Cyclical Patterns of Business Entry and Exit Dynamics in the US Economy*

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Abstract

This paper documents the cyclical patterns of business entry and exit dynamism in the US using the Business Dynamic Statistics (BDS) dataset. The main finding is that, for both firms and establishments, the entry margin is significantly procyclical while the exit margin shows little cyclicality. In addition to the entry and exit rates, the numbers and relative sizes of entering and exiting businesses exhibit similar patterns over the business cycles. I then examine the roles of size, age, and sector in shaping the observed cyclicality, or lack thereof, and find significant variation across different groups.

Keywords: Entry and exit, Firm/establishment size and age, Business cycles

JEL Classification Codes: E23, E32, L11, L60

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1 Introduction

Businesses open and close. Along with the births and deaths of businesses, jobs are created and destroyed. It is commonly believed that business openings increase or decrease with the aggregate economic activity while business closings move against the tide. One must ask: does the data actually support the common wisdom?

This study attempts to address this question. However, the answer is not a simple "yes" or "no". Using the publicly available data from the Business Dynamic Statistics (BDS) produced by the Census Bureau and covering the years from 1979 through 2013, I document the cyclical patterns of US business dynamism on the extensive margin, that is, the formation and destruction of businesses. Here, a "business" refers to either a firm or an establishment owned by some firm.[1]

The main findings of the paper are summarized in the following facts.

Fact 1 Overall, whether employment-weighted or unweighted, the firm birth rate is significantly *procyclical* and the firm death rate is largely *acyclical*.

Fact 2 The pattern in Fact 1 is not entirely driven by the major observable characteristics of firms, which include firm size, the sectors into which its establishments are classified, and firm age at death.

Fact 3 The cyclicality on the extensive margin decreases in firm size. The birth rates of smaller firms are more procyclical than those of large firms. Also, the death rates of smaller firms are more countercyclical than those of large firms.

Fact 4 Younger firms show weak countercyclicality in death rate. This countercyclicality is not observed in the death rate of older firms.

Fact 5 Neither the entry rate nor the exit rate of establishments shows significant unconditional cyclicality, employment-weighted or unweighted. However, after controlling for observable establishment characteristics, the entry rate becomes significantly procyclical and the exit rate countercyclical. The entry rate shows stronger cyclicality than the exit rate.

Fact 6 Substantial differences in establishment entry and exit cyclicality exist across sectors.

Fact 7 Fact 3 by firm size applies to establishment entry and exit rates by establishment size.

[1] Section 2 gives the definitions of a firm and an establishment in the BDS.

Fact 8 Fact 4 on firm death rates by firm age largely applies to establishment exit rates by establishment age.

Fact 1 concerns the aggregate, unconditional birth and death rates of firms. Fact 2 applies to the conditional rates for each finely classified group, as do Facts 3 and 4. Similarly, the other facts explore both the conditional and unconditional establishment entry and exit rates. There is an additional fact concerning the numbers and sizes of firms and establishments on the margin over the business cycles.

Fact 0 The total number of businesses is procyclical due to the procyclicality of the number of entrants and the acyclicality of the number of exits. The relative size of an entrant is countercyclical due to procyclical average business size. The relative size of an exiting business shows no significant cyclicality.

The pattern of entry and exit is a vital part of the business cycles. However, compared to the intensive margin – the growing and shrinking of existing businesses – the extensive margin is much less studied, largely due to the limited access of establishment- and firm-level micro data. It is of great importance to have a set of sharp, well-documented facts about business entry and exit. The reasons are, at the very least, threefold. First, the entry and exit dynamism is in itself an important feature of the aggregate economic fluctuation and it in turn shapes the observed business cycles. For any theory on the volatility in birth and death of businesses to have a solid ground, we must know first when more firms are born and when more close, and to what degree the openings and closings are correlated to the aggregate economic condition – for the whole economy and also for different groups of businesses. In addition, recent studies also point out the importance of entry and exit in affecting the business cycles. For example, Clementi and Palazzo (forthcoming) and Clementi, Khan, Palazzo, and Thomas (2015) show how entry and exit can amplify and prolong the effect of aggregate productivity shocks in real business cycle models, and Tian (2015) uses the option value of exiting to illustrate how countercyclical productivity dispersion may endogenously arise.

Second, as Figure 1 clearly illustrates, the opening and closing of businesses contributes significantly to total job creation and job destruction. In a given year, startup firms create anywhere from one sixth to nearly one quarter of all jobs created. Meanwhile, closing firms are responsible for anywhere from one seventh to more than one fifth of the destroyed jobs. The entry and exit of establishments plays a even bigger role. The entry of new establishments accounts for at least a third of the jobs created. In some years the fraction spikes to more than 40 percent. At the same time, exiting establishments account for more than a quarter of

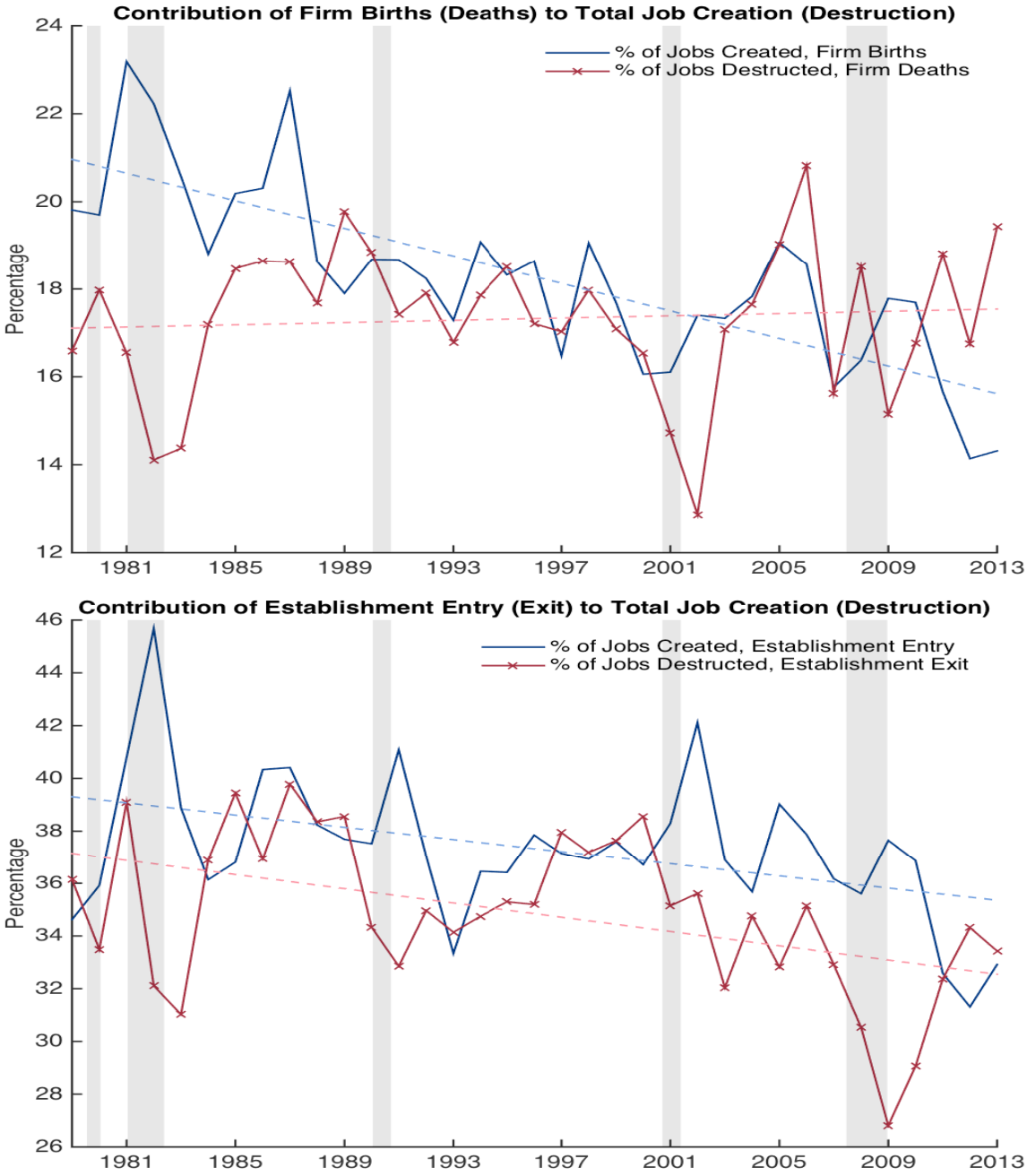


Figure 1: Percentage contribution of the extensive margins to job creation and destruction. Upper panel: % of jobs created (destroyed) due to firm births (deaths) to total jobs created (destroyed) each year, 1979-2013. Lower panel: % of jobs created (destroyed) due to establishment entry (exit) to total jobs created (destroyed) each year, 1979-2013.

total jobs destroyed; in some years they account for nearly 40 percent. In fact, although all of the fraction sequences suggest a declining trend (except for the job destruction fraction due to firm deaths), the sheer numbers of jobs affected are much steadier. As shown in Figure C.1 in Appendix C, firm birth and death creates about 2.9 million jobs and destroys 2.5 million, and establishment entry and exit creates and destroys 5.4 million and 5.0 million respectively. This is true in the US for every one of the past 35 years. Any cyclical change in business openings and closings directly causes job creation and destruction. Hence, in order to better understand the response of the labor market to economic fluctuation, one needs to know about the formation and survival conditions of the employers as well.

And last, these facts provide an additional discipline for the study of firm dynamics over the business cycles. They can serve as calibration targets to fix parameter values, and, moreover, can be used to test the implications of theoretical models that include the entry and exit feature.

The findings of this paper suggests that the entry margin is more sensitive than the exit margin. The cyclical change in the total number of businesses, a measure of the scale of an economy, is mostly driven by the procyclical volume of new entrants. Hence, the paper also contributes to the debate between the sullying and cleansing effects of recessions. Due to the overall acyclicality of the number and rate of exits, the cleansing effect cannot be very large. In addition, because small and young firms are the ones whose exits are more countercyclical, the cleansing effect, if it exists, affects mostly these firms. Because of the procyclicality of entry, the entry margin becomes more selective during recessions, and entrants during recessions have larger *relative* sizes than those born during booms. Several studies on firm dynamics and business cycles following Hopenhayn (1992) and Hopenhayn and Rogerson (1993) predict the intuitive procyclicality of entry and countercyclicality of exit, including Clementi and Palazzo (forthcoming), Clementi, Khan, Palazzo, and Thomas (2015), and Tian (2015), among others. The pattern documented here suggests that correct characterization of the exit margin requires other mechanisms.

The existing literature on the cyclical change in business entry and exit is very limited, and is largely focused on the manufacturing sector. Earlier studies include Dunne, Roberts, and Samuelson (1988), Dunne, Roberts, and Samuelson (1989a), Dunne, Roberts, and Samuelson (1989b), and Campbell (1998). The recent study by Lee and Mukoyama (2015) again focuses on manufacturing and covers the years from 1972 to 1997. They find procyclical entry and largely acyclical exit in this sector at the establishment level only. However, they do not control for or examine the effects of establishment size and age, which are important in determining entry and exit. Another closely related paper is by Moscarini and Postel-Vinay (2012).

They use the same BDS data and focus on the *intensive* margins over the business cycles, and find that large firms are more responsive to business cycles in the sense that they create (destroy) proportionally more jobs when the unemployment rate is low (high). The focus here is the dynamism on the *extensive* margins, where it is actually the small and young firms that are more sensitive to changes in the economic condition.

The rest of the paper is organized as follows. Section 2 briefly introduces the BDS dataset and other data I use in the analysis. Section 3 explains the measures of various variables of interest and discusses robustness issues. Section 4 gives a bird's eye view of the data. Section 5 presents the results of firm birth and death cyclicality in detail and Section 6 presents those of establishment entry and exit. Section 8 provides a few potential explanations for the facts and then concludes. Appendices contain detailed definitions of variables and additional figures and tables.

2 Data

The primary source of data used in this study is the Business Dynamic Statistics (BDS) dataset, a publicly available dataset developed by the Center for Economic Studies at the Census Bureau. The BDS is created from the Longitudinal Research Database (LRD) and contains major statistics on business dynamics at a semi-micro level, categorized according to both firm characteristics and establishment characteristics in each year. According to the BDS's definition, an establishment is a single physical location; a firm is a collection of establishments under a common ownership. Data in Economic Census years (years ending in "2" and "7") is reconciled to the census data. The latest release, from 2015, covers the entire private US economy and consists of annual data from 1976 through 2013.

Note that, due to the year-by-year re-categorization of data, the longitudinal linkages over time are partially but largely broken because one cannot keep track of the history of an individual establishment or firm. Hence the BDS cannot be considered to be panel data or longitudinal data, but rather is cross-sectional data documented year after year.

The BDS distinguishes between *establishments* and *firms*, and hence, the aforementioned firm characteristics and establishment characteristics may differ greatly. The set of establishment characteristics contains an establishment's size, age, sector or location, and the age and size of its parent firm. The set of firm characteristics is then built based on the establishment characteristics. In the BDS, all measures related to firm and establishment sizes are employment-based, and employment is measured as the total number of full- and part-time employees at an establishment for the payroll period containing March 12th of each year.

Therefore, all growth rates reflect the March-to-March changes. The BDS offers two distinct types of firm/establishment size class for each year: the actual size, which is the *average size* between the cited year and the previous year, and the *initial size* measured at the end of the previous year (hence the beginning of the cited year). The size and initial size are identical for an entrant establishment. In this paper, the preferred size notion is the initial size, the size measured *before* any employee flows (including exits) take place. This allows me to focus on the firm/establishment's behavior as a function of its current size.

