sizable difference emerges, between job flows of $YOUNG$ and $MATURE$.

To further appreciate the heterogeneous behavior of firms belonging to different categories, we plot differential job flows. To this end we compute the difference between the de-trended job flows of groups and study the differentials rates in figure 9.[20] Panel (a) displays the difference between job flow rates of small and large firms (SMALL-LARGE), panel (b) those between $YOUNG$ and $MATURE$ (YOUNG-MATURE); panel (c) explores size differential withing the same age category (MATURE/SMALL-MATURE/LARGE); finally panel (d) explores age differential within the same size category (YOUNG/SMALL-MATURE/SMALL).

Visual inspection of Figure 9 suggests that Job flow rates of $YOUNG$ firms were hit harder than those of $MATURE$ firms during the Great Recession and that there was no asymmetric reaction in the job flows of firms of different *SIZE* during the Great Recession

Job flows of *SMALL* firms are slightly more sensitive than those of *LARGE* firms. However, the differential reaction is mainly driven by AGE as becomes clear when conditioning on $MATURE$. Among $MATURE$ firms no clear difference emerges between $MATURE/SMALL$ and $MATURE/LARGE$ firms.

[19] Among other frictions, financial constraints might have had heterogeneous effects on firms of different age and size.

[20] We compute the difference between the de-trended job flows of the respective groups. 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.

Table 1 reports the correlation coefficients between the differential rates depicted in figure 9 and our cyclical indicators.[21] The figures in the table broadly confirm Result 1 and Result 2. Although just nine observations are available to compute correlations, most correlation coefficients are statistically 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 confirms our results. *YOUNG* firms were hit harder than *MATURE* firms during the Great Recession: their JCR decreased more abruptly than that of mature firms, as the differential correlates positively with GDP and negatively with unemployment and their *JDR* increased by more. These dynamics lead also to a stronger decrease in the *NJCR* of young firms with respect to that of mature firms. This result extends to the case of *AGE* conditional on *SIZE* in the last column. The correlations of *SIZE* conditional on *AGE* are, instead, not significant.

5.1.2 Contribution to Aggregate Fluctuations

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. We focus on the *NJCR* in this section and refer the interested reader to appendix figure A.3 for the contributions to *JCR* and *JDR*.

It turns out that fluctuations of employment weights do not display sizable deviations from their trends. For this reason we only consider deviations of the rates weighted by their employment shares.[22]

Figure 10 plots the annual contributions to the net job creation rate by *AGE* (left) and *SIZE* groups (right). The previous section showed that the job flow rates of *YOUNG* firms are characterized by larger deviations from trend than those of *MATURE* firms during the Great Recession. Nevertheless, job flows of *MATURE* firms explain the lion's share of the deviations from trend of the aggregate NJCR.

The difference in the contributions between *MATURE* and *YOUNG* firms stems from the employment weights. *YOUNG* firms account to roughly 11 percent of the employment stock, while *MATURE* firms employ the remaining workers. Thus, although *YOUNG* firms show a stronger reaction during the Great Recession, their jobs flow contribute little to the variability of aggregate job flows because of their small employment share. [23]

One potential concern related to this result is that it could be driven by size as large firms are *MATURE*. The right plot of figure 10 helps to shed light on this concern. It shows that there is no relevant difference in the contribution to the aggregate NJCR by the alternative *SIZE* groups we consider.[24] The employment shares of the *SIZE* groups are quite similar across size classes 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 between firms of different sizes this explains the results.

[21] p-values of each coefficient are reported in round brackets.

[22] Essentially we can treat weights as if they were constant.

[23] 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 Sahin (2019) 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 (2017) focus on the impact of recessions for life cycle patterns of firms and aggregate implications.

[24] The results of appendix figure A.6, which are based on the cut-offs used by FHJM (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.

The last decomposition is along the $AGE/SIZE$ dimension at once. Figure 11 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.
Our analysis suggests that what matters to explain fluctuations in aggregate job flows are the employment weights of each category of firms and not the magnitude of the deviations from trend of the individual job flow rates. The main findings of the last two subsections can be summarized as:

Fact 1: Firms Age. Job flow rates of young firms are more cyclically sensitive than those of large firms. Job flow rates of mature firms provide a larger contribution to the overall variability of aggregate job flow rates.

Fact 2: Firms Size. There is no difference between the cyclicality of firms of different size. Similarly, there is no difference between the contribution of Job flow rates of firms of different sizes to the overall variability of aggregate job flow rates.

5.2 The Role of the Intensive and the Extensive Margins

5.2.1 Comovement

Using (2) we can provide a further decomposition of job creation, distinguishing between the extensive and intensive margin, that is distinguishing between new and expanding establishments. Panel (a) of Figure 12 plots the cyclical component of $\frac{JC_t^{new}}{E_t}$, together with the cyclical component of $\frac{JC_t^{exp}}{E_t}$. Panel (c) reports, instead, the difference between the two cyclical components. Similarly panel (b) reports cyclical components of $\frac{JD_t^{cont}}{E_t}$ and $\frac{JD_t^{death}}{E_t}$, and panel (d) displays their difference.
The job creation rate of expanding establishments was hit harder than that of new ones during the Great Recession.[25] 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.

5.2.2 Contribution to Aggregate Fluctuations

In this section we study the contribution to the net job creation rate distinguishing between the intensive and the extensive margin of creation and destruction. Figure 13 shows that the lion's share of aggregate fluctuations comes from the expansion and contraction of existing establishments, identified by JC^{EXP}/E and JD^{CONT}/E. Job creation by new entrants was below trend during the Great Recession, while the opposite is true for the job destruction rate of closing establishments. Thus, 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. Importantly, the contribution to the NJCR by new establishments remains persistently below its trend also in the aftermath of the Great Recession. This suggests that missing job creation by new entrants could help explaining the sluggish recovery of the U.S. unemployment rate following the Great Recession, as suggested by Gourio et al. (2016) and Sedlacek (2019). We investigate further this issue in the next section. The main result of this sections is the following:

[25] As emphasized above, the intensive margin contributed positively to the aggregate NJCR during the great recession. The contribution, however, was below trend.

Fact 3: Extensive and Intensive Margins of Job Flows. The intensive margin of job flow rates is more cyclical than the extensive one and provides a larger contribution to the overall variability of job flow rates.

5.2.3 The Extensive Margin: New Firms vs New Establishments

Next, we consider the job creation and destruction due to actual entry and exit. We distinguish between the job creation due to establishments created by startups, $JC^{NEW,FIRMS}/E$, and the job creation coming from new establishments belonging to expanding firms, $JC^{NEW,ESTABS}/E$. Symmetrically we distinguish between job destruction by establishments belonging to firms which went out of the market, $JD^{DEAD,FIRMS}/E$ and job destruction by establishments closed by contracting firms, $JD^{DEAD,ESTABS}/E$. [26] The plots in Figure 14 show that there are differences among both groups. We find that the contraction in $JC^{NEW,ESTABS}/E$ is more pronounced than $JC^{NEW,FIRMS}/E$.

The right plot indicates that during the Great Recession the $JD^{DEAD,FIRMS}$ was above trend, while the opposite holds for $JD^{DEAD,ESTABS}/E$. Overall the reaction on the destruction side is less pronounced compared to the creation side. As mentioned above, the reaction of the destruction margin might be buffered due to ad hoc policies.

The heterogeneous behavior on the job creation as well as job destruction side can be seen also in terms of the correlations in table 2. 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. The differential rates among the new establishments and dead establishments point towards a higher sensitivity of those establishments that belong to continuing firms, but correlation with the business cycle measure are not statistically significant.

In a last step, we decompose the creation and destruction rates further into the average size and the entry and exit rates as we outlined in section 3.2. By doing this, we investigate the role of average size of entering/exiting establishments as well as their entry and exit rates. The linearly de-trended series are shown below in figure 15.[27]

Panels (a) show that the average size of new establishments that belong to expanding firms is more cyclically sensitive than that of establishments opened by startups. Similarly, Panel (c) shows that the relative size of establishments shut down by contracting firms is more cyclical with respect to that of establishments shut down because the parent firm goes out of the market.

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.[28] 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 smaller scale compared to a boom.

The result resembles Pugsley and Sahin (2019) 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

[26] An example for the first treatment is given by Clementi and Palazzo (2016), while Pugsley and Sahin (2019) focus only on the entry of new firms.

[27] In appendix figure A.1 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.

[28] 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.

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 less establishments are created. In contrast, the exit rates differ. While the exit rate of firms is higher with respect to trend and starts increasing before the beginning of the Great Recession, the exit rate of establishments that belong to continuing firms show an increase with respect to the trend just at the very end of the recession period. As a last check we look at the actual correlations between the entry/exit rates and average size with the aggregate measures. As indicated by table 3, the average size of incumbent firms is more cyclically sensitive with respect to that of startups and dead firms. The entry and exit rates reveal the opposite pattern, i.e. a higher sensitivity of establishments belonging to new or dead firms.[29]

Next we look at the actual entry and exit of establishments and decompose the JC^{NEW}/E and JD^{DEAD}/E 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 $DEAD, ESTABS$. The results are plotted in figure 16.

The decline of the JC^{NEW}/E is partially due to the lower entry rate of new establishments, particularly in 2009 and 2010. However, specially in the last three years of the sub-sample, the quantitative contribution to the JC^{NEW}/E coming from $NEW, FIRMS$ is limited and lower with respect to that due to $NEW, ESTABS$. Indeed, It can be seen that the role of *size* of the latter group contributes substantially.

The decomposition suggest two observations. The first one is that new establishments by expanding firms are smaller than before. A potential explanation is that the Great Recession altered the cost-benefit balance of setting up relatively large establishments. The second one is that the missing job creation due to a lower entry rate of new firms is quantitatively limited, questioning the view that the slow recovery after the Great Recession is due to missing job creation by new firms.

One of the reasons why the overall JD^{DEAD}/E 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 dampened because the average size of exiting plants was smaller than usual.

6 Results over the Full Sample Period

While the previous part of the analysis focused on the period of the Great Recession, we now consider the full sample period, namely 1982 to 2013. The longer sample period allows us to take into account also the 1981/82, 1990/91, and 2001 recession episodes and verify our previous findings in a more general context. We focus on the heterogeneous cyclical reactions of different groups of firms, similar to MPV (2012) and FHJM (2013). First, we analyze the AGE and $SIZE$ groups and then investigate the extensive and intensive margins.

The longer time series allows us to compute meaningful correlations between differentials rates and cyclical indicators. Further, it allows to quantify the contribution of the variability of the job flow rates of individual AGE and $SIZE$ categories to the business cycle variability of aggregate job flow rates through a variance decomposition. As in the previous analysis we will focus on deviations from a liner trend.

[29] These correlations, which are computed using only nine data points, are not statistically significant.

6.1 The Role of Age and Size

6.1.1 Comovement and Contribution to Aggregate Fluctuations

In this section we assess whether the AGE or the $SIZE$ dimension matters most when it comes to explain variability of job flow rates over the business cycle. While MPV (2012) highlight the heterogeneous response between $SMALL$ and $LARGE$ firms and conclude for a higher sensitivity of $LARGE$ firms during periods of high and low unemployment, FHJM (2013) emphasize the importance of AGE and in particular the role of $YOUNG/SMALL$ firms.

Based on the BDS data we plot the linearly de-trended job flows in figure 17. Shaded gray areas represent NBER recessions. Panel (a) displays the aggregate $NJCR$, JCR, and JDR. Panel (b) shows job flow rates of $SMALL$ firms, while panel (c) those of $LARGE$ firms. Panel (d) refers to $YOUNG$ firms and finally panel (e) to $MATURE$ ones. All plots show a pro-cyclical behavior of the $NJCRs$ and the JCRs, while $JDRs$ behave counter-cyclically.

The graphs allow to compare the behavior of job flows across different recessions, the behavior of different job flows, and the behavior of different types of firms. While the previously mentioned pro-cyclicality 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 recession episodes.

The 2001 recession is the one with the highest peak of the overall JDR. This was driven by the $JDRs$ of $LARGE$ and $MATURE$ firms, which spike up in the same period. The Great Recession is characterized by the biggest drop in the $NJCR$ over the entire sample period. The figure shows that the $NJCR$ of $YOUNG$ firms suffered a tremendous decline with respect to its trend.

To understand the actual differences between $SMALL$ and $LARGE$, and $YOUNG$ and $MATURE$ we plot the differentials in figure 18. Besides plotting the two unconditional AGE and $SIZE$ differentials in the upper graphs, we include the $SIZE$ differential conditional on $MATURE$ and the AGE differential conditional on $SMALL$ at the bottom.

We correlate each of the differential rates with our business cycle measures. Correlation coefficients, and their p-values, are reported in table 4.

As shown by the first column of Table 4, we do not find statistical support for the result by MPV (2012), namely that $LARGE$ are more cyclical than $SMALL$ firms.[30] We partially recover their result when we condition on mature firms. As shown in the third column of the Table, the differential rate $NJCR^{M/S} - NJCR^{M/L}$ displays a correlation with the cyclical component of the unemployment rate equal to 0.3. The latter is significant at the ten percent level.[31] This suggests that the result by MPV (2012) could be driven by job flows of mature firms.

The neatest results, however, refer to AGE. Columns 2 is fully in line with the previous findings for the period of the Great Recession: $YOUNG$ firms are more cyclical than $MATURE$ ones. This is, for example, confirmed by the strongly positive and statistically significant correlation between the $NJCR$ differential and GDP.