The age of an establishment is the difference between the cited year and its birth year, the year it first reported positive employment. An establishment is a new entrant when its age is zero.[2] The age of a firm is calculated from the age of the establishments owned by it, which, for the majority of firms, is the age of its oldest establishment.[3] A startup firm is then a firm with age zero. And a firm is considered to have exited when all of its establishments and the firm itself cease all operations.[4] To distinguish establishment exits from firm exits, in the rest of the paper, I use "exit" for establishments and "death" for firms. Similarly for entry, I use "entry" for establishments and "birth" for firms. To slightly abuse the language, I also use "entry" and "exit" when I refer to both establishments and firms.

The BDS also classifies establishments by sector and location. All nine of the broadly classified private sectors are covered by the dataset using Standard Industrial Classification (SIC) codes. Each establishment is grouped into the sector in which it is classified. Naturally, it is impossible to assign a single code to multi-establishment and multi-sector firms. Therefore, a firm is included in a sector group if it has at least one establishment classified in that sector.[5] The BDS classifies the locations of establishments into the states of the US, excluding outlying territories. A firm may operate in more than one state and therefore its location is defined in the same way as its sector. However, the BDS does not have a finer classification that includes both a sector code and a location code. For example, the BDS cannot pinpoint

[2]The BDS defines the event of "establishment entry" such that the establishment's last-year employment is zero and its current employment is positive, with the reverse defined as "exit". Hence, it is possible for an establishment to enter and exit multiple times during its lifetime. Also, if a business enters and then exits between two observation times, the information may be lost in the BDS. In this paper, I focus on the entrants that satisfy the BDS definition and have zero age. Those with non-zero age that are identified as entrants are treated as businesses undergoing inactive periods. However, it is impossible to distinguish a true exit from a transition into inactivity. Hence, the establishment exit rate is over-estimated.

[3]To avoid abrupt changes in firm age due to mergers and acquisitions, a firm actually has an initial age, which is the age of the oldest establishment owned by this firm at its time of birth, and then age accumulates in the following years.

[4]The BDS does not count firms that cease to exist due to mergers and acquisitions as firm exits.

[5]This results in multiple counts of a single firm when it has establishments in different sectors.

the exact group of establishments that are classified in the service sector and are located in the state of Pennsylvania in any year. This paper looks at the classification by sector.

The measures of the economic condition come from various sources. The cyclical indicators at the aggregate level are constructed using the quarterly real GDP from the National Income and Product Accounts (NIPA) and the monthly civilian unemployment rate from the Current Population Survey (CPS). On the sector level, I use the industry-level real value added from the Annual Industry Accounts (AIA) of the Bureau of Economic Analysis and construct the sector-specific cyclical indicators. For post-1997 data, AIA classifies industries according to the 2007 North America Industry Classification System (NAICS). For the historical data, that is, pre-1997 data, the original SIC-coded data is converted using the 2002 NAICS codes.

3 Methodology

3.1 Detrending and Matching of Data

Because the cyclical patterns of entry and exit dynamics are the focus of this paper, the first task is to extract cyclical components from the time series data sequences. The preferred method of detrending in this paper is to use a Hodrick-Prescott (HP) filter. As a robustness check, linear detrending is also considered when plausible. Also, because the BDS data are measured each year on March 12 and all change rates are consequently calculated March-to-March, I need to match the timing between the BDS data and other data.

The detrending of quarterly real GDP is standard with little disagreement in the literature. The trend in the logarithm of real GDP is removed using the HP filter with smoothing parameter 1600.[6] To match the March-to-March observations in the BDS, the contemporaneous *level* of aggregate activity is the simple average of the quarterly detrended logarithms of GDP between the second quarter of the previous year and the first quarter of the cited year, interpreted as the average percentage deviation from the trend, denoted gdp_t. The *growth rate* of GDP is simply the percentage change from the first quarter of the previous year to the first quarter of the cited year, denoted ΔGDP_t.

The literature suggests several smoothing parameter options for the monthly unemployment rate. Moscarini and Postel-Vinay (2012) choose a very high smoothing parameter (8.1×10^6) at monthly frequency; Ravn and Uhlig (2002) also suggest a high value (1.296×10^5). In this paper, I stick to the more conventional choice of 14400 for the monthly data. Similar to the real GDP, the contemporaneous annual unemployment rate, u_t, is the simple average of

[6] Shimer (2012) uses a high smoothing parameter, 10^5, for quarterly data.

the detrended unemployment rate between the March of the previous year and February of the cited year.

I am aware of the potential difference caused by the order of detrending and aggregating higher frequency time series data. If one removes the time trend from higher frequency data first and then aggregates the residuals into the desired lower frequency, any potential time effects and cyclical patterns at the higher frequency are removed, and the aggregation results are consistent regardless of the choice of the starting and ending dates for the lower frequency. A potential downside is that any shortcomings associated with the chosen detrending method could accumulate in aggregation. The other option is to directly remove the time trend from the aggregated data. While being simple, intuitive, and arguably more immune to measurement errors that tend to occur at higher frequency, it may result in lost information in the aggregation stage and therefore lose the advantage of the availability of higher frequency data. Though each option has its advantages and shortcomings, I stick to the first – detrending before aggregating – in order to be more consistent with the handling of the annual industry-level data, discussed below.

The real annual sectoral value added is computed by aggregating the value added by each industry within a given sector, which is then matched to the BDS data. The challenges here are: i) linking the pre-1997 AIA data and the post-1997 data, ii) grouping the industries into corresponding sectors, and iii) dealing with the timing inconsistency between the March-to-March BDS data and the calendar-year-based AIA data. Appendix A addresses the first two in detail. The raw *level* is still the HP-detrended logarithm of sectoral real GDP and the raw *growth rate* is still the percentage change. Following Ravn and Uhlig (2002), I choose a lower smoothing parameter of 6.25 for all the annual sequences.[7] According to the observation times in the BDS, it is plausible to assume that about 75% of the job flows take place in the previous year and the rest in the cited year. Hence, for each sector, I assign a 75% weight to the cyclical component in its real value added of last year and the complementary weight to that of this year, and the weighted average is my preferred measure of the sectoral level of GDP. Similarly, the weighted average of the sectoral GDP growth rate of the previous year and that of the cited year serves as the sectoral growth rate.

As is mentioned in Moscarini and Postel-Vinay (2012) and shown in the overview of the BDS produced by the Census Bureau, the reliability of the BDS data is questionable for the earlier observations. Therefore, following them, I also use the data covering 1979-2013.

[7] I experimented with the conventional choice, 100, and there is no substantial change.

3.2 Potential Bias and Robustness

As mentioned before, the BDS data sequences are essentially series of cross-sectional data, with the longitudinal links largely broken. This mostly affects the classification of establishments and firms by employment-based size. The cutoffs for each size group are time-invariant. However, a firm can jump from one size group in a given year to another in the next year. In such cases, it is not obvious which size group the firm should belong to. This is referred to as the *size distribution fallacy* by Davis, Haltiwanger, and Schuh (1998). Extending it to reflect business cycle features, Moscarini and Postel-Vinay (2012) cast the term *reclassification bias* and suggest that, to overcome this bias, the *initial* size notion in the BDS should be used instead of the average size notion. By doing so, the contribution of the initially small firms can be separated from that of the initially large firms.

Moreover, in addition to the initial size, when calculating the entry and exit *rates*, the denominators I use are also the *initial numbers* of establishments or firms in a given group. For each group, the initial number is simply the count of businesses at the beginning of the cited year, or the end of the previous year. Combined, the entry rate is defined as the ratio of the volume of entrants over the pre-existing incumbents; while the exit rate is the exiting fraction of the pre-existing incumbents. Due to the nature of entry and exit, the analysis of the *volumes* on the extensive margin does not suffer from the reclassification bias so much as the rates, as long as they are classified according to the initial sizes.

Note the asymmetry in the interpretation of entry rate and exit rate. They share the same denominator, the volume of pre-existing businesses. Hence, the exit rate approximates the (conditional) probability of exiting, under the assumption that the Law of Large Numbers holds. For a characteristic group g, and a year t, the exit rate $Rate^X_{g,t}$ becomes

$$\text{Exit Rate of group } g \text{ at } t = \frac{\text{\# of exits in } g \text{ at } t}{\text{\# of pre-existing businesses in } g \text{ at } t} \approx \Pr(\text{Exiting}|g,t).$$

However, the entry rate does not have this interpretation, as the volume of potential entrants is unobservable.

Meanwhile, although the entry and exit rates are computed as ratios between simple counts of businesses, when looking at a broad group of businesses or the whole economy, one may find the equal contribution by very different firms implausible. The main concern here is, again, the size difference. Naturally, a tiny mom-and-pop business is considered to have a different impact on the economy than a gigantic corporation with thousands of employees when it starts or ceases to operate. Hence, to incorporate the effects of entry and exit on employment, an alternative is to compute the employment-weighted rates. Let G be a large collection of businesses (e.g., the whole economy), $g \in G$ a smaller group (e.g., a specific

size group). Assign a weight to each group g's entry according to g's contribution to the total jobs created due to entry in all of G. Then, the preferred measure of employment-weighted entry rate of G at year t is the weighted average of entry rate of each $g \in G$. The weight of each group g's exit and the resulting employment-weighted exit rate of G are calculated in a similar way. The detailed definitions of all variables are in Appendix B.

The standard cyclicality measure of a variable of interest is the unconditional correlation coefficient of the detrended observations with a cyclical indicator as the measure of aggregate economic activity. The advantage of this approach is that it minimizes any presumption of causality. The downside is related to the method of detrending. In addition, it is also not quite useful when measuring cyclicality of the within-group entry or exit rate while controlling for other observable characteristics. Therefore, as a second measure of cyclicality, I report the regression coefficient after regressing the original observations (without detrending) of the variable of interest (entry/exit rates) on a cyclical indicator, while controlling for a linear time trend and a set of fixed effects of identified characteristics (size, age, sector, etc.). In doing so, I can also conveniently read the conditional cyclicality of the variable while controlling for other aspects.

Naturally, when doing the regressions, I explicitly impose a causation direction between the cyclical indicator and the dependent variable. The dependent variable and the cyclical indicator may have a significant correlation, yet the causation direction cannot be determined. In fact, the aggregate condition can affect the business dynamics, which may in turn lead to changes in the observed measures of aggregate economic activity. If this is indeed the case, the endogeneity is inevitable, and appears in the form of simultaneity bias. However, the sign of the regression coefficient should remain intact. And even though the interpretation of a single coefficient is problematic, comparing the coefficients from the same regression while using data from different groups can still show how cyclicality changes across groups.

4 The BDS at a Glance

The Increasing Volume. The scale of the US economy, measured as the total number of businesses, shows a steady growing trend from the beginning of the 1980s until the Great Recession, as shown in Figure 2. The total volume of firms has increased by nearly 50 percent and that of establishments by almost 60 percent. The trend is disrupted around 2008 due to the "missing generation" of new entrants during the recession, a phenomenon studied by Karahan, Pugsley, and Sahin (2015) and Siemer (2014). The increasing trend reappears in 2011 and has remained since then.

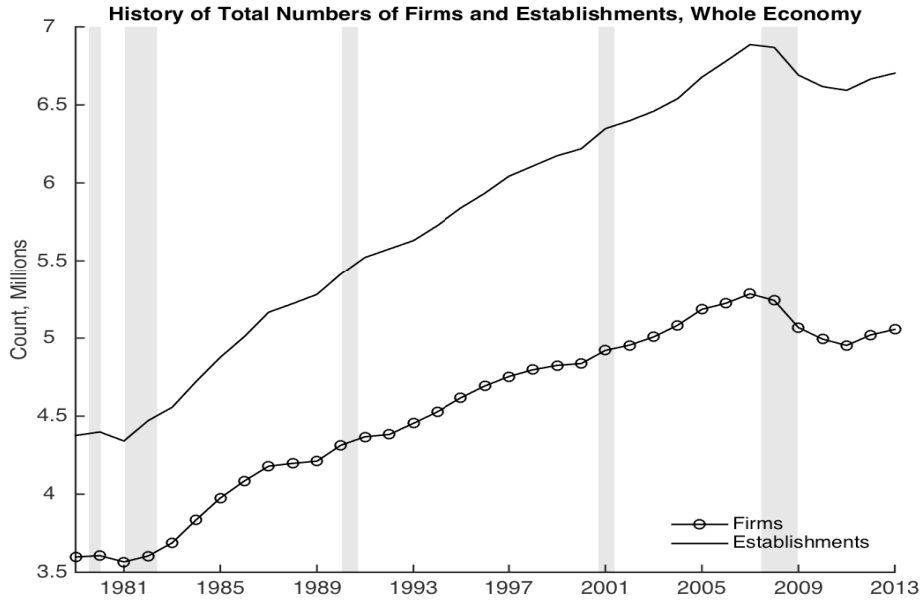


Figure 2: Growing scale of the market: total numbers of firms and establishments in the US economy, 1979-2013.

Although not visually obvious, the scale of the economy is "breathing" while growing. Table 1 demonstrates the significant procyclicality in the fluctuation of the number of businesses around the trend, with or without the post-recession period. The correlation coefficients of the *level* indicators (cyclical components of real GDP gdp_t and unemployment rate u_t) are greater in absolute values and are more significant than the correlation coefficients of the *growth rate* of real GDP. Interestingly, the annual growth rate in number of businesses comoves more with the *growth rate* of real GDP than with the levels.

The Declining Margins. Although the number of firms and establishments entering and exiting shows a mild long-term growing trend,[8] the *rate* of such dynamics is steadily declining over time on both the firm and establishment levels, as shown in Figure 3. On the firm level, the raw, unweighted startup rate declines from higher than 14 percent in 1979 to 8 percent more recently, while the death rate shows a much milder decline from about 10 percent to 8 percent. The establishment level shows a similar extent of decline. Meanwhile, Figure C.3 in the appendix illustrates that, out of the total number of new establishments, there is a clear, shrinking fraction of establishment entry due to firm birth, from over 85 percent in 1979 to

[8]See Figure C.2 in the appendix. In fact, the trend is once again disrupted during the Great Recession.

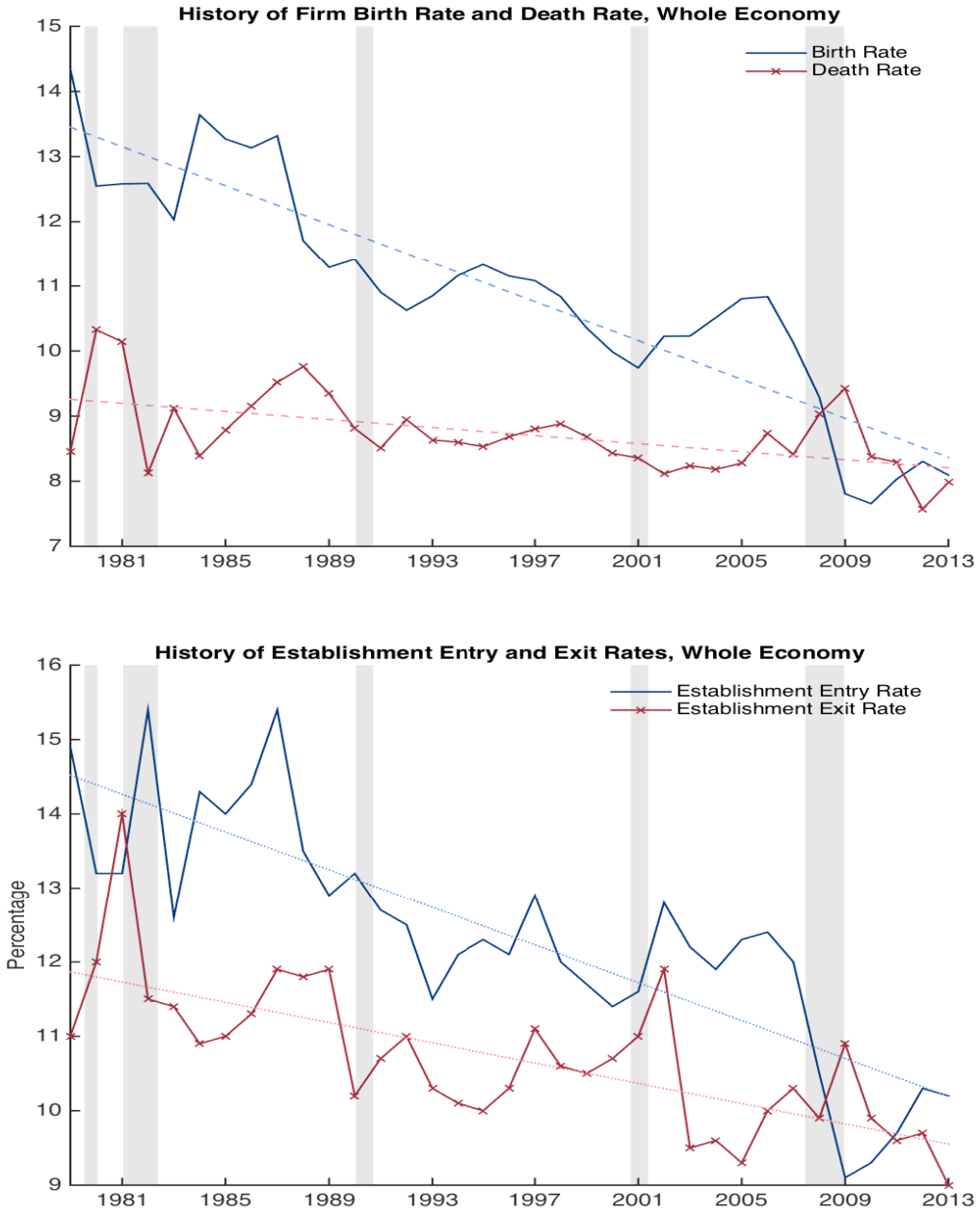


Figure 3: Secular decline on the extensive margins, 1979-2013. Upper panel: history of unweighted firm birth and death rates. Lower panel: history of unweighted establishment entry and exit rates.

Table 1: Procyclical Volume of Businesses: Correlation with Main Cyclical Indicators

	gdp_t	ΔGDP_t	u_t
SAMPLE PERIOD: 1979-2013			
Total Number of Firms †	0.6315^{***}	0.2874^{*}	-0.4934^{***}
Total Number of Establishments †	0.6087^{***}	0.1697	-0.5275^{***}
Growth Rate in Number of Firms	-0.0043	0.5772^{***}	-0.0246
Growth Rate in Number of Establishments	0.0675	0.4550^{***}	-0.1169
SAMPLE PERIOD: 1979-2007			
Total Number of Firms †	0.5657^{***}	0.3026	-0.3812^{**}
Total Number of Establishments †	0.5263^{***}	0.1509	-0.4153^{**}
Growth Rate in Number of Firms	-0.1427	0.3702^{**}	-0.0193
Growth Rate in Number of Establishments	-0.0271	0.1590	-0.1858

† All *level* variables in the first column are detrended logarithms using a Hodrick-Prescott filter with a smoothing parameter of 6.25. The resulting cyclicality of period 1979-2007 is also robust to linear detrending.
*,**,*** Significant at 10%, 5%, and 1% levels, respectively. This applies to the rest of the tables as well.

about 75 percent in 2013. The fraction of establishment exit due to firm death does not have a clear trend and fluctuates around 65 percent during the entire sample period. Taking into account the job creation and destruction associated with the entry and exit activity, I report in Figure C.4 in the appendix a similar observation using the employment-weighted rates of firm and establishment entry and exit. Before the Great Recession, entry rate is always higher than the exit rate, and consequently the economy gains volume faster than the growth in the numbers of entry and exit, which eventually results in the decline in the entry and exit rates. As mentioned before, the Great Recession is the first time in a long period that the US economy actually loses volume, and this is mainly due to the exceptionally low startup rate. The decline in the extensive margin of the US business dynamism is first documented and studied by Decker, Haltiwanger, Jarmin, and Miranda (2013), and a potential explanation is provided by, among others, Karahan, Pugsley, and Sahin (2015).

The main focus of this paper is the rate of entry and exit at both the firm and establishment levels. Nonetheless, I report the cyclicality of entry and exit *numbers* in Table 2. Without normalizing to the rates, the result from the numbers on the extensive margins already carries the flavor of the main finding: at both the firm and establishment levels, the entry side is significantly procyclical while the exit side is acyclical. Comparing firm birth and establishment entry, it turns out that the unconditional cyclicality of firm birth is the stronger of the two,

Table 2: Cyclicality of the Volumes on the Extensive Margin: Correlations

	gdp_t	ΔGDP_t	u_t
NUMBER OF FIRMS			
Startup Firms (Births)	0.4442^{***}	0.4466^{***}	-0.3172^{*}
Closing Firms (Deaths)	0.1199	-0.1872	-0.0436
NUMBER OF ESTABLISHMENTS			
New Establishments (Entry)	0.3182^{*}	0.1312	-0.2973^{*}
Exiting Establishments (Exit)	0.0393	-0.2736	-0.0187
Entrants due to Firm Birth	0.4228^{**}	0.4098^{**}	-0.2989^{*}
Exits due to Firm Death	0.1150	-0.1906	-0.0402

Full sample period, 1979-2013. All variables in the first column are detrended logarithms using a Hodrick-Prescott filter with a smoothing parameter of 6.25.

and the firm birth correlates with the *growth* of aggregate GDP while the establishment entry does not.

The Growing Size. Both the number of total employees and the number of businesses exhibit increasing trends over time. The question then becomes whether the average (employment-based) size of a business gets bigger or smaller as the net result. Figure 4 answers by plotting two increasing sequences, the average firm size and the average establishment size.[9]

On average, a firm has about 3 more employees than a firm did 35 years ago and an establishment has about 1 more employee. Note that, the temporary size reduction during the Great Recession is not as striking as the decline in startup firms and the overall upward trend remains intact. Indirectly, this suggests that small businesses received a particularly hard blow from the Great Recession and both the absolute number and the compositional fraction of the small businesses decreased. It also confirms the notion of "jobless recovery": total number of businesses slowly moves up although still far away from the long-term trend, and average size of a business moves toward the trend from below, which means the total number of jobs grows very slowly after the Great Recession. A similar increase in firm size emerges from the average number of establishments a firm has, which has increased nearly 10 percent since 1979, as illustrated in Figure C.6 in the appendix.

From the figures we can see a great deal of size fluctuation around each upward trend.

[9]The entry businesses are included when calculating the average sizes. Actually, after removing the contribution of the startup firms (entrant establishments), the average *continuing* firm (establishment) always has about 2 more employees than the all-firm (all-establishment) average and shows a similar upward trend.

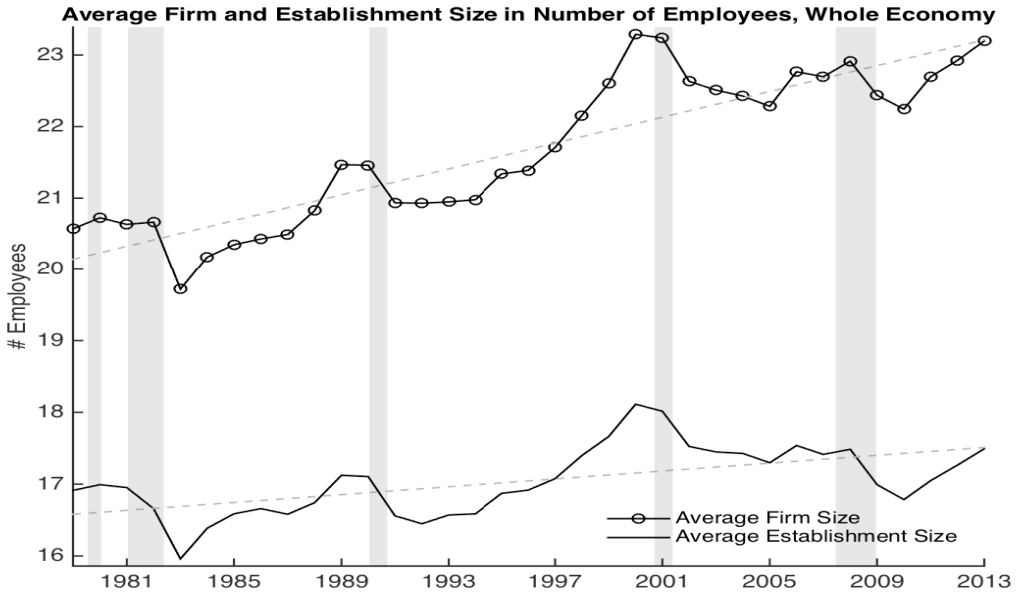


Figure 4: Growing average firm size and average establishment size, 1979-2013.

I would also like to see whether the fluctuation in average business size correlates with the aggregate economic condition. Table 3 serves this purpose. Not surprisingly, the average business size, measured as number of employees, is indeed procyclical, strongly and significantly so. Intuitively, we expect larger *continuing* businesses in good times, hence the procyclicality. Including the newborns does not change the cyclicality. Interestingly, on the contrary, the average number of establishments owned by a firm shows countercyclicality. In recessions, one should expect relatively more multi-unit firms among all firms and also among the continuing ones. Hence, the countercyclicality is not solely driven by fewer startups, which tend to be single-unit firms, in recessions. In fact, since the opening and closing of an establishment is the extreme case of (fixed, tangible) capital adjustment, it suggests a nontrivial effect of capital adjustment cost (together with the sunk cost paid upon entry) in preventing the active business closing and in inducing the "wait and see" behavior. Employment adjustment cost, on the other hand, is not large enough to dampen the job creation and destruction cyclicality.

Table 3: Cyclicality of the Average Business Size: Correlations

		gdp_t	ΔGDP_t	u_t
NUMBER OF EMPLOYEES				
Average Firm Size		0.6921^{***}	-0.0302	-0.6585^{***}
Average Firm Size, Continuers		0.7694^{***}	0.1262	-0.7080^{***}
Average Establishment Size		0.7713^{***}	0.0833	-0.6822^{***}
Average Establishment Size, Continuers		0.8222^{***}	0.1680	-0.7226^{***}
NUMBER OF ESTABLISHMENTS IN A FIRM				
Average Number of Establishments		-0.3115^{*}	-0.3872^{**}	0.1267
Average Number of Establishments, Continuers	-0.2581	-0.2854^{*}	0.0743	

Full sample period, 1979-2013. All variables in the first column represent the detrended number of employees using a Hodrick-Prescott filter with a smoothing parameter of 6.25. Linear detrending produces very similar results. Continuers are all businesses with positive employment at the time, excluding those defined as entrants.

It is not yet transparent how the size of a business upon entry or exit changes over time. The following section on relative sizes addresses this point.

Relative Sizes. Unlike the average size of a continuing business, the absolute average size of a new business does not have a growing trend; neither does the average size of a closing business, as depicted in Figure C.5.[10] The relative size of a new business or a closing one, on the other hand, seems to slowly decline over time, as plotted in Figure 5. Here, the relative size is defined as the average size of an entrant or an exiting business, normalized by dividing it by the the average size of a continuing business. Trend or no trend, the size of an average establishment on the margin is always considerably bigger than that of an average firm. And a typical opening or a closing business is always much smaller than an average continuing business.

The cyclicality of the average business size on the margin disappears, except for the negative correlation of the average entry establishment size with the GDP growth rate. This is shown in Table 4. It suggests that the extent to which an average entering (exiting) business is responsible for job creation (destruction) does not change with or against the aggregate economic fluctuation. Meanwhile, the relative size of a typical entrant does exhibit countercyclicality, compared to the acyclical relative size of an exiting business. On its own, this can be interpreted to mean that a booming economy allows relatively smaller firms or establishments to appear on the market. However, such cyclical change in relative size is mainly due

[10] Figure C.6 shows the average number of establishments owned by a startup or a closing firm; there is no clear trend here either.