Turning to the variability of aggregate fluctuations in job flows and identify the contributions to the variability

[30] The analysis of MPV (2012) refer to the period 1979-2009 and is based on a slightly older version of BDS. Further they adopt an HP-filter instead of a liner filter. Adopting a high smoothing (smoothing parameter 390.625) HP filter we recover a correlation coefficient between the $NJCR$ differential and cyclical unemployment of 0.38 (p-value 0.03) for the same period, which is in line with their findings. For an extensive discussion of the relationship between our results and those by MPV (2012) see appendix B.

[31] 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.

of fluctuations of aggregate job flow rates by each different group of firms.[32] To do so we resort to the variance decomposition outlined in Section 4.2. Pugsley and Sahin (2019) 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.

Figure 19 visualizes the contributions of de-trended job flow rates of $AGE/SIZE$ groups to the overall variability of $\widetilde{NJCR}$. Mature firms explain about 78 percent of the variability of the cyclical component of the aggregate NJCR, while there are no major differences in the fraction of variance explained by alternative size classes. Table 7 goes a step further and also provides a decomposition of the variability of the aggregate JCR and the JDR and leads to a very similar conclusion.

6.2 Intensive and Extensive Margins

6.2.1 Comovement and Contribution to Aggregate Fluctuations

This section aims at comparing cyclicality of the intensive margin to that of the extensive margin. Table 5 reports differentials rates for $EXP - NEW$ and $CONT - DEAD$ establishments. We find a stronger sensitivity of the establishments that expand and contract. As in the Great Recession period the intensive margin of job creation is more cyclically sensitive.

Figure 20 provide a decomposition of the variability of the NJCR distinguishing between the intensive and the extensive margin of creation and destruction. It shows that the intensive margin of job creation and destruction, namely job creation by expanding establishments and job destruction by contracting establishments explains about 90 percent of the variability of the aggregate NJCR.

6.2.2 The Extensive Margin: New Firms vs New Establishments

Next we distinguish between establishments creation and destruction due to entry and exit and that due to expansions and contractions of continuing firms. We do not detect any heterogeneous behavior.

Table 6 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. Next we decompose the JCR^{NEW} and the JDR^{DEAD} further into contributions of *size* and *entry/exit* rates. Results, again, 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 $JC^{NEW,ESTABS}/E$ and $JD^{DEAD,ESTABS}/E$ 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 Sahin (2019).

[32] 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. General trends in the employment weights, however, are taken into account as described by our methodology in section 4.2.

The main result of this session is that Facts 1-3, identified for the Great Recession period, extend to the whole sample.

7 Conclusion

This paper investigates the cyclical behavior of the Job Flow rates of alternative categories of firms in terms of age and size in The US between 1976 and 2013. Job flow rates of young firms, those with an age of five years or less, are more cyclically sensitive with respect to that of mature firms. We do not detect any statistically significant difference in the cyclicality of the job flow rates between small and large firms. Further, job flow rates of mature firms explain most of the variability of the corresponding aggregate job flows over the business cycle. Job flow rates due to contractions and expansions of continuing establishments are more cyclical than job flows due to entry and exit of establishments.

Our findings underline the importance of firm age to understand the cyclical properties of Job Flow rates, while they underplay the relevance of the size dimension. The "granular" hypothesis suggests that macroeconomic questions can be clarified by looking at the behavior of large firms. Our result suggests that, as far as Job Flow Rates are concerned, studying the behavior of mature firms could be more relevant to understand the business cycle.

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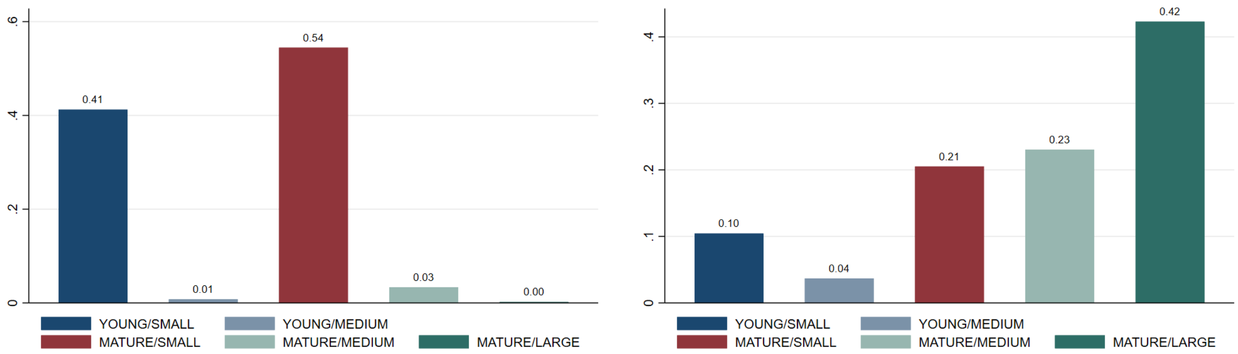
Figures

Figure 1: Share of Firms and Employment Shares according to *AGE* and *SIZE*

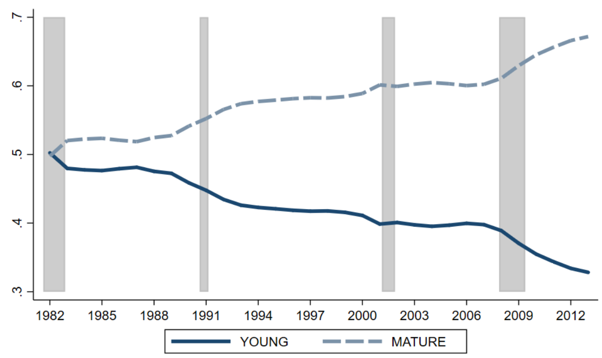
(a) Share of Firms (b) Employment Shares



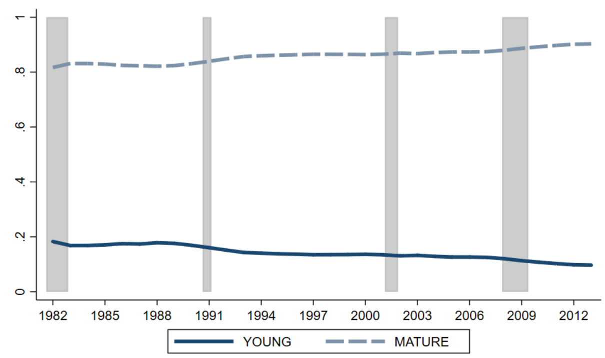
The left panel plots the average share of firms as percentage of total firms in the market. The right panel plots the average employment share of the respective groups. All shares are averaged over the period 1982-2013.

Figure 2: Shares of Firms and Employment Shares over Time

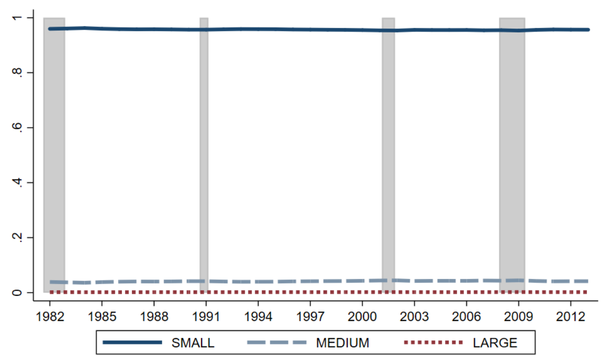
(a) Share of Firms by *AGE*



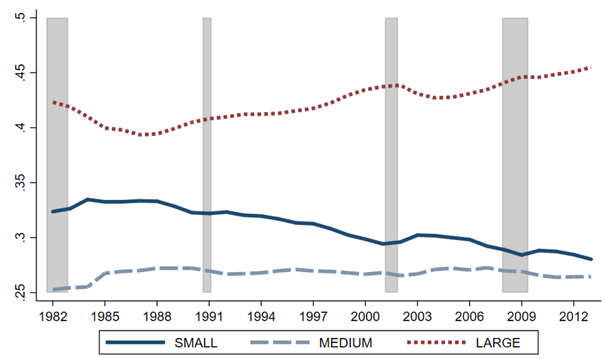
(b) Employment Shares by *AGE*



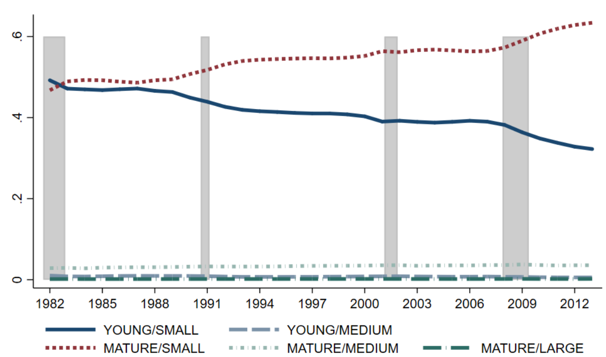
(c) Share of Firms by *SIZE*



(d) Employment Shares by *SIZE*



(e) Share of Firms by *AGE/SIZE*



(f) Employment Shares by *AGE/SIZE*

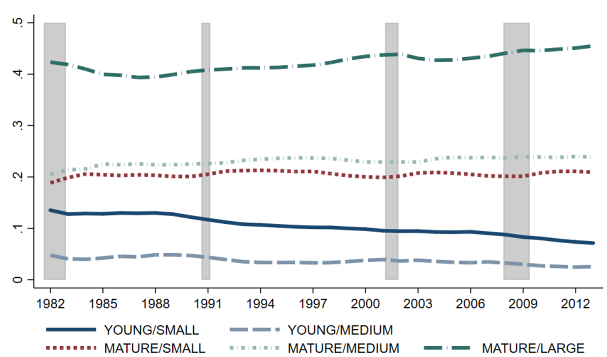
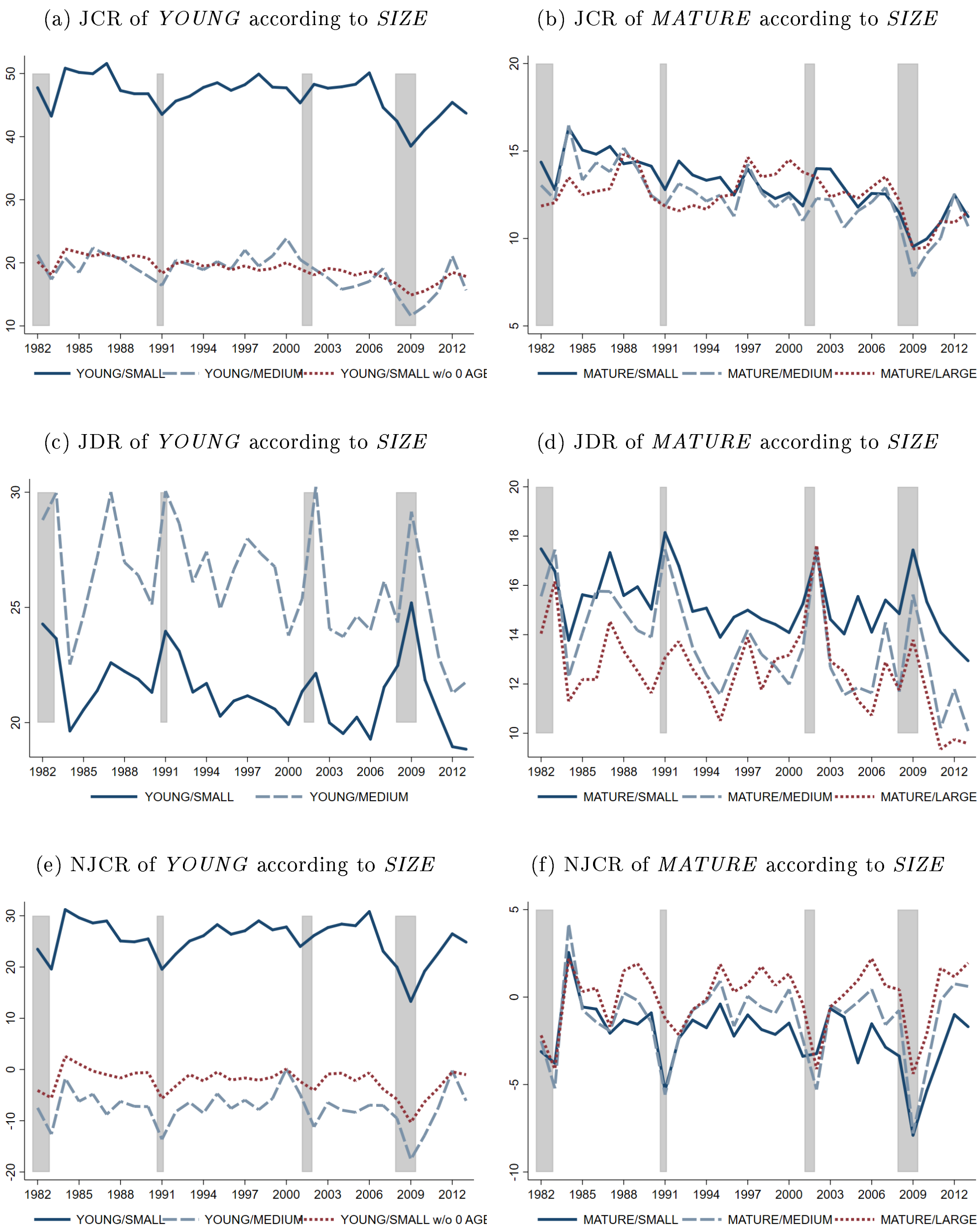