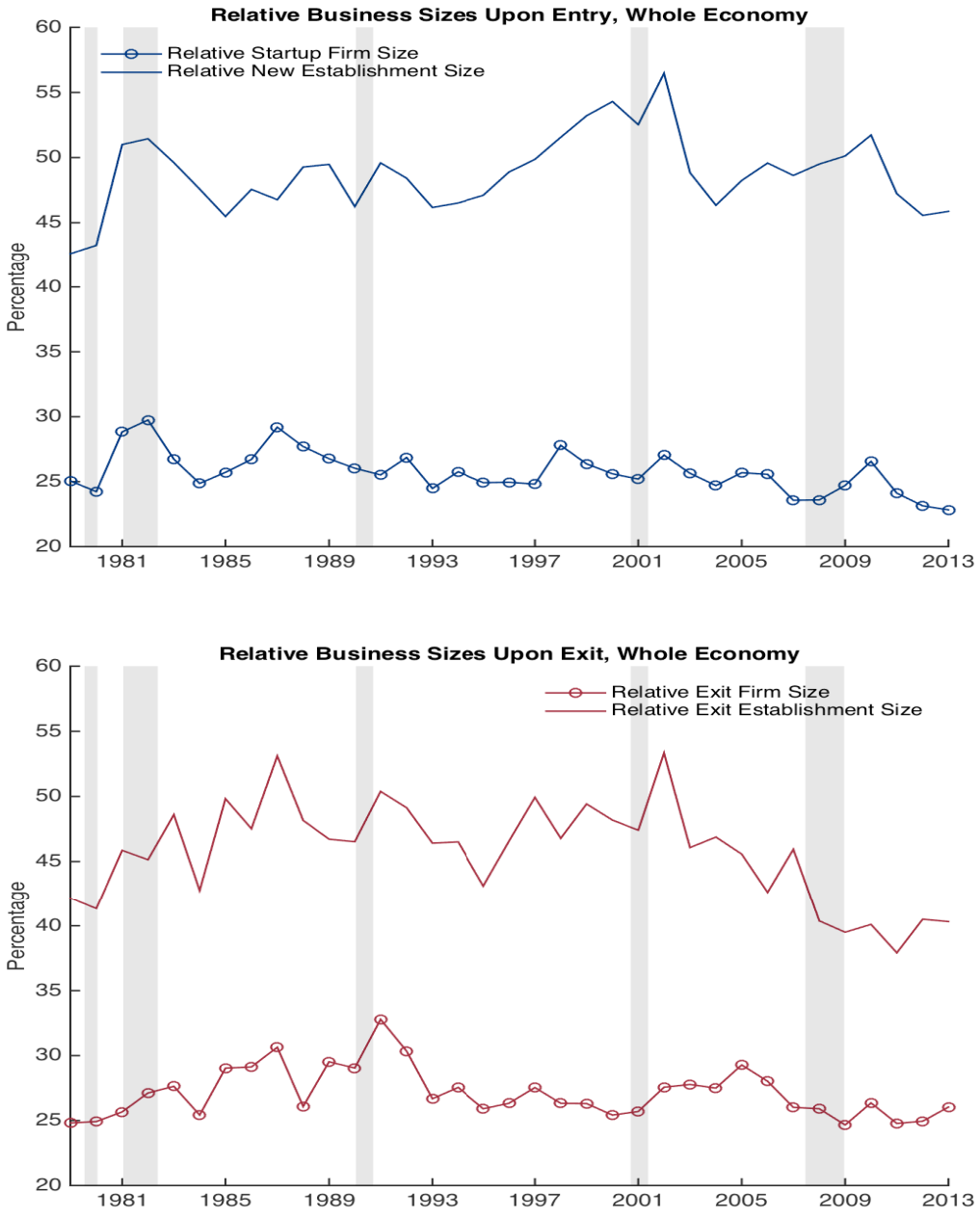


Figure 5: Relative business size upon entry and exit. Upper panel: average size of entrant establishments (firms) as a fraction of average size of respective continuing businesses. Lower panel: average size of exit establishments (firms) as a fraction of average size of respective continuing businesses.

Table 4: Cyclicality of the Relative Size of Business on the Extensive Margin: Correlations

	gdp_t	ΔGDP_t	u_t
AVERAGE SIZE IN NUMBER OF EMPLOYEES			
Average Startup Firm Size	-0.1029	-0.2551	0.1694
Average Closing Firm Size	0.0791	-0.2145	-0.0510
Average Entry Establishment Size	0.0359	-0.3101^{*}	-0.0270
Average Exit Establishment Size	0.0508	-0.1931	0.0343
RELATIVE SIZE IN PERCENTAGE			
Relative Startup Firm Size	-0.3036^{*}	-0.2900^{*}	0.3487^{**}
Relative Closing Firm Size	-0.1314	-0.2514	0.1387
Relative Entry Establishment Size	-0.2467	-0.3652^{**}	0.2206
Relative Exit Establishment Size	-0.1729	-0.2316	0.2250

Full sample period, 1979-2013. All variables in the first column are detrended using a Hodrick-Prescott filter with a smoothing parameter of 6.25.

to the *intensive* margin, i.e., the procyclicality in an average continuer's size.

The average firm size, measured as number of establishments, of a startup or a closing one does not show significant cyclicality, absolute number or relative to continuers. The exact values of correlation coefficients are in Table D.1 in the appendix.

Composition. The BDS classifies each establishment into one of the nine broadly defined sectors. Naturally, it is impossible to assign a single sector to firms operating in multiple sectors. Hence, a firm can show up multiple times when classified by sectors, and the distribution of firms by sector should be more accurately interpreted as the number or fraction of firms that own at least one establishment that is classified into that sector. The sectoral composition of the US economy in terms of number of firms, establishments, and employees changes dramatically over time. The manufacturing sector and the service sector are frequently mentioned examples. The manufacturing sector accounts for about 28% of employment and around 7.5% of establishments and firms at the beginning of the sample period. These numbers decrease to less than 11% and 5%, respectively, at the end. On the contrary, the service sector now provides well over 40% of total employment and has more than 40% of establishments and almost half of all firms. These fractions are about 24%, 30% and 33%, respectively, before the 1980s. The detailed plots are in the appendix. As mentioned before, earlier research studying entry and exit dynamics mainly focuses on the manufacturing sector and mainly establishment-level data from the Annual Survey of Manufacturing (ASM) and the Census of

Manufacturing (CM). Examples are Dunne, Roberts, and Samuelson (1988), Campbell (1998), and recently Lee and Mukoyama (2015). This results mainly from the limitation in the availability of other suitable datasets. However, due to the diminished role of manufacturing, it is crucial to examine other sectors in order to get the whole picture. Indeed, as the result in the following sections shows, cross-sectoral differences are not to be neglected.

There are nine size groups for establishments and twelve size groups for firms in the BDS. The firm size distribution and establishment size distribution are both highly right-skewed for the entire sample period, as shown by the figures in the appendix. More than a half of all firms have fewer than five employees each, which is the smallest size group. The fraction of the smallest establishments is also close to a half. And the smallest size group contributes about 70% or more of activities on the extensive margins. Zooming in on the right tails of the two size distributions, the fraction of larger firms and that of larger establishments show increasing trends over time. In combination with the observation of the ever-growing size of firms and establishments, this means that not only do businesses get larger on average, but there are also more of the larger businesses in simple volume and in proportion. Hence, more employees work for the larger firms. In fact, the largest firm size group (10,000 or more employees) provides more than a quarter of total jobs. Also, according to Moscarini and Postel-Vinay (2012), large firms are responsible for proportionally more job destruction in times of high unemployment rates.

Firms and establishments are also classified according to their ages into eleven age groups in the BDS. Since there is no data record before 1976, the ages of those pre-existing firms and establishments at that time cannot be properly determined. Hence, those firms always have left-censored age and they comprise the twelfth age group. The volume of the youngest firms, aged five years or younger, shows no visible trend during the sample period. Neither does the volume of young exiting businesses. Yet the youngest firms lessen and lessen in proportion, decreasing from a half to less than a third. The youngest exiting firms make up less than half of total firm deaths now, compared to over 60% at the beginning of the sample period.

The observation above leads to the first business-cycle-related fact on the features of entering and exiting businesses.

Fact 0. *The total number of businesses is procyclical due to the procyclicality of the number of entrants and the acyclicality of the number of exiting businesses. The relative size of an entrant is countercyclical due to the procyclicality of the average business size. The relative size of an exiting business shows no significant cyclicality.*

Table 5: Unconditional Cyclicality of Firm Birth and Death Rates: Correlations

	gdp_t	ΔGDP_t	u_t
UNWEIGHTED			
Firm Birth Rate	0.3229^{*}	0.5242^{***}	-0.1963
Firm Death Rate	0.0457	-0.1777	0.0272
Establishment Entry Rate due to Firm Birth	0.3238^{*}	0.4414^{***}	-0.2071
Establishment Exit Rate due to Firm Death	0.0688	-0.1842	0.0081
Job Creation Rate due to Firm Birth	0.0575	0.1348	0.0591
Job Destruction Rate due to Firm Death	-0.0052	-0.2560	0.0954
EMPLOYMENT-WEIGHTED			
Firm Birth Rate	0.4238^{**}	0.6150^{***}	-0.2672
Firm Death Rate	0.0820	-0.1984	-0.0099
Establishment Entry Rate due to Firm Birth	0.4075^{**}	0.5583^{***}	-0.2807
Establishment Exit Rate due to Firm Death	0.0280	-0.1979	0.0194

All variables in the first column are detrended using a Hodrick-Prescott filter with a smoothing parameter of 6.25. Linear detrending does not substantially affect the signs and significance.

5 Firm-level Cyclical Patterns of Birth and Death Rates

I report in this section how firm-level birth and death rates move over the business cycles. With all firms in the US economy taken into account, the cyclicality of the unconditional birth or death rate is in the form of a raw correlation coefficient between the overall birth or death rate and a measure of the aggregate economic condition. The within-group cyclicality is captured by the sign of the corresponding coefficient from a controlled regression. I then break the firms into different groups according to an observable characteristic and examine how that characteristic affects the cyclicality.

5.1 Aggregate Picture

Fact 1. *Overall, the firm birth rate is significantly procyclical and the firm death rate is acyclical. This is also true for the employment-weighted birth and death rates.*

The upper half of Table 5 lists the raw correlation coefficients between the detrended, unweighted birth and death rates and three cyclical indicators. Similar to the cyclicality of volumes on the extensive margins in Table 2, the firm birth rate and associated establishment entry rate are significantly procyclical with both the *level* and the *growth* rates of aggregate

real GDP. Meanwhile, the unweighted death-related rates do not show any significant correlation. The exception is the job creation rate due to firm births, which is acyclical.

Considering the drastic difference between small and large firms' impact on employment dynamics, I construct employment-weighted birth and death rates, where the weights are determined by the firm's contribution to the total job creation or destruction. I report in the lower half of Table 5 the resulting correlations, which show a pattern that is similar to that of the unweighted rates.

The difference in the unconditional cyclicality of firm birth- and death-related rates may potentially be driven by inappropriate aggregation. Both the numerator and the denominator of a rate are simple, indiscriminate counts of businesses that do not consider how much these businesses differ from each other. Hence, in an attempt to address this concern, I look at the variables of interest for each finely defined group of firms. Thanks to the BDS classification, each group of firms is labeled by size, sector, age, and observation time. Therefore, firms within a group are considered to be very similar. Treating each group as a unit, I then compute the birth- and death-related rates for each.[11] Pooling together all groups, I can regress the raw values of each variable of interest on a linear time trend, a set of controls and a chosen cyclical indicator. Taking into account the changing sectoral composition of the US economy, I include sector-specific trends as regressors as well. Moreover, since each group is clearly labeled with a sector, the *level* and *growth* of the sectoral real value added are also included as cyclical indicators, denoted gdp_{it} and ΔGDP_{it}, respectively, for each sector i. They measure the economic condition specific to a sector. This exercise leads to the next observation.

Fact 2. *The pattern in Fact 1 is not entirely driven by the major observable characteristics of firms, which include firm size, the sectors into which the firm's establishments are classified, and firm age at death.*

Table 6 shows the cyclicality of firm birth- and death-related rates as regression coefficients. Each entity in the table is the estimated $\hat{\gamma}$ and its significance from the following regression.

$$y_{i,j,t} = \gamma X_{i,t} + \beta_0 + \beta_1 t + \sum_i \beta_{2,i} t \times D_i + \sum_i \beta_{3,i} D_i + \sum_j \beta_{3,j} D_j + \epsilon_{i,j,t}, \tag{1}$$

where $y_{i,j,t}$ is the value of one of the six dependent variables in Table 6 for a group labeled by sector i, age and/or size j; $X_{i,t}$ is the value of one of the five cyclical indicators at time t;[12]

[11] Apparently, startup firms have zero age by definition, hence the age dimension is ignored when dealing with firm births. The death of a firm, on the other hand, can occur at any positive age.

[12] For aggregate cyclical measures, apparently $X_{i,t} = X_{i',t}$ for all sector pairs (i, i').