Figure 3: Job Flow Rates over Time according to Age



(a) JCR of *YOUNG* according to *SIZE*

(b) JCR of *MATURE* according to *SIZE*

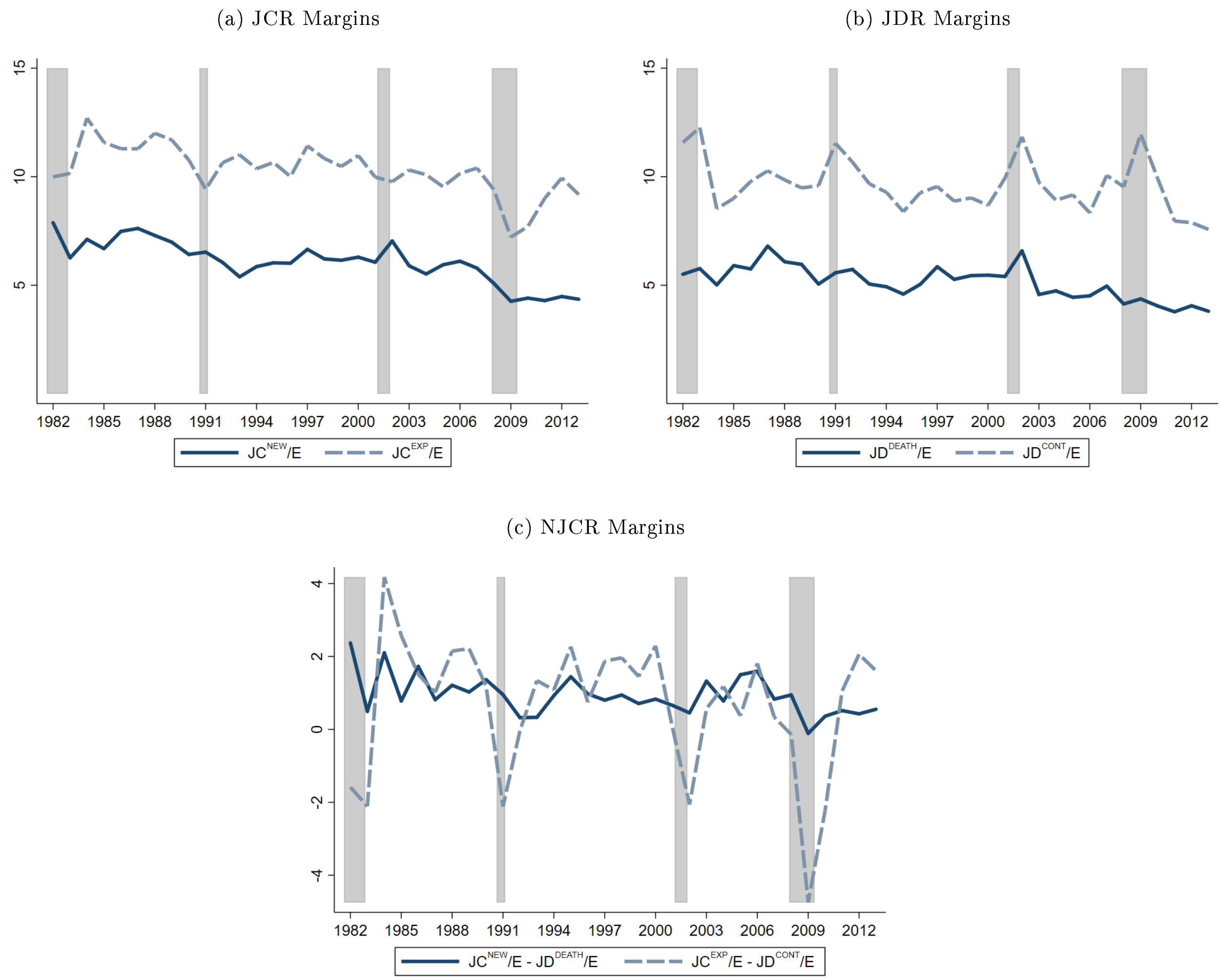
(c) JDR of *YOUNG* according to *SIZE*

(d) JDR of *MATURE* according to *SIZE*

(e) NJCR of *YOUNG* according to *SIZE*

(f) NJCR of *MATURE* according to *SIZE*

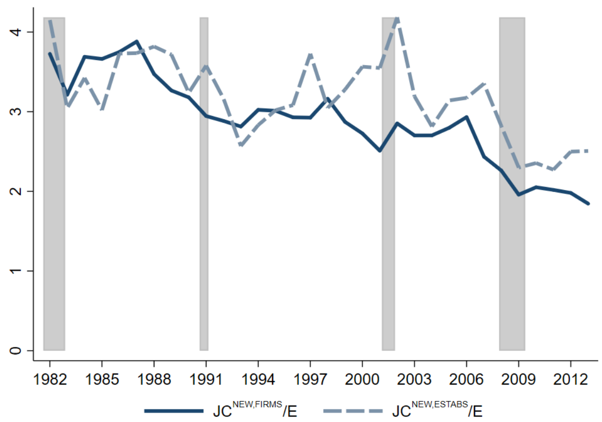
Figure 4: The Intensive and Extensive Margins of Job Flows



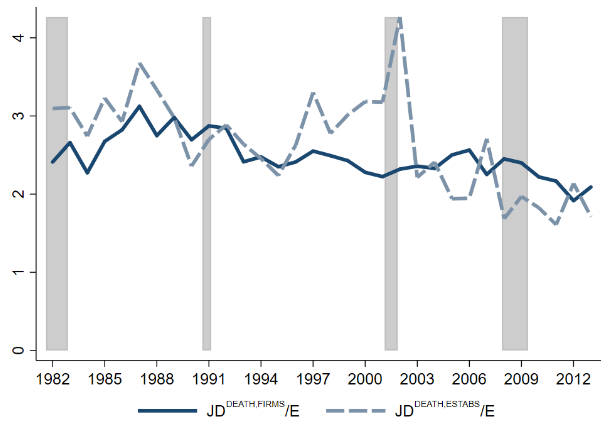
The figure plots the intensive and extensive margins of job flows. Panel (a) plots the margins for the job creation rate, panel (b) for the job destruction rate, and panel (c) for the net job creation rate. The exact definitions are described in the text.

Figure 5: The Extensive Margin: Firms and Establishments

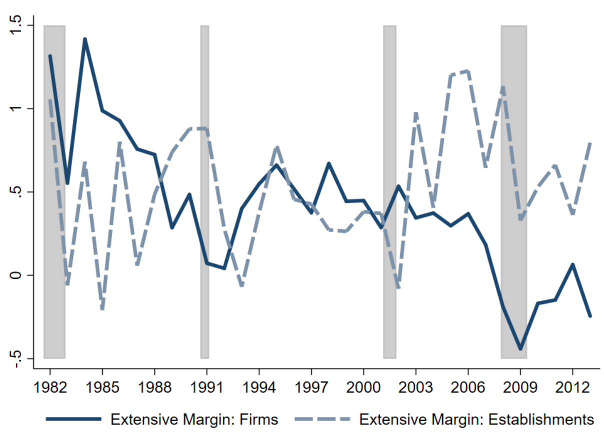
(a) Job Creation: Firms vs. Establishments



(b) Job Destruction: Firms vs. Establishments

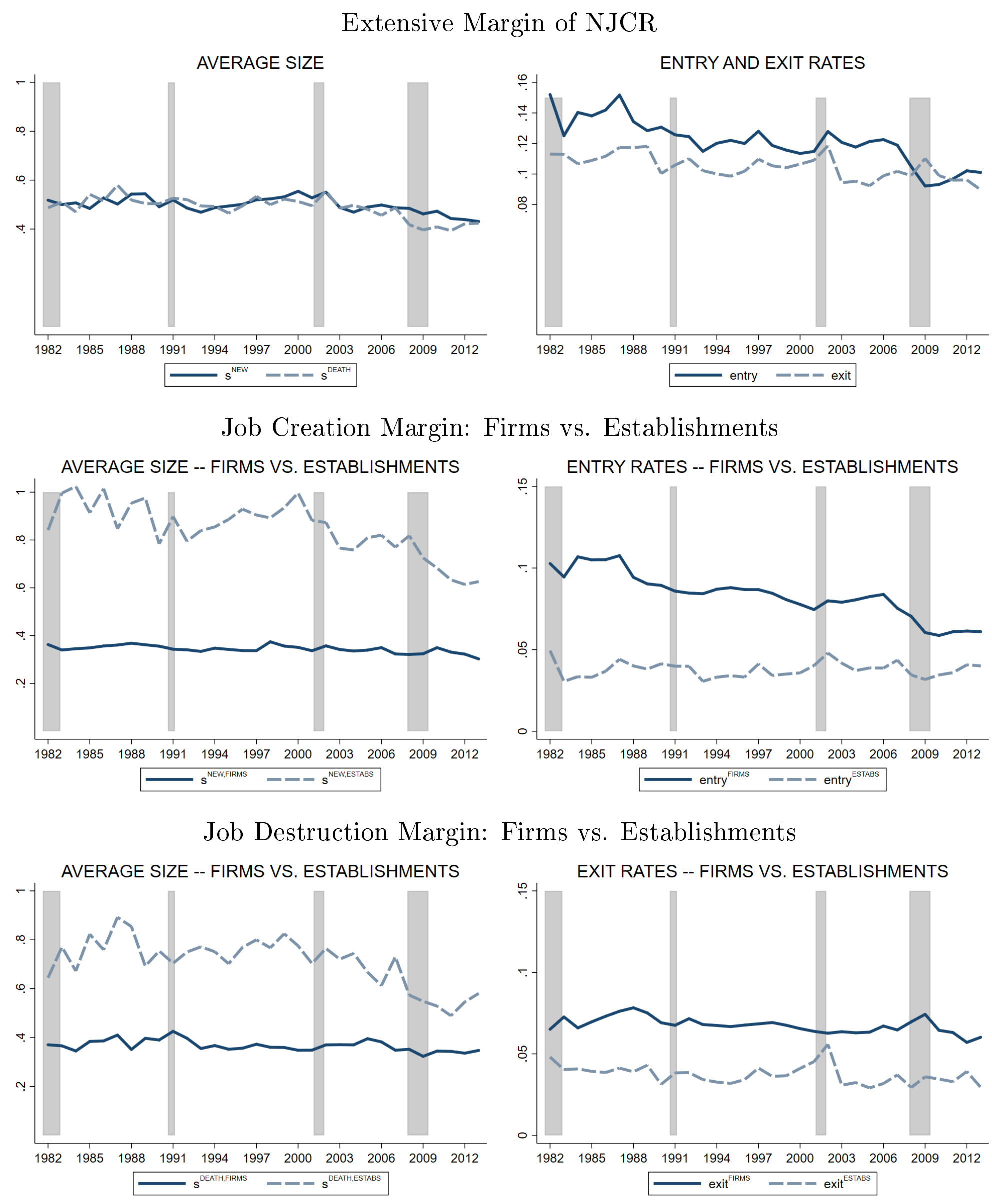


(c) Extensive Margin of NJCR



The figure plots the decomposition of the extensive margin of the net job creation rate according to firms and establishments. The exact decomposition follows the procedure outlined in the text.

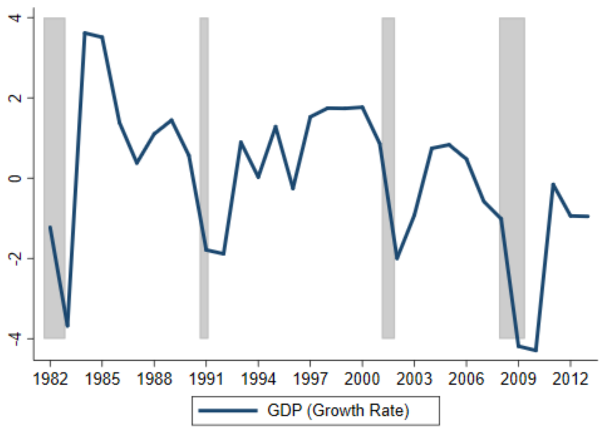
Figure 6: The Extensive Margin – Average Size and Entry/Exit Rates



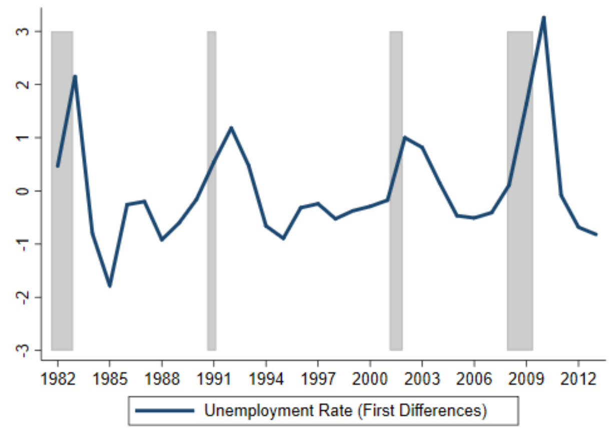
The figure plots the components of the extensive margin of the net job creation rate according to establishment size and entry/exit rates. The exact decomposition follows the procedure outlined in the text.

Figure 7: Aggregate Cyclical Indicators

(a) Cyclical GDP



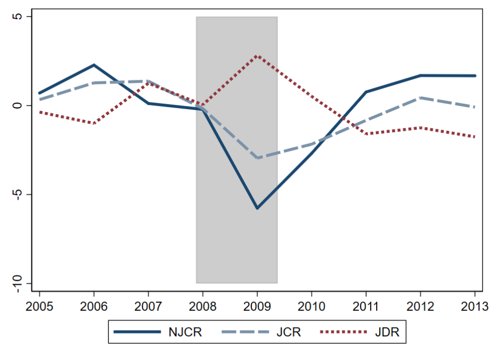
(b) Cyclical Unemployment Rate



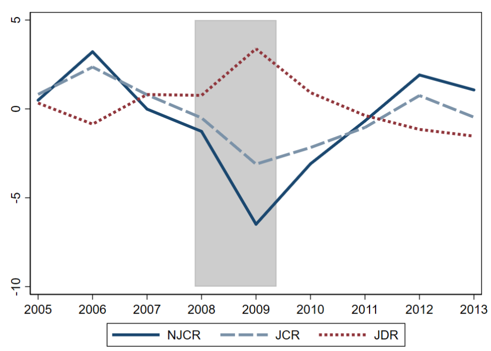
The left graph plots the de-meaned growth rates of real GDP. The right graph shows the first differences of the unemployment rate. Data are downloaded from FRED. Exact sources and computations are written in the accompanying text.

Figure 8: Job Flows during the Great Recession

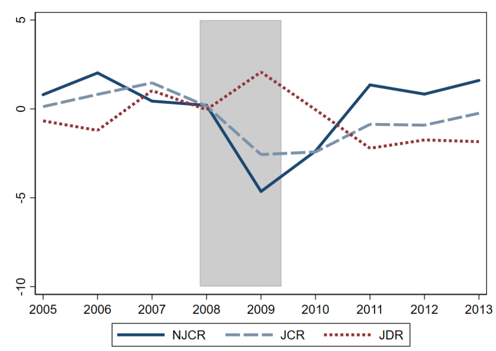
(a) NJCR, JCR, and JDR



(b) NJCR, JCR, and JDR – *SMALL*

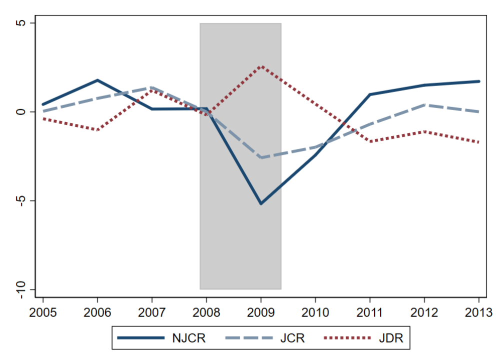


(c) NJCR, JCR, and JDR – *LARGE*



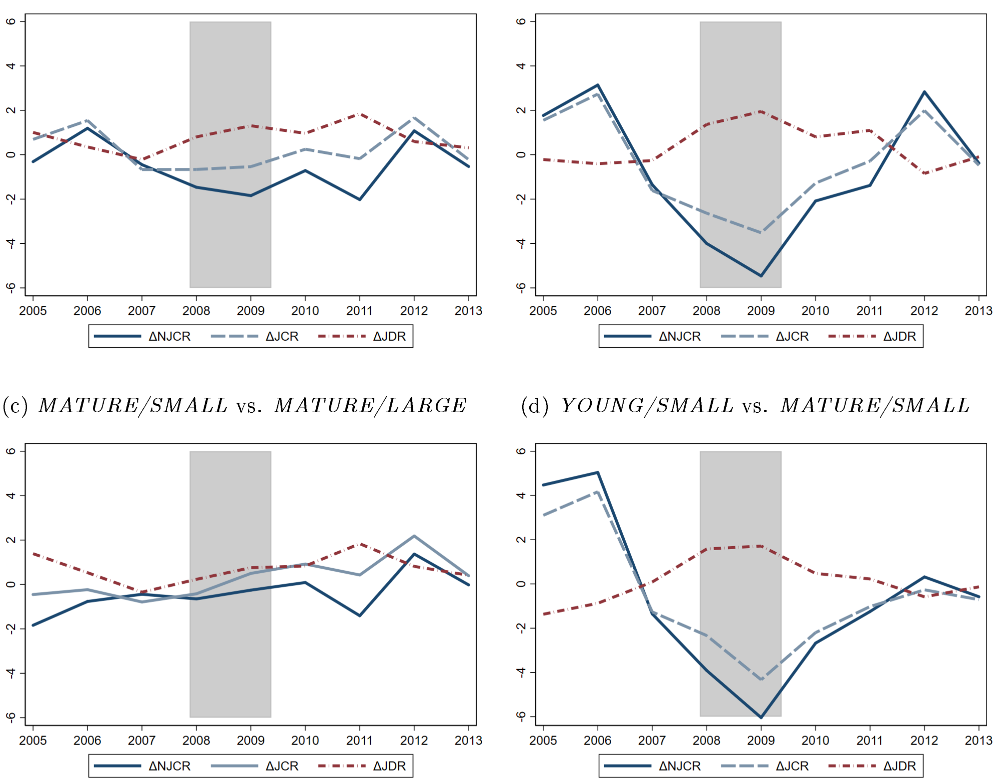
(d) NJCR, JCR, and JDR – *YOUNG*

(e) NJCR, JCR, and JDR – *MATURE*



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 9: Differential Job Flows during the Great Recession



(a) *SMALL* vs. *LARGE*

(b) *YOUNG* vs. *MATURE*

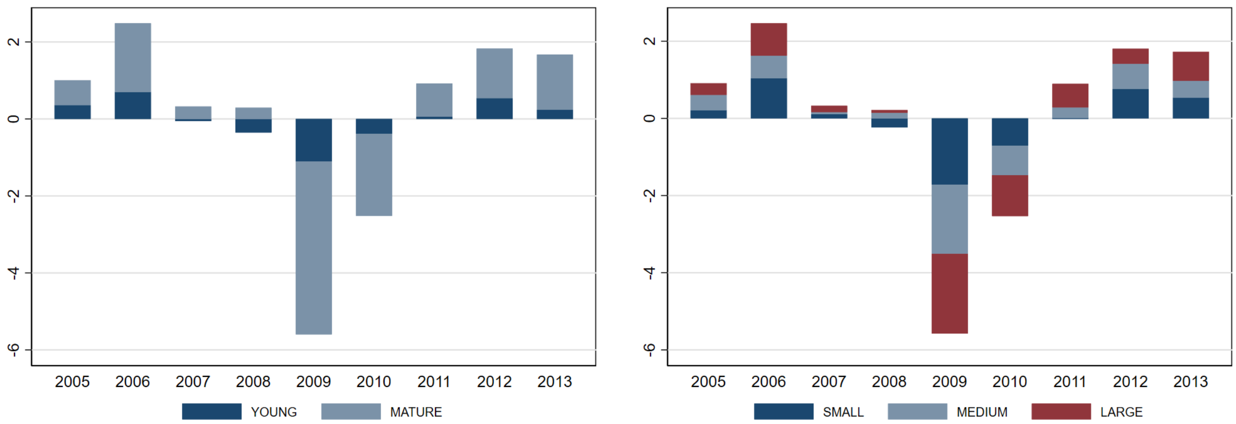
(c) *MATURE/SMALL* vs. *MATURE/LARGE*

(d) *YOUNG/SMALL* vs. *MATURE/SMALL*

The graph plots the Differential Job Flows. 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.

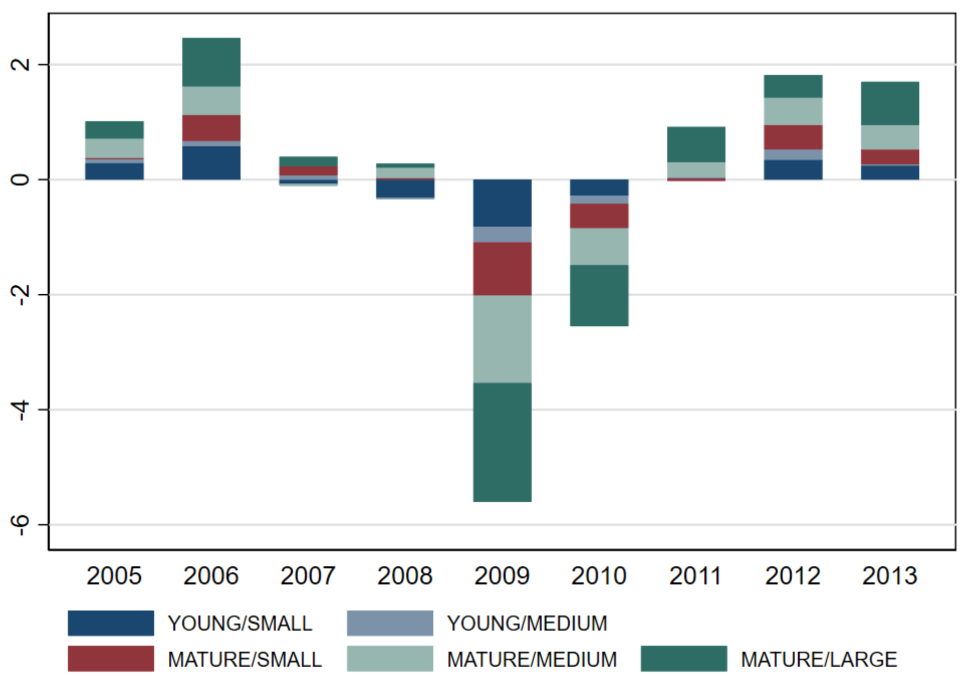
Figure 10: Contribution to *NJCR* by *AGE* and *SIZE* – Great Recession

(a) Contribution to NJCR by *AGE* (b) Contribution to NJCR by *SIZE*



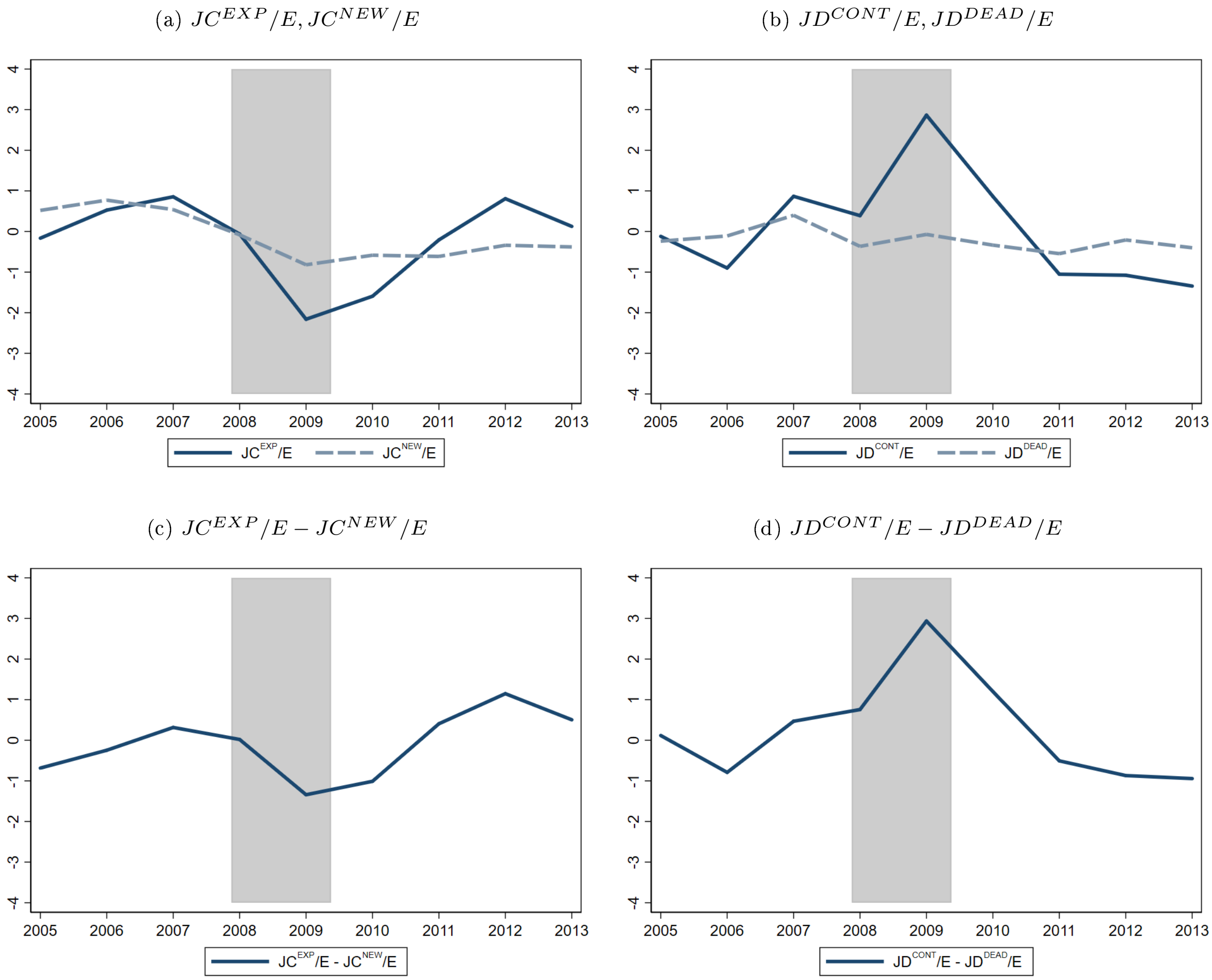
The graph plots the weighted contributions of individual job flow rates to overall *NJCR*. The left plot shows the contributions broken down by *AGE*, the right plot is broken down by *SIZE*.