Table 6: Cyclicality of Firm Birth and Death Rates, Observable Characteristics Controlled

	Dependent Variables†					
	Firm Birth-Related Rates			Firm Death-Related Rates		
	I	II	III	IV	V	VI
Cyclical Indicators	Firm	Estab.	JCR	Firm	Estab.	JDR
AGGREGATE						
gdp_t	0.1529^{***}	0.1182^{***}	0.1031^{***}	0.0107	0.0225	-0.0168
ΔGDP_t	0.0160	0.0011	-0.0222	-0.0044	-0.0326^{**}	-0.0422^{***}
u_t	-0.3720^{***}	-0.2914^{***}	-0.2141^{**}	0.1251	0.0818	0.1529^{*}
SECTORAL						
gdp_{it}	0.0548^{***}	0.0390^{***}	0.0476^{***}	0.0024	0.0044	-0.0046
ΔGDP_{it}	0.0670^{***}	0.0563^{***}	0.0472^{***}	-0.0235^{***}	-0.0307^{***}	-0.0333^{***}
Min.Num.Obs.	2384	2384	2128	12818	12818	12818
Min.Adj.R^2	0.8472	0.8657	0.8197	0.6830	0.7338	0.5805
Controls‡	Y	Y	Y	Y	Y	Y
Age ††	N	N	N	Y	Y	Y

† Full sample, pooled regressions. The dependent variables are (I) firm birth rate, (II) establishment entry rate due to firm birth, (III) job creation rate due to firm birth, (IV) firm death rate, (V) establishment exit rate due to firm death, and (VI) job destruction rate due to firm death. Each entity represents the result of one regression, where a dependent variable is regressed on a cyclical indicator and a set of control variables.

‡ The observations of the dependent variables are raw values without detrending. This applies to the following regressions as well. For the births, the controls include a common time trend, sector-specific time trends, and sector fixed effects, firm size group fixed effects. For the deaths, the controls include a common time trend, sector-specific time trends, and sector fixed effects, firm size group fixed effects, and firm age group fixed effects.

†† Observations labeled with left-censored age are ignored. So is the case for the regressions in the rest of the paper.

D_i and D_j are dummies controlling for a complete set of fixed effects; the interaction $t \times D_i$ captures the sector i-specific linear time trend. As discussed in Section 3, the estimated value of $\hat{\gamma}$ may suffer from the simultaneity bias and cannot be interpreted on its own. Nonetheless, the cyclicality is captured in the sign of $\hat{\gamma}$.

We can read from Columns I to III in Table 6 that the procyclicality of firm birth-related rates is robust and significant, even with the observable characteristics controlled for. These rates co-move with both the aggregate economic condition and the sector-specific condition.[13] Columns IV to VI show the acyclical death-related rates when the *levels* of output are considered, again with the observable features controlled for. Interestingly, they are negatively

[13]Though I must admit that the sectoral indicators also partially reflect the aggregate condition.

correlated with the GDP *growth*.

In the following subsections, I study how firm size and age affect the cyclicality across groups. The effect of being in different sectors is discussed in Section 6, as a sector code is attached to each establishment instead of firms.

5.2 Firms Small and Large

This section documents the following fact, which compares the cyclicality of conditional firm birth and death rates for various size groups.

Fact 3. *The cyclicality on the extensive margin decreases in firm size. The firm birth rates of smaller firms are more procyclical than those of larger firms. Also, with firm age being controlled for, the firm death rates of smaller firms are more countercyclical than those of larger firms. This fact applies to the job creation (destruction) rate due to firm birth (death) as well.*

Table 7: Cyclicality of Firm Birth Rate: Contribution by Firm Size

	Cyclical Indicators as Regressors†				
	Aggregate			Sectoral	
Firm Size Group	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	0.0789	0.0380	-0.3619	0.1170^{*}	0.1505^{***}
b) 5 to 9	0.2555^{***}	0.0856^{*}	-0.6505^{**}	0.0661^{*}	0.0819^{***}
c) 10 to 19	0.2842^{***}	0.0481	-0.6143^{***}	0.0526	0.0609^{***}
d) 20 to 49	0.2248^{***}	-0.0027	-0.6025^{***}	0.0570^{**}	0.0548^{***}
e) 50 to 99	0.1102^{**}	-0.0180	-0.3375^{**}	0.0226	0.0389^{**}
f) 100 to 249	0.1210^{**}	-0.0927^{***}	-0.3024^{*}	0.0598^{**}	0.0524^{***}
g) 250 to 499	0.0062	0.0541	0.2213	0.0737^{**}	0.0567^{***}
h) 500 to 999	-0.0308	0.0033	0.1530	0.0333	0.0229^{**}
i) 1000 to 2499	0.0011	0.0024	0.0018	-0.0514^{**}	-0.0338^{**}
j) 2500+ ‡	-0.0202^{**}	-0.0142^{***}	0.0255	0.2291^{**}	-0.0000

† A common linear time trend and sectoral fixed effect are controlled for. Including an additional sector-specific time trend does not result in substantially different cyclicality coefficients.

‡ This is not one of the original 12 firm size groups in the BDS. The three largest size groups have missing data, and are treated as a single group. The relevant data on this group is then calculated using the aggregate data and the data on the first nine size groups.

Table 8: Cyclicality of Firm Death Rate: Contribution by Firm Size

	Cyclical Indicators as Regressors†				
	AGGREGATE			SECTORAL	
Firm Size Group	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	0.0343	-0.1607^{***}	0.0190	-0.0051	-0.0883^{***}
b) 5 to 9	-0.0276	-0.0432^{***}	0.2703^{***}	0.0032	-0.0225^{***}
c) 10 to 19	-0.0201	-0.0061	0.2409^{***}	-0.0346^{**}	-0.0236^{***}
d) 20 to 49	-0.0782^{**}	0.0187	0.3615^{***}	-0.0256	-0.0226^{*}
e) 50 to 99	0.0832	0.0873^{**}	-0.0026	-0.0140	-0.0242
f) 100 to 249	0.0889	0.0765	-0.0606	0.0123	-0.0015
g) 250 to 499	0.2867	0.0614	-1.2755	0.5614^{***}	0.1903
h) 500 to 999	-0.3481	0.1289	1.4252	-0.7755	-0.0891
i) 1000 to 2499	-0.2997	-0.1067	0.2616	-0.3253	-0.3280
j) 2500+ ‡	0.3667	-0.1722	-2.2629	0.3952	-0.3797

† A common linear time trend and both sector and age fixed effects are controlled for. Including an additional sector-specific time trend does not result in substantially different cyclicality coefficients.
‡ This is actually for firms with 2500 to 4999 employees. Not enough data with both age and size specified is available for firms larger than 5000 employees.

The role that firm size plays in determining the cyclicality of firm birth and death rates (and related measures) is demonstrated by the juxtaposition of the size-by-size regression results. Assuming the aforementioned bias does not change with firm size, it makes sense to compare the signs, absolute values, and the significance levels of coefficients of the same regression across size groups and to interpret the variation as difference in cyclicality.

Each column of Table 7 lists the estimated coefficients $\hat{\gamma}_j$ for each size group j from the same regression:

$$y_{i,j,t} = \gamma_j X_{i,t} + \gamma_{0,j} + \beta_{1,j} t + \sum_i \beta_{2,i,j} D_i + \epsilon_{i,j,t}, \text{ for each } j, \tag{2}$$

where i indicates the sector and j the firm size.

The main observation from Table 7 is that firm birth rate is significantly procyclical for the majority of size groups and the procyclicality seems to decrease in firm size. When the aggregate cyclical measure is the level of GDP or unemployment rate, the coefficient is significant for the smaller half of the groups except for the smallest firms with fewer than 5 employees, and its absolute value shows a declining trend as size gets larger. The coefficient on aggregate GDP growth rate is insignificant for most groups. On the contrary, the sectoral

output level does not correlate with the birth rate as much as the aggregate level, while the sectoral growth rate has a systematic, positive relation with firm birth rate, with the scale of such relation decreasing in firm size. As an alternative measure, the procyclicality of the job creation rate due to firm birth is also stronger for firms of smaller sizes, as illustrated in Table D.2 in the appendix.

On the exiting margin, each column of Table 8 reports the regression results from the same regression on the firm-death related measures, one similar to (2) but with additional controls for firm ages. As expected, the cyclicality of firm death rate is not as significant as the cyclicality of firm birth rate. However, the groups of smaller firms indeed show significant countercyclicality compared to the acyclicality (and in some cases, even procyclicality) of the larger firms. Table D.3 presents a similar pattern of decreasing-in-size countercyclicality of the job destruction rate due to firm deaths.

Fact 3 on the decrease of cyclicality in firm size suggests that smaller firms are more sensitive to the economic condition on the *extensive* margins in terms of their births and deaths. This supports the implicit implication made by Tian (2015). Given the option value of exiting, smaller firms are more likely to exit due to their choice of risk, hence they always have higher exit rates. Recessions reduce the size of firms and push more firms toward the exiting margin, which implies a higher degree of countercyclicality in the exit rates of small firms.

Meanwhile, I must emphasize that Fact 3 does not contradict the empirical findings on the *intensive* margin documented by Moscarini and Postel-Vinay (2012) using the same BDS data. They find the negative (positive) correlation between the net job creation rate and the aggregate level of unemployment (GDP) is much stronger for large firms than for small ones. Actually, Fact 3 here and their findings are quite compatible in the sense that, in recessions, large firms can respond by shedding more employees and consequently reduce their size, while small firms do not have as large an intensive margin and some of them are forced to exit the market. The opposite happens in booming economies. Hence, the size of a firm serves as a buffer against the exiting hazard.

5.3 Firm Deaths: Young versus Old

Another important characteristic of a firm is its age. As established by Haltiwanger, Jarmin, and Miranda (2013), it is the age of firms that largely determines the average level of exiting hazard and growth in employment, coined as the "up or out" feature of young firms. In this section I look at how firms' ages may determine the cyclicality of their death rates, controlling for their size and sector.

Fact 4. *Younger firms show very weak countercyclicality in death rate. Such countercyclicality is not present in the death rate of older firms and, in some cases, even mild procyclicality is found. This fact applies to the job creation (destruction) rate due to firm birth (death) as well.*

Table 9: Cyclicality of Firm Death Rate: Contribution by Firm Age

	Cyclical Indicators as Regressors†				
	AGGREGATE			SECTORAL	
Firm Age ‡	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.1589	0.0259	0.9447^{**}	0.0155	-0.1143^{**}
c) 2	-0.0042	0.0174	0.0065	0.0105	-0.0071
d) 3	0.0061	-0.0163	0.2916^{*}	0.0041	-0.0470^{***}
e) 4	0.0684	-0.0307	0.0824	-0.0054	-0.0394^{***}
f) 5	0.1808^{***}	-0.0054	-0.1200	0.0229	-0.0069
g) 6 to 10	0.0328	-0.0727^{***}	0.0387	-0.0035	-0.0060
h) 11 to 15	0.0783^{**}	-0.0460^{**}	-0.1312	0.0136	-0.0266^{***}
i) 16 to 20	0.0613^{**}	-0.0261	-0.1270	-0.0009	-0.0063
j) 21 to 25	0.0729^{**}	-0.0249	-0.1351	-0.0302^{*}	-0.0087
k) 26+	0.1137^{***}	-0.0221	-0.2434^{***}	0.0142	-0.0181

† A common linear time trend and both sector and firm size fixed effects are controlled for. Including an additional sector-specific time trend does not result in substantially different cyclicality coefficients.
‡ The left-censored age group is ignored in the regressions.

Similarly to the presentation of regressions by firm size in Table 8, Table 9 displays the juxtaposition of the regression results by age group. Again, under the assumption that the aforementioned bias does not change with firm age, any variation in the signs, absolute values, and the significance levels of coefficients of the same regression across firm age groups is interpreted to be difference in cyclicality.

Each column of Table 9 lists the estimated coefficients $\hat{\gamma}_k$ for each age group k from the same regression:

$$y_{i,j,k,t} = \gamma_k X_{i,t} + \gamma_{0,k} + \beta_{1,k} t + \sum_i \beta_{2,i,k} D_i + \sum_j \beta_{2,j,k} D_j \epsilon_{i,j,k,t}, \text{ for each } k, \tag{3}$$

where i indicates the sector and j the firm size, and $y_{i,j,k,t}$ refers to one of the firm death-related measures.

The death rate of younger firms displays a very weak negative relation with the aggregate unemployment level and sectoral output growth. On the contrary, the groups that contain

oldest firms seem to have a mildly procyclical exit rate. The same pattern is also observed for the job destruction rate due to firm death, recorded in Table D.5.

Indeed, this is the reason that the effect of firm age on death rate cyclicality must be controlled for where the cyclicality (or lack thereof) of the death rate conditional on firm size is concerned. Table D.6 demonstrates how the countercyclicality of small firms' death rate is reduced if age is not controlled for. Startup and young firms do tend to be small in size, but small firms may also be old. Since the death rate of the old firms can be procyclical, the small and old firms diminish the negative relation of the small firm group as a whole with the economic condition.

Now the question is why older firms may exhibit procyclical death rates. Potential explanations are discussed in Section 8.

6 Establishment-level Cyclical Patterns of Entry and Exit Rates

This section documents the cyclicality of entry and exit rates at the establishment level. As I did in Section 5, I look at the unconditional correlation coefficients on an economy-wide scale, and then examine the roles that observable establishment-level characteristics play in shaping the cyclicality.

6.1 Aggregate Picture

Fact 5. *Neither the establishment entry rate nor the establishment exit rate shows significant unconditional cyclicality, employment-weighted or unweighted. However, after controlling for observable establishment characteristics, entry rate becomes significantly procyclical and exit rate countercyclical. The entry rate shows stronger cyclicality than the exit rate, in terms of absolute values.*

Table 10: Unconditional Cyclicality of Establishment Entry and Exit Rates: Correlations

	gdp_t	ΔGDP_t	u_t
UNWEIGHTED			
Establishment Entry Rate	0.2239	0.1364	−0.2089
Establishment Exit Rate	−0.0217	−0.2596	0.0430
Job Creation Rate due to Establishment Entry	0.0747	−0.0529	−0.0741
Job Destruction Rate due to Establishment Exit	−0.0832	−0.2345	0.1470
EMPLOYMENT-WEIGHTED			
Establishment Entry Rate	0.2580	0.1436	−0.1880
Establishment Exit Rate	0.0452	−0.2135	0.0170

All variables in the first column are detrended using a Hodrick-Prescott filter with a smoothing parameter of 6.25. Linear detrending does not substantially affect the signs and significance.