Figure 11: Contribution to *NJCR* by *AGE/SIZE* – Great Recession



The graph plots the weighted contributions of individual job flow rates to overall *NJCR*.

Figure 12: Extensive and Intensive Margins during the Great Recession



(a) $JC^{EXP}/E, JC^{NEW}/E$

(b) $JD^{CONT}/E, JD^{DEAD}/E$

(c) $JC^{EXP}/E - JC^{NEW}/E$

(d) $JD^{CONT}/E - JD^{DEAD}/E$

Figure 13: Contribution to NJCR by Entry and Exit – Great Recession

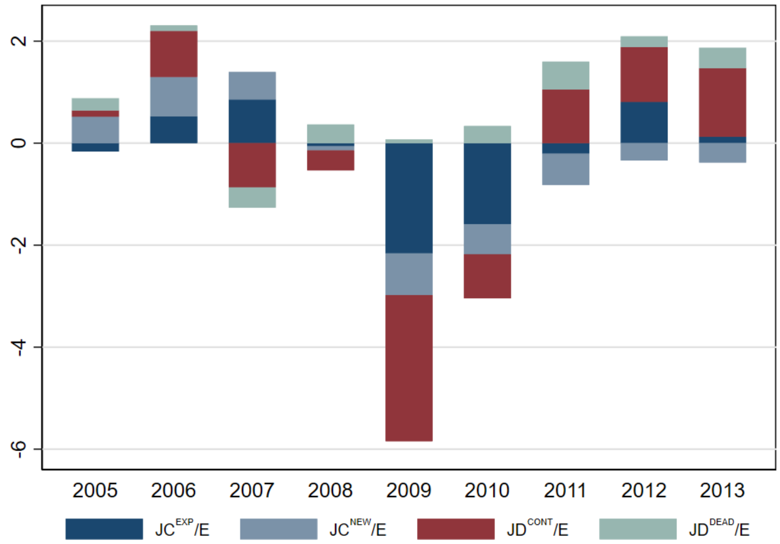
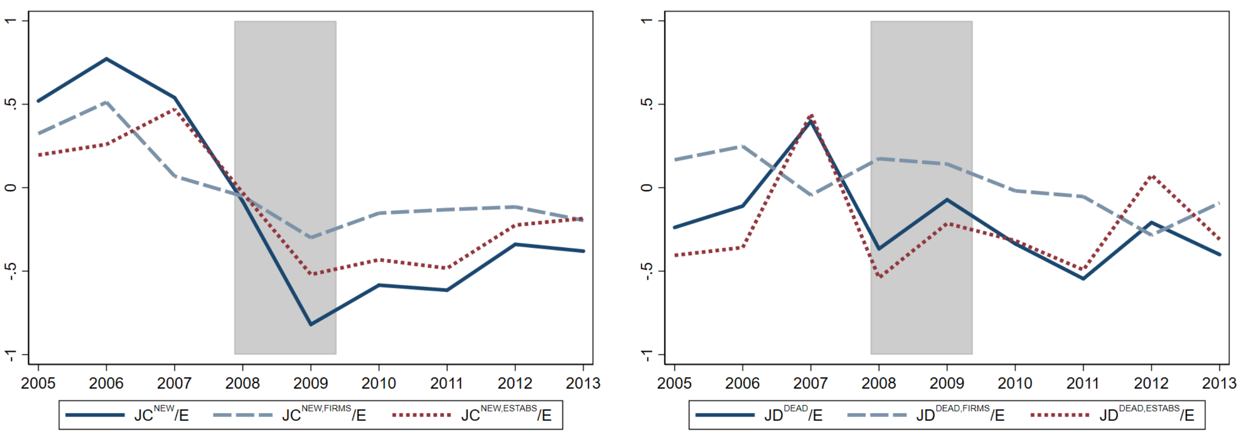


Figure 14: Job Creation of *NEW* and Job Destruction of *DEAD* during the Great Recession

(a) $JC^{NEW}/E, JC^{NEW,FIRMS}/E, JC^{NEW,ESTABS}/E$

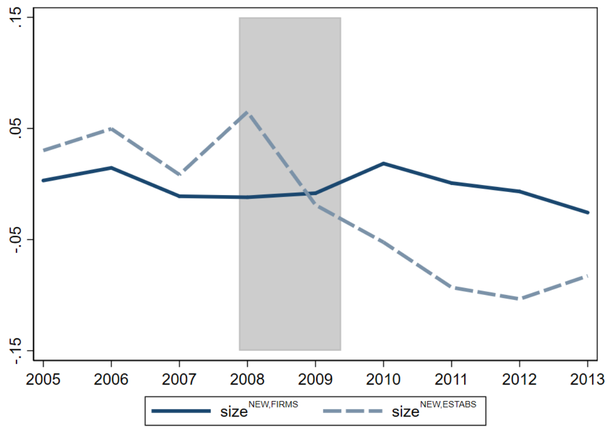
(b) $JD^{DEAD}/E, JD^{DEAD,FIRMS}/E, JD^{DEAD,ESTABS}/E$



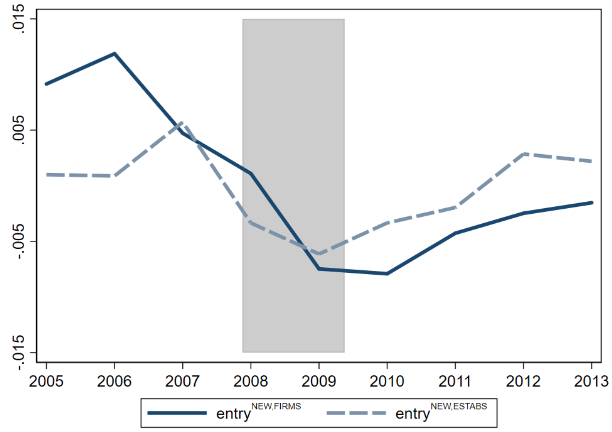
The left plot shows the JC^{NEW}/E broken down by $JC^{NEW,FIRMS}/E$ and $JC^{NEW,ESTABS}/E$. Similarly, the right plot shows the JD^{DEAD}/E broken down into $JD^{DEAD,FIRMS}/E$ and $JD^{DEAD,ESTABS}/E$. All rates are linearly de-trended.

Figure 15: Average Size and Entry/Exit Rates during the Great Recession

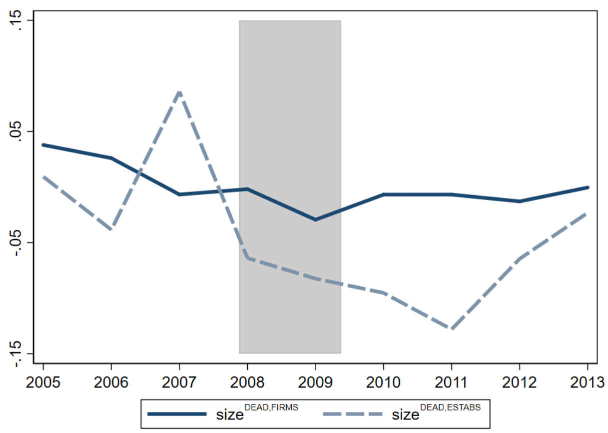
(a) Size: $NEW, FIRMS$ and $NEW, ESTABS$



(b) Entry Rate: $NEW, FIRMS$ and $NEW, ESTABS$



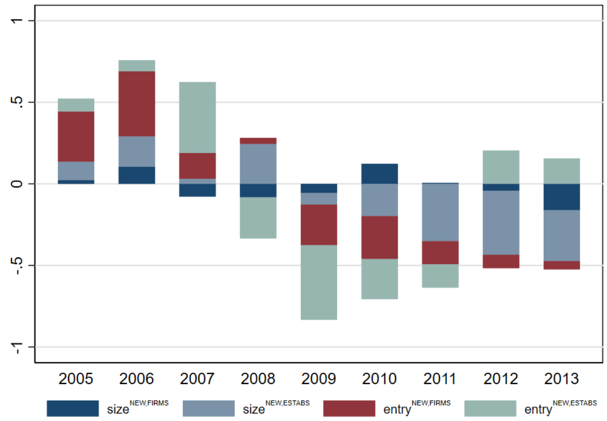
(c) Size: $DEAD, FIRMS$ and $DEAD, ESTABS$

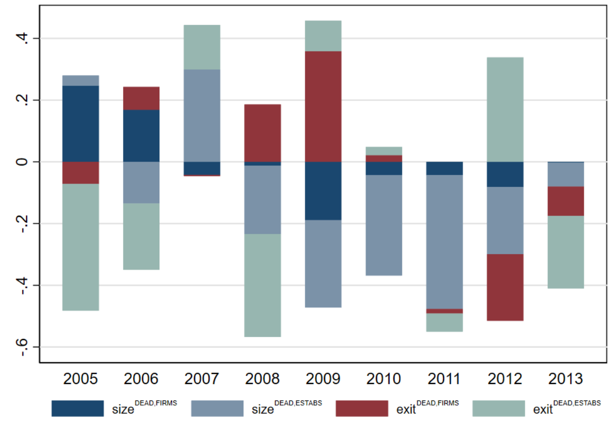


(d) Exit Rate: $DEAD, FIRMS$ and $DEAD, ESTABS$

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

Figure 16: Contribution to JC^{NEW}/E and JD^{DEAD}/E Flows – Great Recession

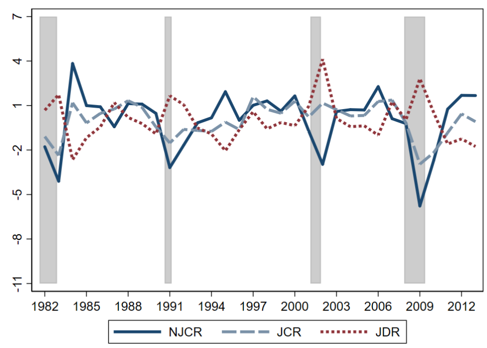




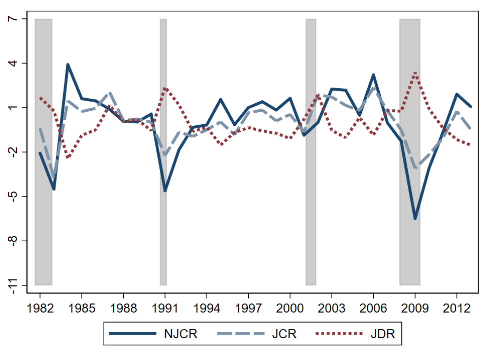
The graphs decompose the entry, JC^{NEW}/E, and exit margin, JD^{DEAD}/E, into contributions of *size* and *entry/exit*.