Like the firm death rate, the establishment exit rate shows no significant cyclicality. However, unlike the strongly and significantly procyclical firm birth rate, economy-wide establishment entry rate does not have a clear cyclical pattern. The unconditional correlation coefficients are in Table 10.

To see whether the acyclicality in establishment entry and exit rates remains after controlling for the observable establishment characteristics, I do a similar exercise to that of Section 5.1. The entry- and exit-related measures are computed for each group of similar establishments and several controlled regressions are done on the full, pooled sample. The regression formula is the same as (1), except that each dummy variable controls for an establishment characteristic.

Table 11 paints a completely different picture of the entry and exit cyclicality measured as regression coefficients. The procyclicality of entry emerges and so does the countercyclicality of exit. Establishment entry and exit rates both correlate with aggregate and sectoral measures of economic condition and the exit rate is more responsive to output growth. The job creation rate due to establishment entry correlates more strongly with the sectoral economic condition while the exit-related job destruction rate has a negative relation with both aggregate and sectoral economic condition.

In what follows, I isolate the effect on the entry and exit cyclicality by each characteristic – sector, size, and age – by doing controlled regressions by group. This is also an attempt to address the discrepancy between the messages conveyed by Tables 10 and 11.

Table 11: Cyclicality of Establishment Entry and Exit Rates with Observable Characteristics Controlled

	Dependent Variables †			
	Establishment Entry		Establishment Exit	
	I	II	III	IV
Cyclical Indicators	Entry Rate	Job Creation Rate	Exit Rate	Job Destruction Rate
AGGREGATE				
gdp_t	0.1080^{***}	0.0299	-0.0326	-0.0607^{**}
ΔGDP_t	-0.0038	-0.0672^{***}	-0.0430^{***}	-0.0693^{***}
u_t	-0.3305^{***}	-0.1917	0.2468^{***}	0.2901^{***}
SECTORAL				
gdp_{it}	0.0389^{**}	0.0388^{**}	-0.0098	-0.0132
ΔGDP_{it}	0.0615^{***}	0.0457^{***}	-0.0227^{***}	-0.0333^{***}
Min.Num.Obs.	2196	1942	12963	12963
Min.Adj.R^2	0.7007	0.6299	0.7023	0.5976
Controls ‡	Y	Y	Y	Y
Age ††	N	N	Y	Y

† Full sample, pooled regressions. The dependent variables are (I) establishment entry rate, (II) job creation rate due to establishment entry, (III) establishment exit rate, and (IV) job destruction rate due to establishment exit. Each entity represents the result of one regression, where a dependent variable is regressed on a cyclical indicator and a set of control variables.

‡ The observations of the dependent variables are raw values without detrending. This applies to the following regressions as well. For the births, the controls include a common time trend, sector-specific time trends, sector fixed effects, and establishment size group fixed effects. For the deaths, the controls include a common time trend, sector-specific time trends, sector fixed effects, establishment size group fixed effects, and establishment age group fixed effects.

†† Observations labeled with left-censored age are ignored.

6.2 Sector by Sector

Fact 6. *Substantial differences in establishment entry and exit cyclicality exist across sectors when establishment size and/or age is controlled for.*

Each column of Table 12 lists the estimated coefficients $\hat{\gamma}_i$ for each sector i from the same regression:

$$y_{i,j,t} = \gamma_i X_{i,t} + \gamma_{0,i} + \beta_{1,i} t + \sum_j \beta_{2,i,j} D_j + \epsilon_{i,j,t}, \text{ for each } i, \tag{4}$$

where j indicates an establishment size group and $y_{i,j,t}$ is the entry rate of an establishment group labeled by (i, j) at time t.

Table 12: Cyclicality of Establishment Entry Rate: Contribution by Sector

	Cyclical Indicators as Regressors †				
	Aggregate			Sectoral	
	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
ASFF ‡	0.5392^{***}	-0.0056	-1.4768^{***}	0.0519	0.0479^{*}
Mining	0.3560^{**}	-0.4743^{***}	-1.2897^{**}	0.0692	0.1047^{**}
Construction	0.1813^{**}	0.2958^{***}	-0.3005	0.0605^{*}	0.1396^{***}
Manufacturing	0.1240^{**}	0.0454	-0.3440^{*}	0.0737^{**}	0.0465^{**}
TPU ‡	-0.3720^{***}	0.0638	1.2692^{***}	-0.1261^{**}	0.0134
Wholesale trade	0.0924	-0.0361	-0.3697^{*}	0.0247	0.0062
Retail trade	0.1204^{*}	-0.0252	-0.4872^{**}	0.0957^{*}	0.0598^{**}
FIRE ‡	0.0882	0.0793	-0.2460	0.2443^{**}	0.2467^{***}
Services	0.0992^{**}	0.0530^{**}	-0.2730^{*}	0.0092	0.0869^{**}

† Controls include a common, linear time trend and establishment size fixed effects.
‡ ASFF stands for agricultural services, forestry, fishing. TPU stands for transportation and public utilities. FIRE stands for finance, insurance, real estate.

All sectors show procyclical establishment entry rates with various degrees of significance, except for the transportation and public utilities (TPU) sector, whose entry rate appears to be countercyclical. The sectors with procyclical entry have entry rates that correlate more strongly with the GDP level and unemployment rate than with the GDP growth. Meanwhile, the entry rates of these sectors are more sensitive to the sectoral output growth than they are to the sectoral output level. Table D.7 shows weaker procyclicality of the job creation rate due to establishment entry for sectors other than TPU. Furthermore, TPU seems to have a countercyclical entry-related job creation rate as well.

Consistent with the existing findings by, for example, Campbell (1998) and Lee and Mukoyama (2015) the manufacturing sector does have a procyclical establishment entry rate. However, it is implausible for this sector to represent the whole economy.

Table 13 reports the cyclicality of establishment exit rate by sector, measured as the coefficients from a regression formula similar to (4) but with establishment age controls. The degree of variation in cyclicality is even higher than for the entry rate. The mining, construction, and manufacturing sectors show countercyclical establishment exit rates at different significance levels.[14] The other sectors appear to have acyclical exit rates. The finance, in-

[14] Lee and Mukoyama (2015) find little difference in exit rate between good times and bad times using data from the ASM and CM datasets. In fact, if I calculate the raw correlation coefficients for the manufacturing sector exit

Table 13: Cyclicality of Establishment Exit Rate: Contribution by Sector

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
ASFF ‡	-0.0213	-0.2053^{***}	0.0941	0.0010	-0.0191
Mining	-0.3267^{***}	0.0924	1.6219^{***}	-0.0084	0.0868^{***}
Construction	-0.2246^{***}	-0.2951^{***}	0.2669	-0.0739^{**}	-0.1302^{***}
Manufacturing	-0.1371	-0.0439	0.6523^{**}	-0.0779^{*}	-0.0771^{**}
TPU ‡	-0.0754	0.0181	0.2561	-0.0209	-0.0798^{***}
Wholesale trade	0.0380	-0.0611	-0.0781	0.0915^{**}	-0.0026
Retail trade	0.0978^{*}	-0.0045	-0.2346	0.0173	-0.0209
FIRE ‡	0.1329^{*}	0.1041^{**}	0.3263	-0.1537^{*}	0.1925^{***}
Services	0.0546	-0.0006	-0.0096	0.1224^{**}	-0.0182

† Controls include a common, linear time trend, together with establishment age and size fixed effects.
‡ ASFF stands for agricultural services, forestry, fishing. TPU stands for transportation and public utilities. FIRE stands for finance, insurance, real estate.

surance, real estate (FIRE) sector even exhibits a mildly positive correlation. Similarly, the exit-related job destruction rates by sector are presented in Table D.8.

6.3 Establishments Small and Large

Fact 7. *Fact 3 applies to establishment entry and exit rates by size as well. The establishment entry rates of smaller establishments are more procyclical than those of larger establishments. Also, when establishment age is controlled for, the establishment exit rates of smaller establishments are more countercyclical than those of larger establishments..*

Just as noted with firm birth and death, groups of smaller establishments have more procyclical entry rates and more countercyclical exit rates than larger establishments have. Both the analysis and the result is analogous to Section 5.2, and hence I omit the discussion here. Exact cyclical measures on establishment entry and exit rates by size are in Tables 14 and 15. The results for entry-related job creation rate and exit-related job destruction rate are in Tables D.9 and D.10.

An establishment, large or small, is always owned by a parent firm. For single-unit firms, an establishment and its parent firm are identical. For multiple-unit firms, a parent firm

rate without controlling for size and age, the negative sign disappears and they do imply acyclical exit.

Table 14: Cyclicality of Establishment Entry Rate: Contribution by Establishment Size

	Cyclical Indicators as Regressors †				
	AGGREGATE			SECTORAL	
Establishment Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.0123	0.0120	-0.1955	0.0371	0.1113^{**}
b) 5 to 9	0.1994^{***}	0.0217	-0.5660^{**}	0.0586	0.0744^{***}
c) 10 to 19	0.2190^{***}	0.0005	-0.5377^{**}	0.0430	0.0583^{***}
d) 20 to 49	0.1926^{***}	0.0012	-0.5587^{**}	0.0567^{*}	0.0818^{***}
e) 50 to 99	0.1407^{**}	0.0116	-0.3328	0.0622^{*}	0.0713^{***}
f) 100 to 249	0.1498^{*}	-0.0302	-0.4683^{*}	0.0780^{**}	0.1026^{***}
g) 250 to 499	0.0149	0.1129^{*}	0.1245	0.0831	0.1096^{***}
h) 500 to 999	0.0005	0.0246	-0.1616	0.0788	0.0821
i) 1000+	-0.2405	-0.3362^{**}	0.2806	-0.3774^{**}	-0.0639

† Controls include a common time trend, sector-specific time trends, sector fixed effects, and age fixed effect.

may greatly differ from its establishments in terms of size and age. Hence, an interesting exercise is to see how the parent firm's observable characteristics may affect the entry- and exit-related measures of its establishments.

The regression results on entry and exit rates by parent firm size group are in Tables D.11 and D.13, and those on entry- and exit-related job creation and destruction rates are in Tables D.12 and D.14. In all of these regressions, the controls are based on the parent firm's age and sector.[15] What is interesting is that the largest parent firms start to exhibit significant procyclicality in establishment entry rate and countercyclicality in establishment exit rate. When a large firm owns multiple establishments, the entry and exit of establishments are no longer on the extensive margins for the said firm but on the intensive margins, similar to the hiring and firing of employees.[16]

[15]This is far from ideal, but the BDS labels each group either by firm characteristics or establishment characteristics – never both. Hence, the effects of establishment characteristics cannot be controlled for in these regressions.

[16]One may wonder why the estimated coefficients for groups of smaller parent firms are always negative, whether the dependent variable is entry- or exit-related. Smaller firms tend to coincide with their establishments, hence the negative signs for exit rates. Also, firm age is controlled for, and an entrant has zero age.

Table 15: Cyclicality of Establishment Exit Rate: Contribution by Establishment Size

	Cyclical Indicators as Regressors †				
	Aggregate			Sectoral	
Establishment Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.1261^{***}	-0.2703^{***}	0.2843^{**}	-0.0559^{***}	-0.1200^{***}
b) 5 to 9	-0.0258	-0.0711^{***}	0.2299^{**}	-0.0026	-0.0390^{***}
c) 10 to 19	-0.0057	-0.0057	0.1728^{*}	-0.0318^{**}	-0.0292^{***}
d) 20 to 49	-0.0417	0.0206	0.2908^{**}	-0.0293	-0.0255^{**}
e) 50 to 99	-0.0018	0.0530	0.3124	0.0135	-0.0188
f) 100 to 249	-0.1177	0.0214	0.5462	-0.0613	0.0232
g) 250 to 499	0.2001	0.0127	-0.2679	0.0702	0.0586
h) 500 to 999	0.2888^{**}	0.0427	-0.3837	0.1017	0.0514
i) 1000+	-0.1309	0.0136	0.6204^{**}	-0.1010^{**}	-0.0555^{*}

† Controls include a common time trend, sector-specific time trends, sector fixed effect, and age fixed effect.

6.4 Establishment Exits: Young versus Old

Fact 8. *Fact 4 on firm death rates by age also largely applies to the establishment exit rates. When establishment size is controlled for, the exit rates of the youngest establishment groups are countercyclical. This countercyclicality diminishes quickly as establishments age.*

As in the previous section on establishment size, the analysis here by establishment age is analogous to Section 5.3 and is therefore omitted. Table 16 summarizes the regression results. For the job destruction rate due to establishment exit, see Table D.15.

Also, as in the discussion in the previous section, an establishment's age can differ from its parent firm's age, and parent firm age may affect the entry and exit behavior of establishments. As shown in Tables D.16 and D.17, when the parent firm size is controlled for, an establishment's entry behavior shows little procyclicality regardless of the parent firm's age. Meanwhile, Tables D.18 and D.19 present a negative relation between establishment exit behavior and the economic condition for some parent firm age groups, even when the effect of the parent firm size is controlled for. The parent firm age does not seem to affect the cyclicality of establishment exit rate, except in the case of the oldest firms, whose establishment exit rate appears to be mildly procyclical.