Figure 17: Job Flows over the Business Cycle

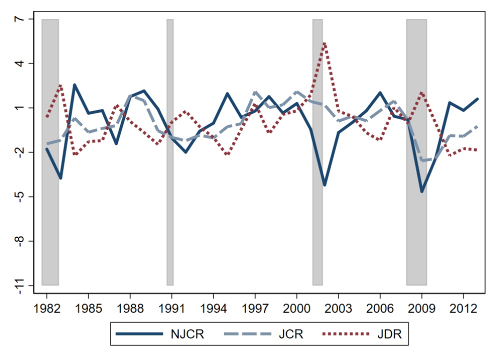
(a) NJCR, JCR, and JDR



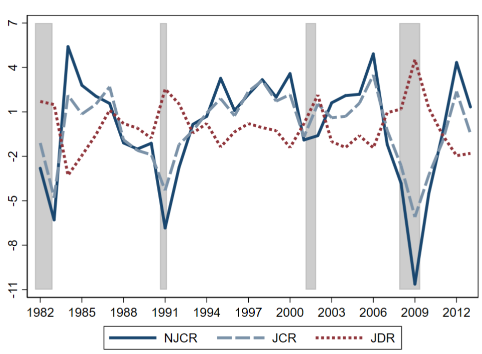
(b) NJCR, JCR, and JDR – *SMALL*



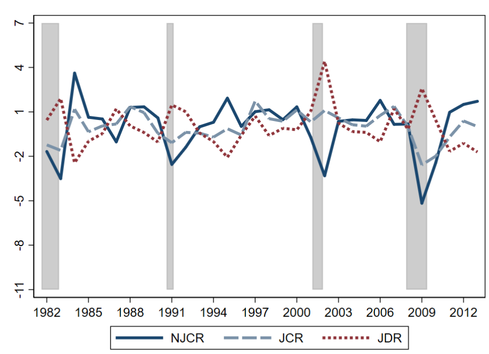
(c) NJCR, JCR, and JDR – *LARGE*



(d) NJCR, JCR, and JDR – *YOUNG*

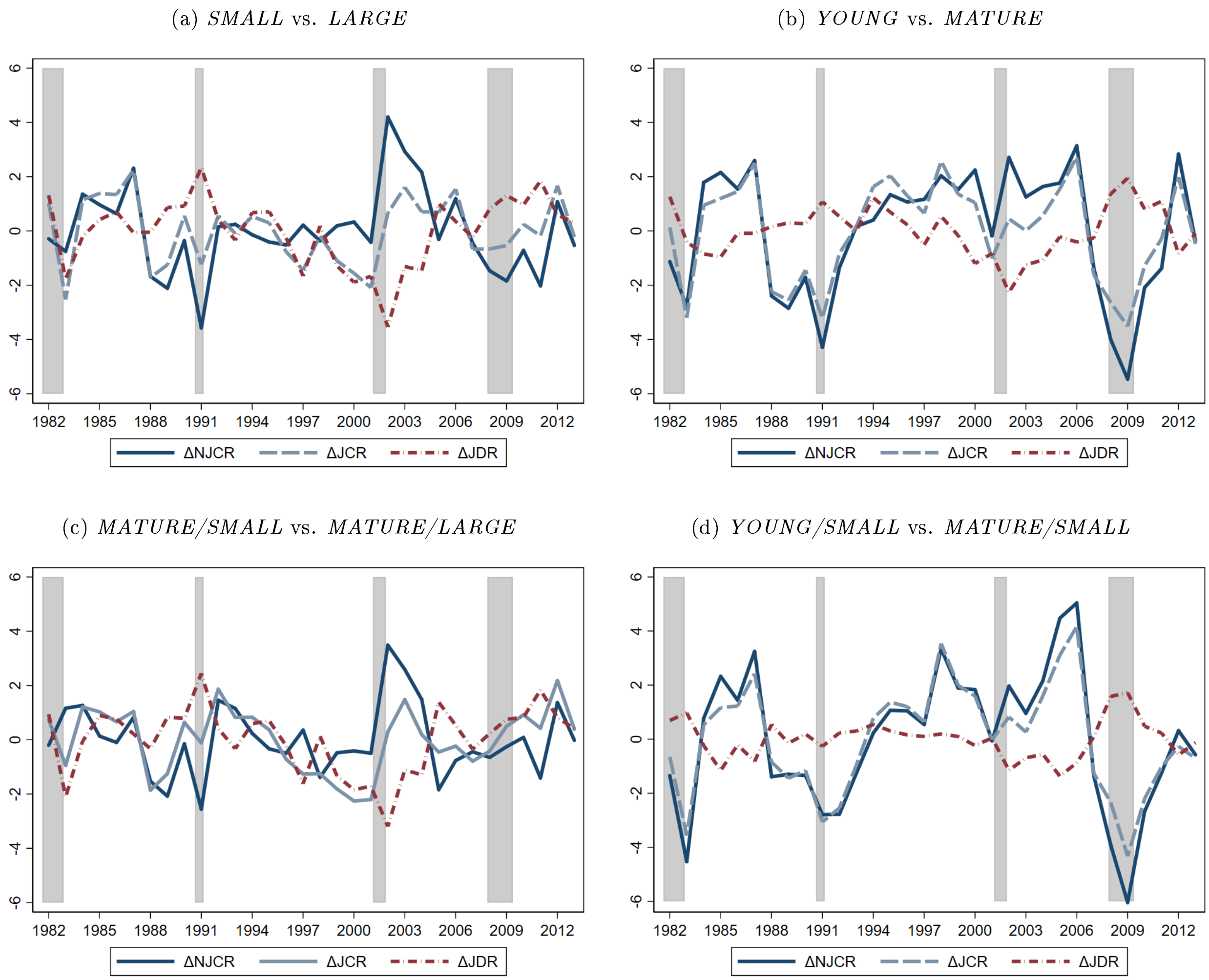


(e) NJCR, JCR, and JDR – *MATURE*



The graph plots the job flow rates. 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.

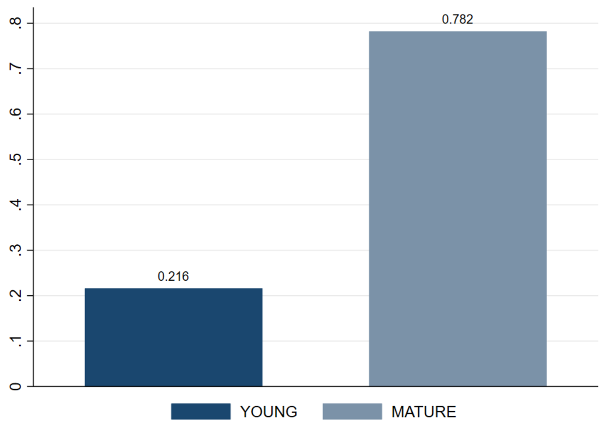
Figure 18: Differential Job Flows over the Business Cycle



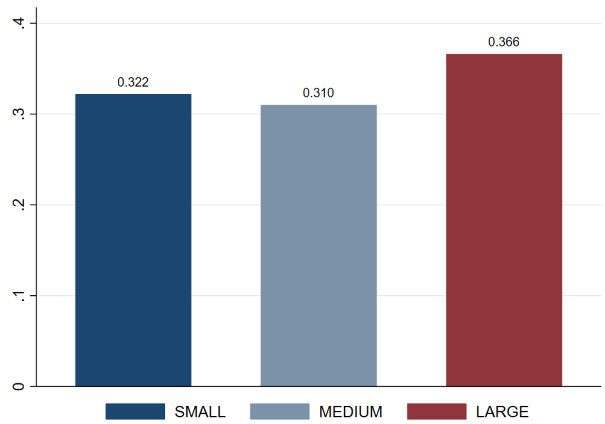
The graph plots the Differential Job Flows of different groups of firms. From the first top left to bottom right panel we look at *SIZE*, *AGE*, *SIZE* conditional on $AGE = MATURE$, *AGE* conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. Differentials are computed by subtracting the respective 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.

Figure 19: Variance Decomposition according to *AGE/SIZE*

(a) Decomposition of NJCR by *AGE*



(b) Decomposition of NJCR by *SIZE*



(c) Decomposition of NJCR by AGE/SIZE

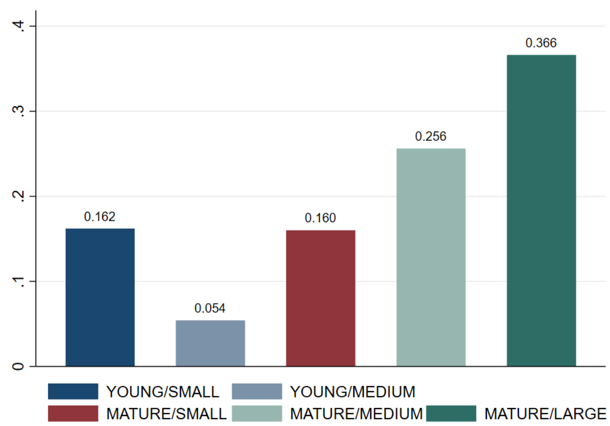


Figure 20: Contribution to NJCR by Entry and Exit

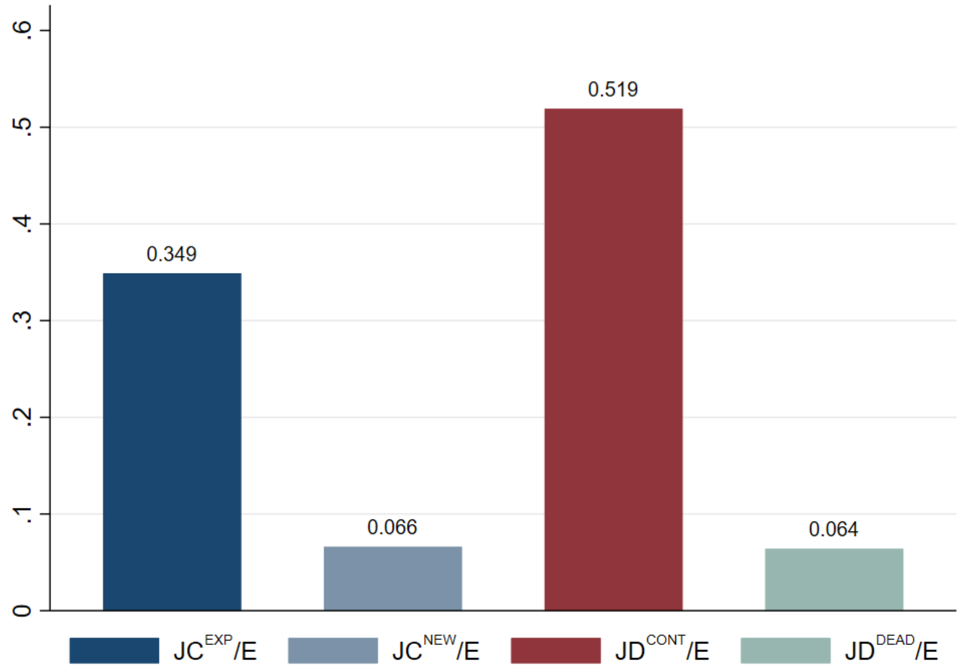
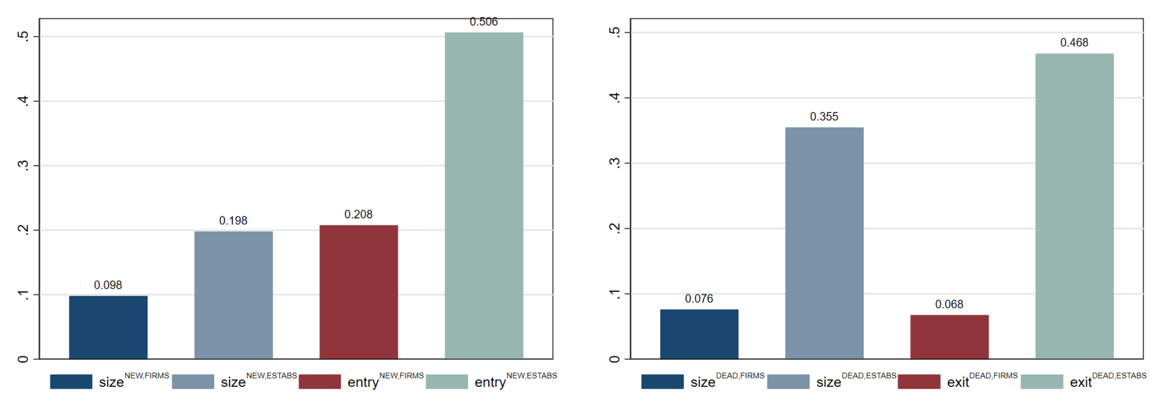


Figure 21: Variance Decomposition of JC^{NEW}/E and JD^{DEAD}/E

(a) Contribution to JC^{NEW}/E by $NEW, FIRMS$ and $NEW, ESTABS$

(b) Contribution to JD^{DEAD}/E by $DEAD, FIRMS$ and $DEAD, ESTABS$



Tables

Table 1: Contemporaneous Correlations of Differentials with GDP and Unemployment Rate

		$AGG.$ $RATE$	$SMALL$ $-LARGE$	$YOUNG$ $-MATURE$	$MATURE:$ $SMALL$ $-LARGE$	$SMALL:$ $YOUNG$ $-MATURE$
JCR	GDP	0.85***	0.34	0.66*	-0.38	0.78**
		(0.00)	(0.38)	(0.05)	(0.31)	(0.01)
	U	-0.81**	-0.24	-0.51	0.20	-0.54
		(0.01)	(0.54)	(0.16)	(0.60)	(0.13)
JDR	GDP	-0.64*	-0.23	-0.60*	0.10	-0.69**
		(0.06)	(0.55)	(0.09)	(0.79)	(0.04)
	U	0.57	0.37	0.60*	0.10	0.52
		(0.11)	(0.33)	(0.09)	(0.80)	(0.15)
$NJCR$	GDP	0.86***	0.39	0.67*	-0.45	0.77**
		(0.00)	(0.30)	(0.05)	(0.23)	(0.02)
	U	-0.80**	-0.38	-0.56	0.13	-0.55
		(0.01)	(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.

Table 2: Contemporaneous Correlations of Entry/Exit Differentials with the Business Cycle

	JC/E		JD/E	
	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.

Table 3: 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.

Table 4: 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 5: 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.

Table 6: 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.

Table 7: Variance Decomposition of Job Flows

Decomposed	*SIZE*			*AGE*		*AGE/SIZE*				
Rate	S	M	L	Y	M	YS	YM	MS	MM	ML
NJCR	0.322	0.310	0.366	0.216	0.782	0.162	0.054	0.160	0.256	0.366
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 4.2.

A Robustness: Alternative Age and Size Cut-Offs

In this robustness section we follow the *AGE* definition of Pugsley and Sahin (2019), i.e. *YOUNG* (0-10 years); *MATURE* (11+ years). This allows us to cover the time period 1987-2013. 24% of the workers are employed in *YOUNG* firms, 76% in *MATURE* firms.

While we follow Moscarini and Postel-Vinay (2012) in defining small, medium, and large firms, Fort et al. (2013) as well as Pugsley and Sahin (2019) 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 A.4 shows the job flow rates for the alternative size cut-off.

Figure A.5 plots the cyclicality during the Great Recession.

Figure A.6 plots the contribution to aggregate fluctuations during the Great Recession.

Table A.3 reports the cyclical correlations over the business cycle.

Tables A.4 and A.5 report the contribution to aggregate fluctuations over the business cycle.

B Relation to MPV (2012)

In this section we investigate in detail the correlation analysis of MPV (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 figure A.2, because the high smoothing parameter of MPV (2012) leads to an HP-trend that is very close to a linear trend. Instead, what really changes results are the different cyclical measures. While we focus on growth rates of real GDP and first differences of the unemployment rate, MPV (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.[33]. Figure A.7 shows that the timing of the aggregate cyclical indicators is different.

- A further difference stems from the fact that MPV (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 mentioned before, there are possible

[33] Their parameter for quarterly GDP is 1600, which corresponds to our annual parameter of 6.25. The high monthly smoothing parameter of 8.1E6, which was suggested by Shimer, corresponds to 390.625 on an annual level.

differences between editions due to further knowledge of links over time as well as re-balancing in census years.