Table 16: Regressions by Establishment Age: Establishment Exit Rate

	Cyclical Indicators as Regressors				
	AGGREGATE			SECTORAL	
Establishment Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.2145^{**}	-0.0555	1.0414^{***}	-0.0199	-0.0561^{*}
c) 2	-0.1343^{*}	-0.0058	0.5461^{**}	-0.0922^{**}	-0.0409^{*}
d) 3	0.0947	-0.0209	-0.0298	0.0250	-0.0241
e) 4	0.0642	-0.1015^{***}	0.3615^{*}	-0.0100	-0.0735^{***}
f) 5	0.1188^{**}	-0.0499^{*}	-0.0668	0.0173	-0.0265^{*}
g) 6 to 10	0.1087^{***}	-0.0563^{**}	-0.1723	0.0180	0.0119
h) 11 to 15	0.0251	-0.0169	-0.0261	0.0064	-0.0185
i) 16 to 20	0.0557	-0.0346	-0.0853	-0.0247	-0.0226
j) 21 to 25	0.0381	-0.0652^{*}	-0.1023	-0.0316	-0.0306^{*}
k) 26+	0.0721	-0.0301	-0.1542	0.0149	-0.0125

7 The Lead and Lag between the Business Cycles and the Extensive Margin

The cyclicality (or lack thereof) of business entry and exit documented in the previous sections considers the contemporaneous correlation and/or regression coefficients. However, it is possible that the interaction between the economic condition and the entry and exit dynamism takes time, and hence, to complement the previous findings, a complete picture requires such consideration as well. In this section, I take a closer look at the changes on the extensive margin of business dynamism over the business cycles and examine the lead and lag relation between them.

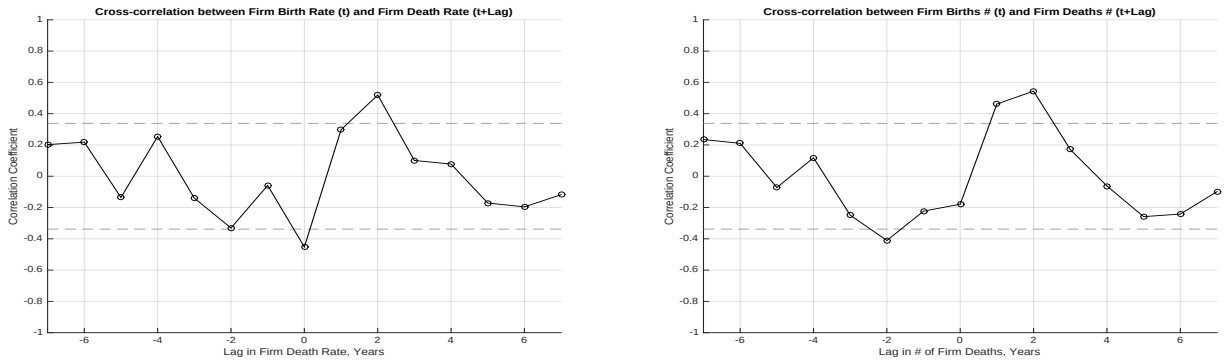
7.1 The Aggregate Picture: Firms and Establishments

Visually, both the volumes and rates of business exit seem to co-move with business entry, with exit lagging entry, as depicted in, e.g., Figures 3 and 3. Hence, it is possible that the acyclicality of business exit is actually driven by its lagged co-movement pattern with the entry.

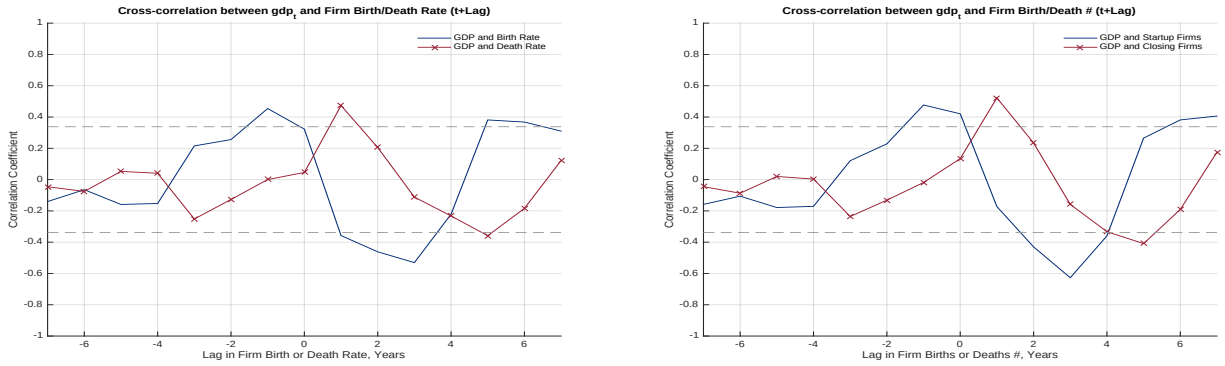
Starting from the economy-wide scale, Figure 6 explores the suspected lead and lag rela-

I. Rate of Firm Birth/Death

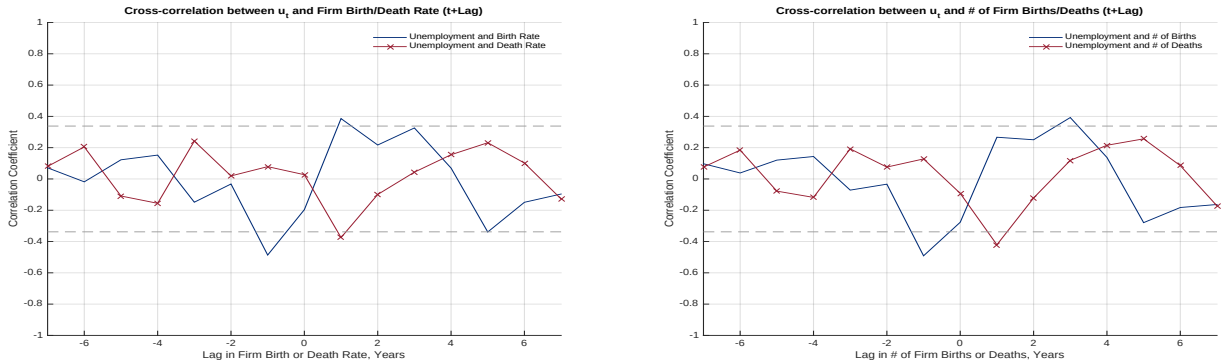
II. Number of Firm Births/Deaths



(a) firm birth at (t) and firm death at (t+Lag)



(b) gdp_t and firm birth (solid line)/death (x-marked line) at (t+Lag)

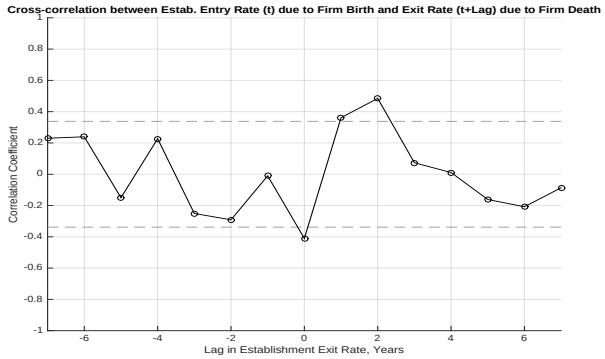


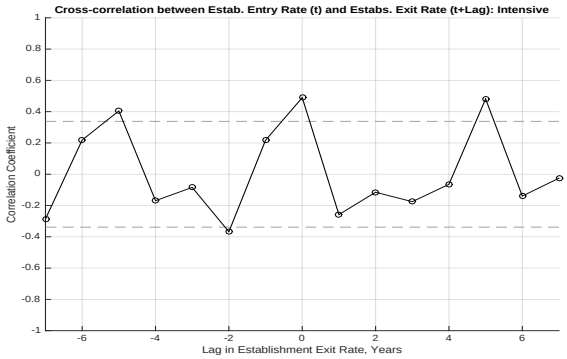
(c) u_t and firm birth (solid line)/death (x-marked line) at (t+Lag)

Figure 6: Lead and lag between the cyclical components of the aggregate firm birth and death rates and aggregate economic condition. Each horizontal axis shows the number of lagged years and vertical axis the correlation coefficient. The broken lines indicate Bartlett's error bands, at approximately 95% confidence level.

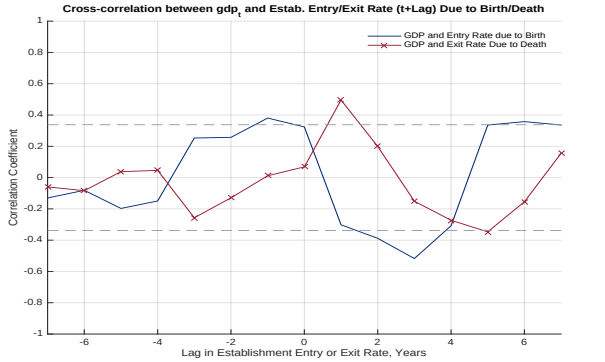
I. Entry/Exit due to Firm Birth/Death

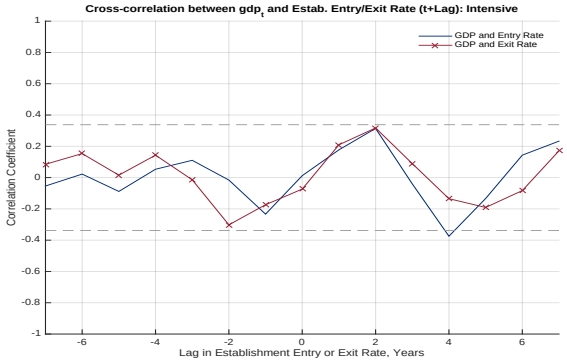
II. Entry/Exit caused by Continuing Firms



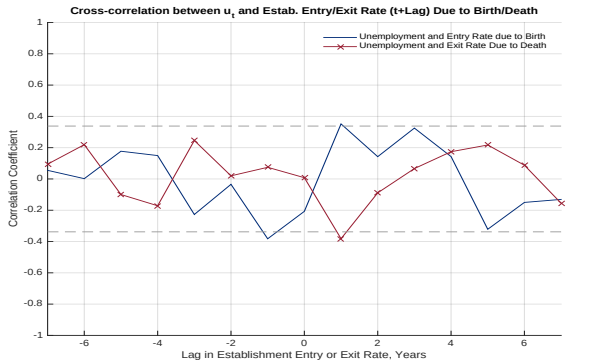


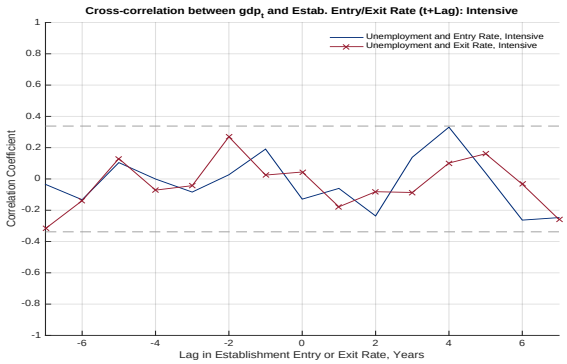
(a) Estab. entry rate at (t) and estab. exit rate at (t+Lag)





(b) gdp_t and estab. entry (solid line)/exit (x-marked line) rate at (t+Lag)





(c) u_t and estab. entry (solid line)/exit (x-marked line) rate at (t+Lag)

Figure 7: Lead and lag between the cyclical components of the establishment entry and exit rates and aggregate economic condition. Each horizontal axis shows the number of lagged years and vertical axis the correlation coefficient. The broken lines indicate Bartlett's error bands, at approximately 95% confidence level.

tionship by plotting the cross-correlation functions.[17] Panel (a) shows that, for both rates and numbers, aggregate firm birth and firm death have a negative contemporaneous correlation. However, positive correlation appears when death lags birth and the absolute value peaks at the two-year lag. Hence, this confirms our suspicion that firm birth does lead the firm death, by about one to two years. This implies that, if the firm birth rate increases in a particular period, then the firm death rate will be expected to increase in the following one or two periods. So is the case for numbers of births and deaths.

Panel (b) plots the cross-correlations between the level of GDP and firm birth or death, for rates and numbers. As shown in Tables 2 and 5, the contemporaneous correlation between the GDP level and firm birth is significantly positive, while that between the GDP level and firm death is not significant though also positive. Meanwhile, firm birth appears to lead the aggregate level of GDP by about a year; lagged firm death becomes positively correlated with aggregate GDP and the coefficient is at its maximum when the lag is a year. An intuitive interpretation is that it is the increase in firm openings that boosts the aggregate output; then, after a year or two, firm closings also increase, possibly due to increased competition, more appealing outside option, or other reasons.

Panel (c) uses the unemployment rate as the measure of aggregate economic condition and repeat the exercise in (b). Similar to the message conveyed by (b), firm birth leads the unemployment rate by a year and firm death lags the unemployment rate by a year. Besides, note that in (b) and (c), lagged firm opening exhibits negative correlation with the measure of aggregate economic condition. The implication seems to be that, when more employees lose their jobs, more choose a different career path and become entrepreneurs, accompanied by more startups in the following years. This in turn reduces unemployment and leads to a boom. Thus completes a cycle.

On the establishment level, the same pattern naturally holds for the entries and exits due to firm births and deaths. However, the establishment entry and exit *not* caused by firm birth and death does not show such pattern. The comparison is shown in Figure 7. Column I depicts the lead and lag relation between aggregate economic condition and the establishment entry and exit rates due to firm birth and death, one very similar to Figure 6. In sharp comparison to Column I, Column II shows a strongly positive contemporaneous relation between establishment opening and closing cause by continuing firms, on their intensive margin. Firms opening new establishments is accompanied by firms closing existing establishments. The co-movement in the upward and downward adjustment in continuing firms' scales suggests a fixed-capital reallocation mechanism, and that such reallocation tends to happen more fol-

[17] Similar lead and lag pattern is observed in the aggregate employment-weighted firm birth and death rates.

lowing an improved economic condition.

7.2 Sector by Sector

Perhaps not surprisingly, the pattern holds within each sector as well, as shown in Panel I of Figure 8. Though the absolute values vary across sectors, conditional firm birth and death rates have negative contemporaneous correlation in every one of them. Despite that, the positive correlation peaks when firm birth leads firm death by two years. Meanwhile, using either aggregate GDP level, unemployment rate, or sectoral value added level as measure of economic condition, we observe that firm birth leads it and firm death lags it for the majority of sectors. This is shown in the upper panels of Figures C.9 through C.11. The establishment entries and exits due to the births and deaths of firms show the same pattern, and hence the figures are omitted.