In table A.6 we report the coefficients of correlations with the HP-filtered cyclical measures in the same way as MPV (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 de-trended 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 of the job flow rates does not matter much. But at the same time the results show that the findings of MPV (2012) are not valid for our sample. The main coefficient of interest for MPV (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. The effect 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.

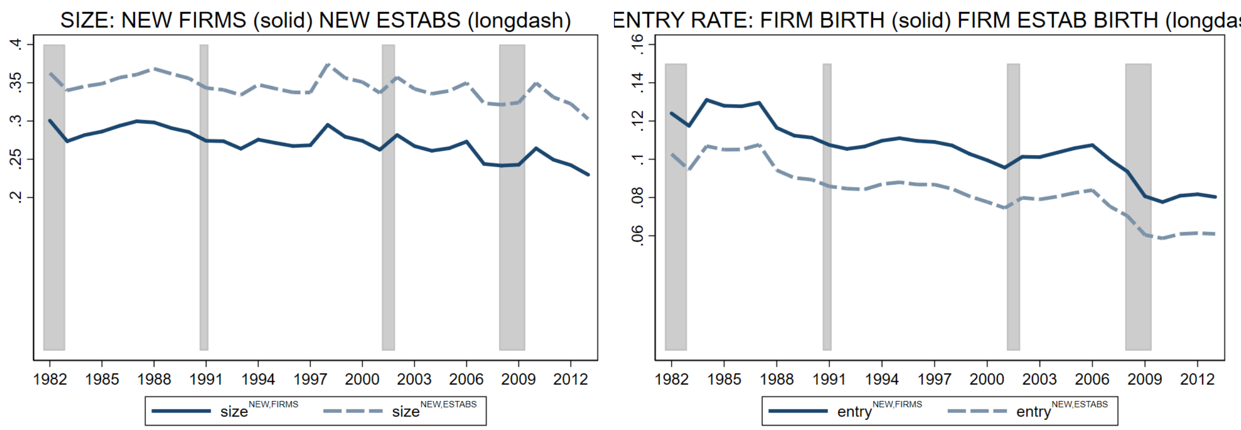
It turns out that the result is highly dependent on the period of observation. If we constrain our sample to the sample period of MPV (2012), i.e. 1979-2009, in column (3) we find support for their result. And even more so when we also include the *YOUNG/LARGE* firms in column (4). However, even then 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.[34] 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 MPV (2012) are weakened. The second driver for the different results is the sample period. Using the period 1982-2013 instead of 1979-2009 weakens the results of MPV (2012) further.

[34] Keep in mind that we defined the size differential in the opposite way, i.e. *SMALL - LARGE*, while MPV (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, MPV (2012) HP-filter the entire available time series for the aggregate variables and not only the sample period.

Appendix Figures

Figure A.1: Entry/Exit at the Firm and Establishment Level

(a) Decomposing $JCR^{NEW,FIRMS}$ on the Firm and Establishment Level



(b) Decomposing $JDR^{DEAD,FIRMS}$ on the Firm and Establishment Level

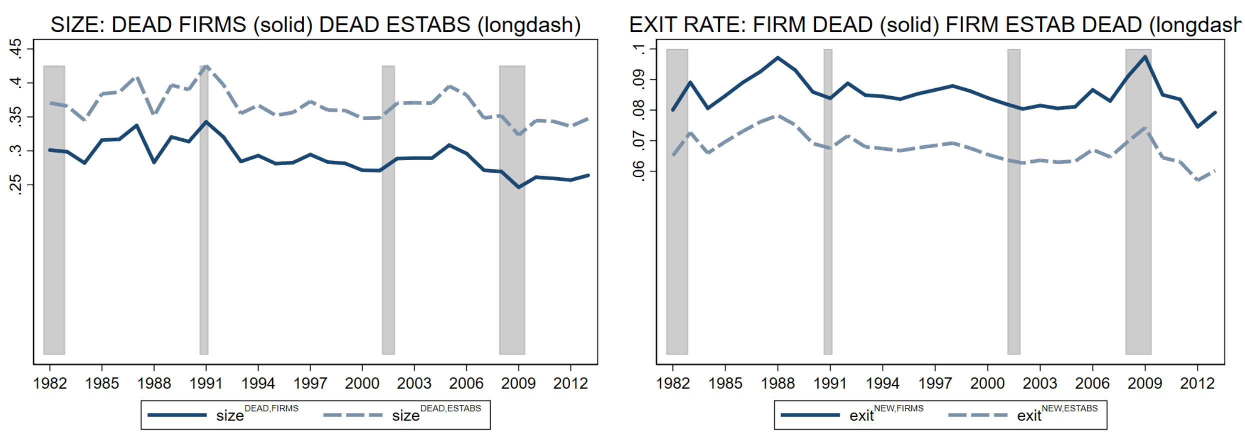
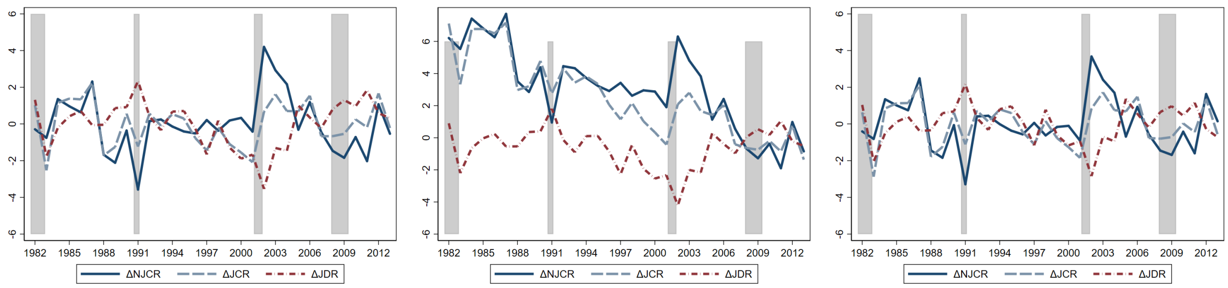


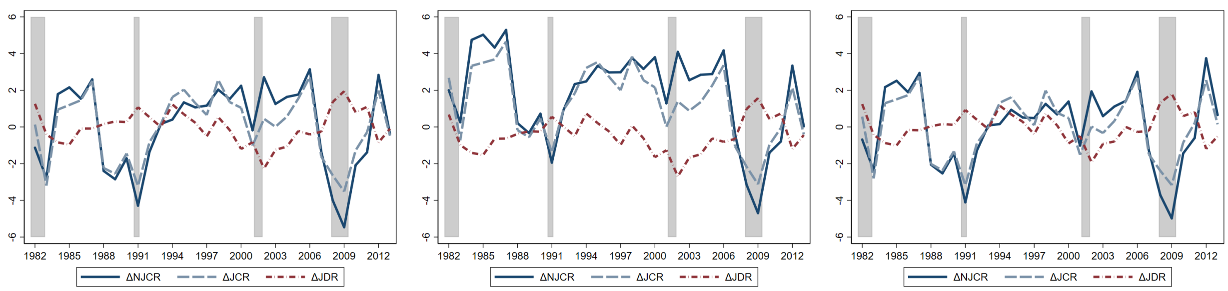
Figure A.2: Differential Job Flows – Alternative Filters

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

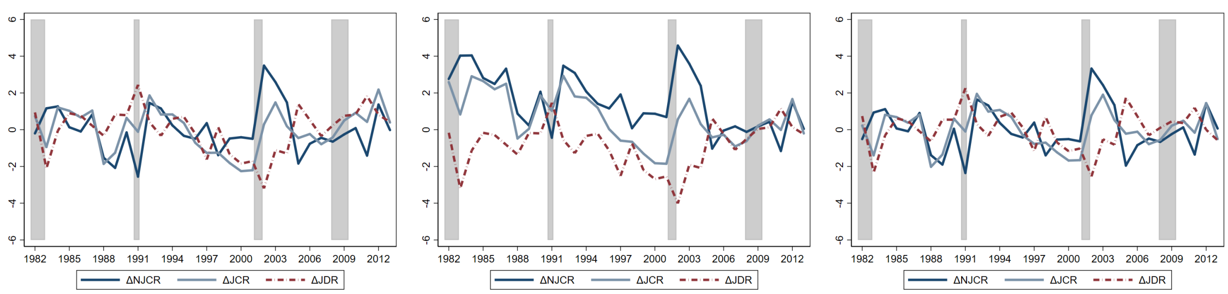
(a) *SMALL* vs. *LARGE*



(b) *YOUNG* vs. *MATURE*



(c) *MATURE/SMALL* vs. *MATURE/LARGE*



(d) *YOUNG/SMALL* vs. *MATURE/SMALL*

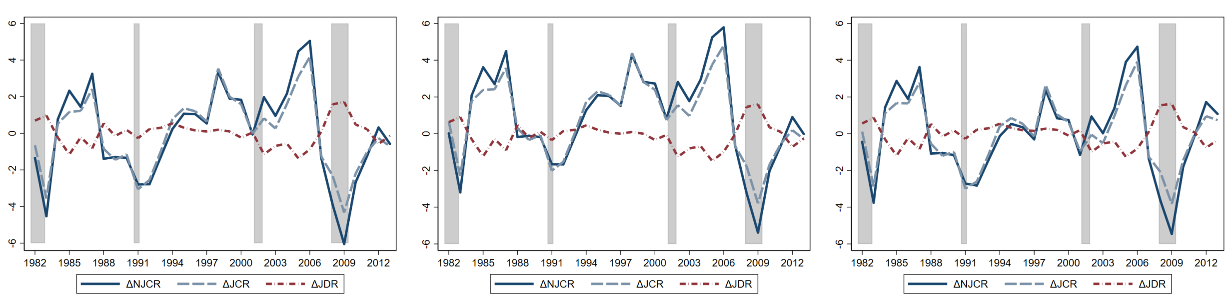
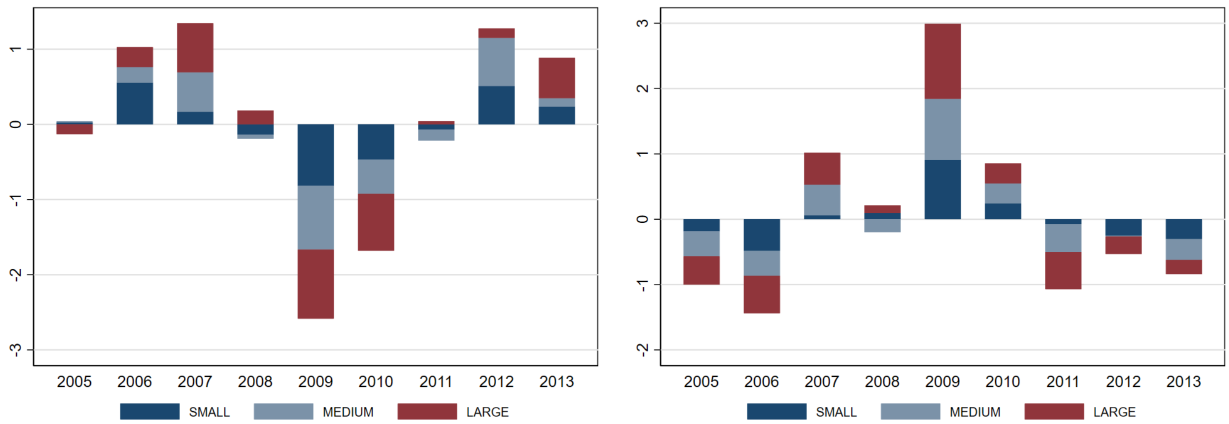
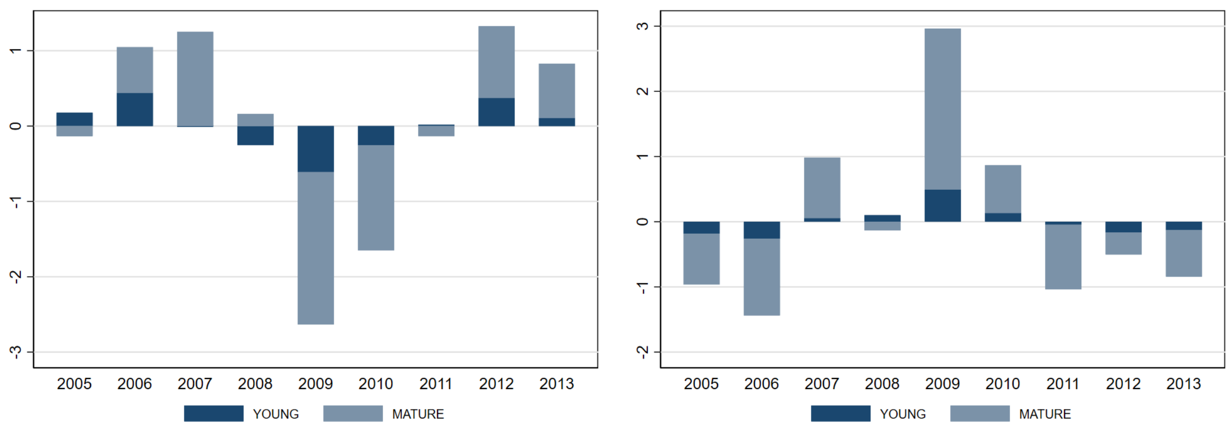


Figure A.3: Contribution to JCR and JDR – Great Recession

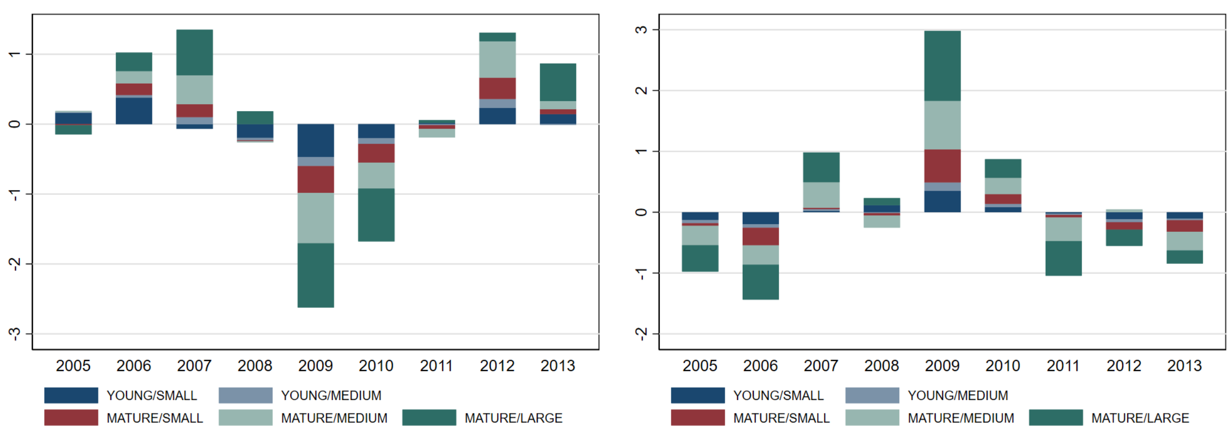
(a) Contribution to JCR and JDR by $SIZE$



(b) Contribution to JCR and JDR by AGE



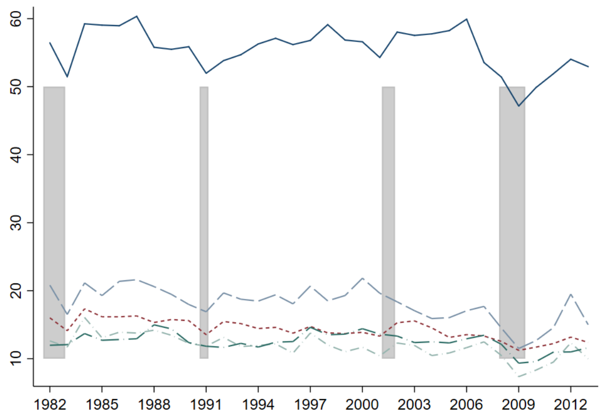
(c) Contribution to JCR and JDR by $AGE/SIZE$



The graph plots the weighted contributions of individual job flow rates to overall JCR and JDR during the period of the Great Recession.

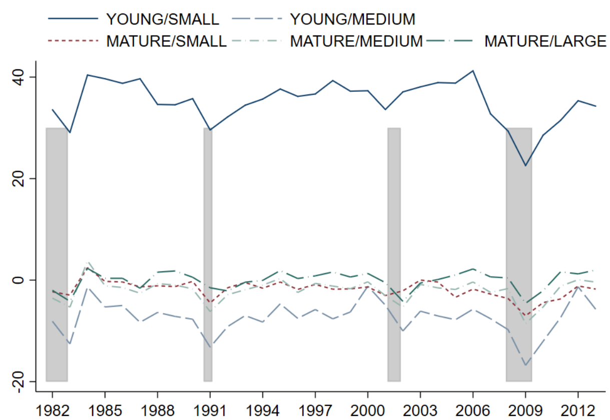
Figure A.4: Job Flow Rates by AGE/SIZE over Time – Alternative Size Cut-off

(a) Job Creation Rate



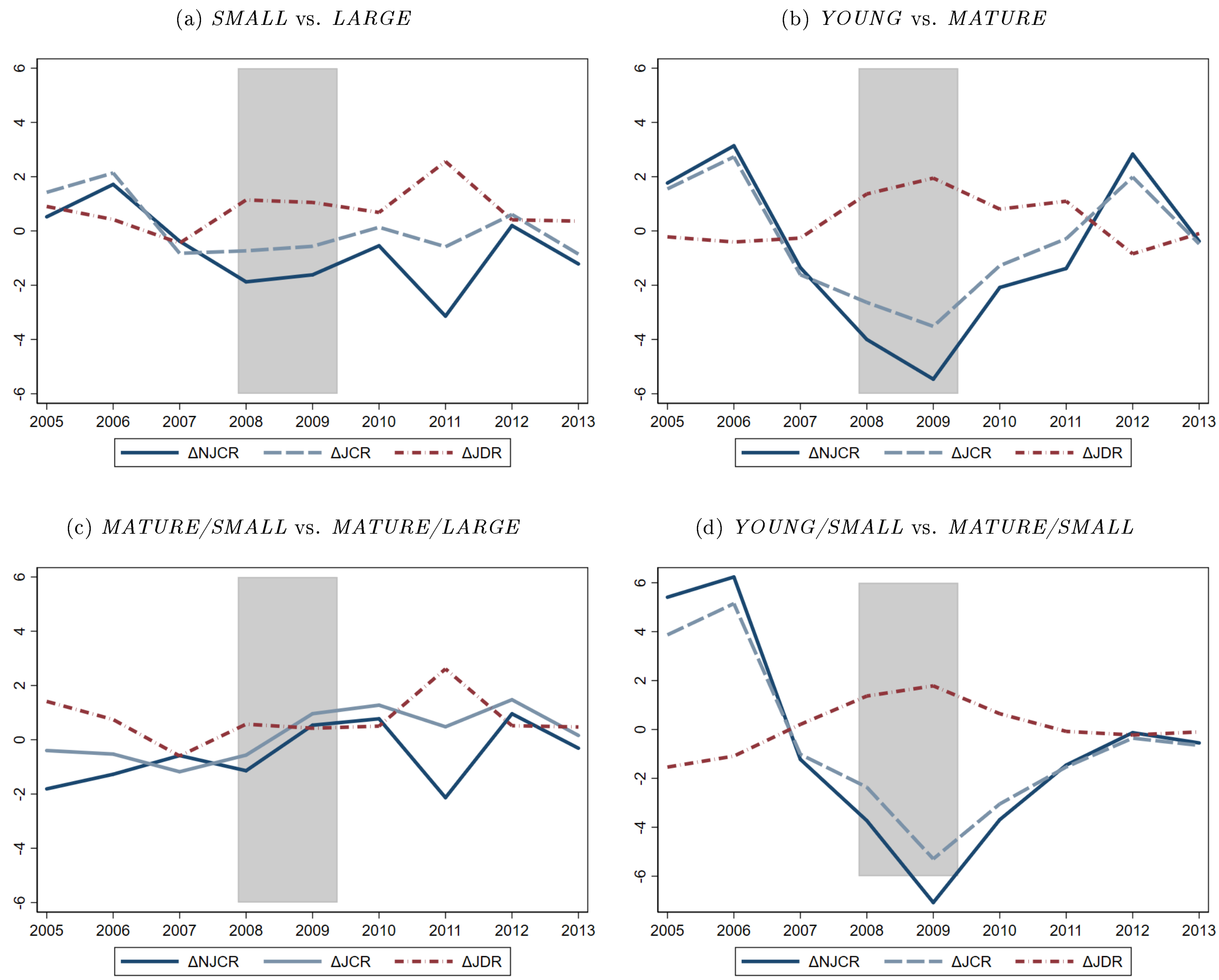
(b) Job Destruction Rate

(c) Net Job Creation Rate



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.

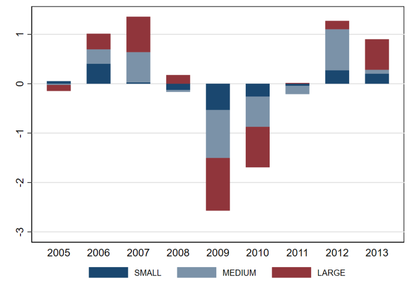
Figure A.5: Differential Job Flows during the Great Recession – Alternative Size Cut-Offs



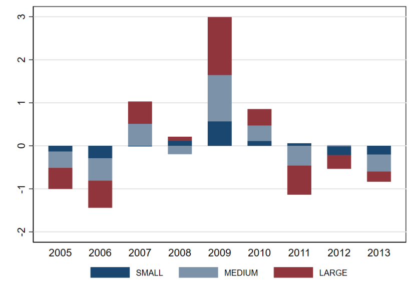
The graph plots the Differential Job Flows of different groups of firms. From the first top left to bottom right panel we look at *SIZE*, *AGE*, *SIZE* conditional on $AGE = MATURE$, *AGE* conditional on $SIZE = SMALL$, and $MATURE/LARGE - YOUNG/SMALL$. Differentials are computed by subtracting the respective 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 A.6: Contribution to Job Flows – Great Recession – Alternative Size Cut-Offs

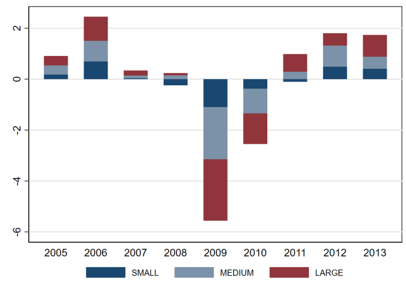
(a) Contribution to JCR by *SIZE*



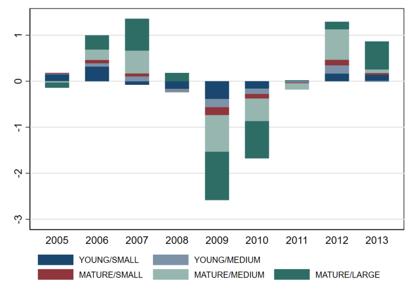
(b) Contribution to JDR by *SIZE*



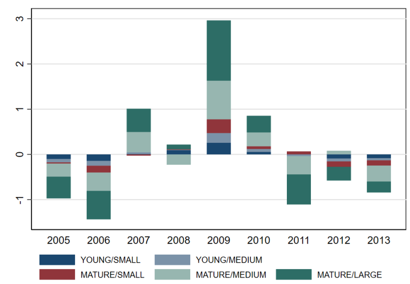
(c) Contribution to NJCR by *SIZE*



(d) Contribution to JCR by *AGE/SIZE*



(e) Contribution to JDR by *AGE/SIZE*



(f) Contribution to NJCR by *AGE/SIZE*

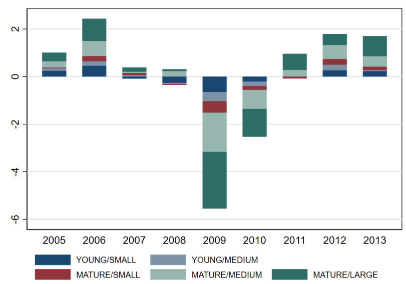
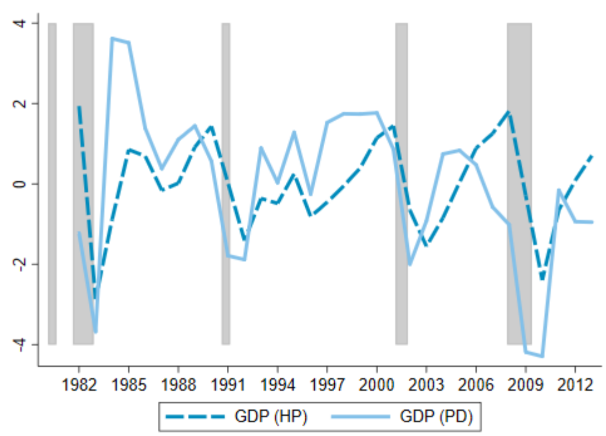
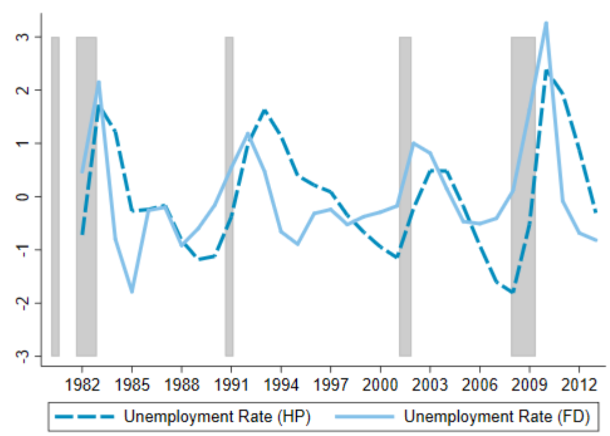


Figure A.7: Comparing the De-Trending of Aggregate Cyclical Indicators

(a) Cyclical GDP



(b) Cyclical Unemployment Rate



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.

Appendix Tables

Table A.1: 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 A.2: 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 4.2.

Table A.3: 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 A.4: Variance Decomposition — Alternative Size Cut-Off

Decomposed	$SIZE$			AGE		$AGE/SIZE$					
Rate	S	M	L	Y	M	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 4.2.

Table A.5: Variance Decomposition — Alternative Size Cut-Off

Decomposed	$SIZE$			AGE		$AGE/SIZE$					
Rate	S	M	L	Y	M	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 4.2.

Table A.6: Correlations of *SMALL-LARGE*-Differential with GDP and Unemployment Rate

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Period		1982-2013	1982-2013	1979-2009	1979-2009	1979-2009	1979-2009	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.

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