The establishment opening and closing caused by continuing firms again show higher degree of co-movement for the majority of the sectors, which confirms the findings on the aggregate level. This is illustrated in Panel II of Figure 8. The lagged response in continuing firms' establishment opening and closing to changes in the aggregate or sectoral economic condition is shown in the lower panels of Figures C.9 through C.11.

7.3 Small and Large

7.4 Young versus Old

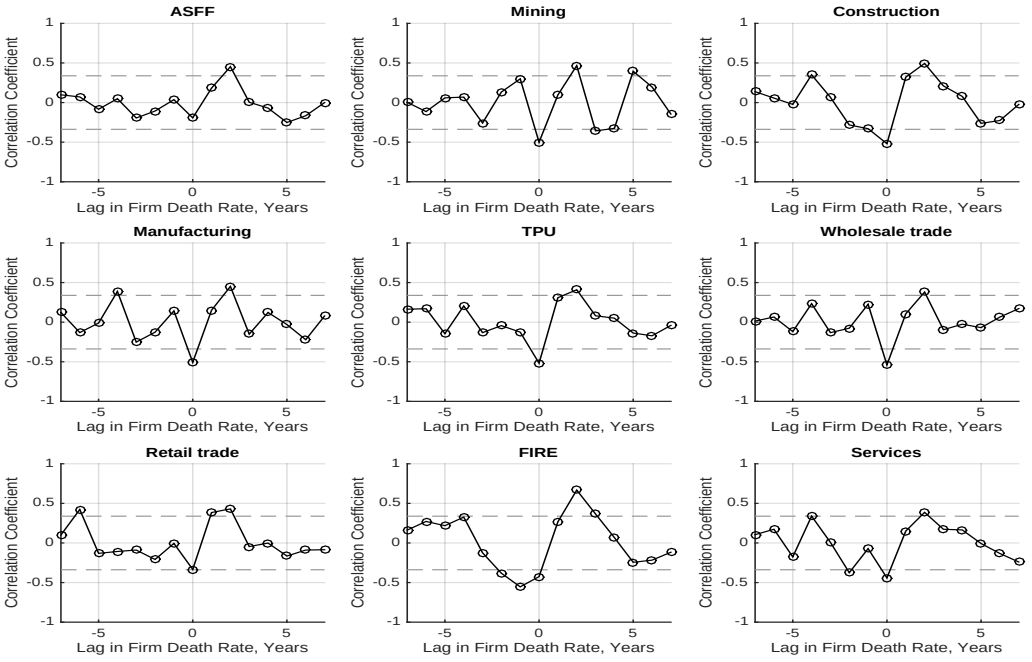
8 Potential Explanation and Discussion

The main finding from the set of documented facts is that business entry is strongly procyclical while business closing shows little countercyclicality, and the cyclicality on the extensive margins for businesses varies greatly with their size, age, and sector.

The next big question is why.

One potential explanation lies in the asymmetry between business opening and closing. The entry of a business is mostly a "to be or not to be" decision without any middle ground. Before a business must exit from the market, however, it has the option to reduce its size by shedding employees. (Similarly, a firm has the option close some of its establishments.) So the larger the firm, the greater its buffer against recessions. This idea is similar to the theories studied, for example, by Tian (2015) and D'Erasmo, Decker, and Boedo (2015). Indeed, the average employment-based size of a business shrinks in recessions, with large firms firing proportionally more employees than small ones. But the average number of establishments

I. Lead/lag between firm birth and death rates, sector by sector.



II. Lead/lag between estab. entry and exit rates caused by continuing firms, sector by sector.

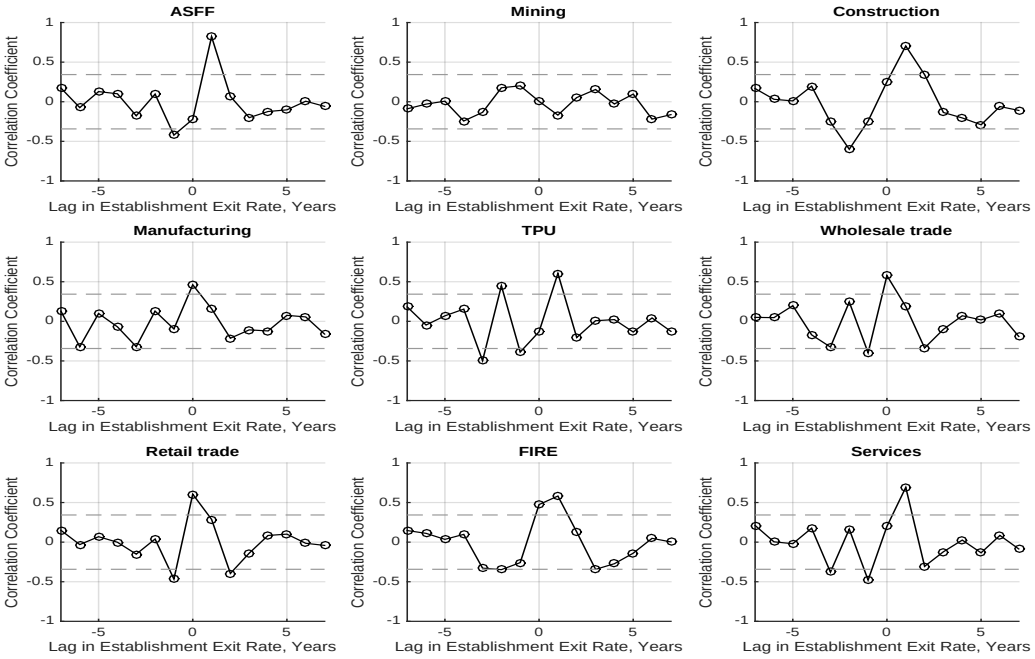


Figure 8: Lead and lag relation by sector.

a firm owns actually increases in recessions. And the absolute volume of closing businesses (firms or establishments) does not increase significantly in recessions. The fact that the total number of businesses decreases in recessions is largely due to there being fewer newborns, not due to an increased number of deaths.

Another potential explanation relates to the increased uncertainty level in recessions, in line with the "real option" and "wait and see" effects brought forth by Bloom (2009). Due to the existence of real adjustment cost, when uncertainty is high, firms have an incentive to maintain their status quo and postpone costly adjustments until things clear up. Hence, in recessions, the forces of higher uncertainty and worse economic condition affect the business closings in opposite ways: even when exit is objectively the right choice, a business may choose to remain due to uncertainty. Meanwhile, these two forces work in the exact same direction in reducing the business openings. In booms, the economic condition is good and the uncertainty level is low, so a business that is not very profitable can exit without hesitation. Again these forces work in the same direction in boosting entry. Combined, the force of countercyclical uncertainty plays a role in reinforcing procyclical entry and dampening the countercyclicality of exit.

The uncertainty theory can also be age-related. After entry, a business needs time to learn how to survive. Young firms do not know their customers as well as older firms do; nor do they know their optimal production strategy or sales strategy, or how best to allocate their resources. Hence, young firms are more sensitive to the aggregate economic condition on the outside and are more likely to fail. Older firms, on the other hand, are more immune to such aggregate shocks even as they are more susceptible to their market-specific shocks. Booms also mean more competition from new businesses.

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APPENDIX

A AIA Data

In the AIA, the 1947-1997 part of the real, industrial value added is documented in chain-weighted 2005 dollars under 2002 NAICS, while the newer part in 2009 dollars under 2007 NAICS. I need the cross-sectional additivity and time-series comparability of the data, hence I convert the first part to get the real value added by industry in 2009 dollar. First, turn 1947-1997 chain-weighted quantity index (2005 = 100, Q^{05}) into quantity index (2009 = 100, Q^{09}).

$$Q_{i,t}^{09} = \frac{Q_{i,t}^{05}}{Q_{i,1997}^{05}} \times Q_{i,1997}^{09}.$$

Then, turn 1947-1997 quantity index (2009 = 100) into real value added in 2009 dollar (V^{09}).

$$V_{i,t}^{09} = \frac{Q_{i,t}^{09}}{100} \times V_{i,2009}^{09}.$$

The aggregation of NAICS-coded industries to SIC sectors is relatively straightforward. The change from NAICS 2002 to NAICS 2007 between the two sub-periods do not have a noticeable effect at the SIC-sector level. Therefore, according to the crosswalk between NAICS and SIC, the aggregation rule is summarized in the following table.

SIC sectors in BDS	2002 and 2007 NAICS industries
07 - agricultural services, forestry, fishing	11
10 - mining	21
15 - construction	23
20 - manufacturing	31, 32, 33
40 - transportation and public utilities	22, 48, 49
50 - wholesale trade	42
52 - retail trade	44, 45, 722
60 - finance, insurance, real estate (FIRE)	52, 53
70 - services	51, 54, 55, 56, 6, 7 (excl.722), 81

B Variable Definitions

In: establishment entry or firm birth; out: establishment exit or firm death.

- `isize` same as defined by BDS. Keep in mind there are several cases: ins, survivors, outs.
- $\texttt{iestabs}_{g,t}$ and $\texttt{ifirms}_{g,t}$: simple count of plants/firms within group g at the beginning of t (at the end of $t-1$) before any ins and outs dynamics happen.

$$\texttt{iestabs}_{g,t} = estabs_{g,t-1}$$
$$\texttt{ifirms}_{g,t} = firms_{g,t-1}$$

- $\texttt{estabs_entry}_{\texttt{g,t}}$ # of establishments with age = 0 and identified as entrants by BDS.
- $\texttt{firmbirth_firms}_{\texttt{g,t}}$ # of firms with fage4 = 0. $\texttt{firmbirth_emp}_{\texttt{g,t}}$ # of employees with fage4 = 0. $\texttt{firmbirth_estabs}_{\texttt{g,t}}$ # of establishment entry with fage4 = 0.
- Rates re-defined using initial counts, unweighted.

  $\texttt{estabs_entry_rate}_{\texttt{g,t}}$, $\texttt{estabs_exit_rate}_{\texttt{g,t}}$;

  $\texttt{firmbirth_firmrate}_{\texttt{g,t}}$, $\texttt{firmdeath_firmrate}_{\texttt{g,t}}$.

  $\texttt{firmbirth_estabs_rate}_{\texttt{g,t}}$, $\texttt{firmdeath_estabs_rate}_{\texttt{g,t}} \implies$

  $\texttt{estabs_entry_rate}_{\texttt{g,t}} - \texttt{firmbirth_estabs_rate}_{\texttt{g,t}}$ = estabs entry rate NOT due to firm birth; $\texttt{estabs_exit_rate}_{\texttt{g,t}} - \texttt{firmdeath_estabs_rate}_{\texttt{g,t}}$ = estabs exit rate NOT due to firm death;

$$Rate^{in}_{g,t} = 100 \times \frac{\#(Ins)_{g,t}}{\#(\text{initial count})_{g,t}}$$
$$Rate^{out}_{g,t} = 100 \times \frac{\#(Outs)_{g,t}}{\#(\text{initial count})_{g,t}}$$

- Employment weighted entry/exit and birth/death rates in a broad group G

  $\texttt{estabs_entry_rate_ew}_{\texttt{g,t}}$, $\texttt{estabs_exit_rate_ew}_{\texttt{g,t}}$;

  $\texttt{firmbirth_firmrate_ew}_{\texttt{g,t}}$, $\texttt{firmdeath_firmrate_ew}_{\texttt{g,t}}$.

$$RateEW^{in}_{G,t} = \sum_{g \in G} \left(Rate^{in}_{g,t} \times \frac{JCin_{g,t}}{\sum_{g \in G} JCin_{g,t}} \right)$$
$$RateEW^{out}_{G,t} = \sum_{g \in G} \left(Rate^{out}_{g,t} \times \frac{JDout_{g,t}}{\sum_{g \in G} JDout_{g,t}} \right)$$

  where $JCin$ ($\texttt{firmbirth_emp}$, $\texttt{job_creation_births}$(age = 0)) is the number of jobs created due to ins and $JDout$ is the number of jobs destructed due to outs ($\texttt{firmdeath_emp}$, $\texttt{job_destruction_deat}$

- Job creation (destruction) rate due to ins (outs).

  $\texttt{estabs_entry_jcr}_{\texttt{g,t}}$, $\texttt{estabs_exit_jdr}_{\texttt{g,t}}$

  $\texttt{firmbirth_jcr}_{\texttt{g,t}}$, $\texttt{firmdeath_jdr}_{\texttt{g,t}}$

$$JCRin_{g,t} = 100 \times \frac{JCin_{g,t}}{0.5Emp_{g,t-1} + 0.5Emp_{g,t}}$$
$$JDRout_{g,t} = 100 \times \frac{JDout_{g,t}}{0.5Emp_{g,t-1} + 0.5Emp_{g,t}}$$

Contemporaneous cyclical indicators

- $\texttt{GDPhplog}_{\texttt{t}}$: aggregate, level, % deviation from trend.

$$\texttt{GDPhplog}_{\texttt{t}} = 25(RGDPhplog1600_{Q2,t-1} + ... + RGDPhplog1600_{Q1,t})$$

- $\texttt{UnempRate}_{\texttt{t}}$: aggregate, level. Smoothing factor is subject to change.

$$\texttt{UnempRatehp}_{\texttt{t}} = \frac{1}{12}(UnempRatehp14400_{Mar,t-1} + ... + UnempRatehp14400_{Feb,t})$$

- $\texttt{GDPgrowth}_{\texttt{t}}$: aggregate, growth rate.

$$\texttt{GDPgrowth}_{\texttt{t}} = 100 \times \frac{RGDP_{Q1,t} - RGDP_{Q1,t-1}}{RGDP_{Q1,t-1}}$$

- $\texttt{GDPbyIndhplog}_{\texttt{i,t}}$: industry, level.
- $\texttt{GDPbyIndgrowth}_{\texttt{i,t}}$: industry, growth rate.

C More Figures

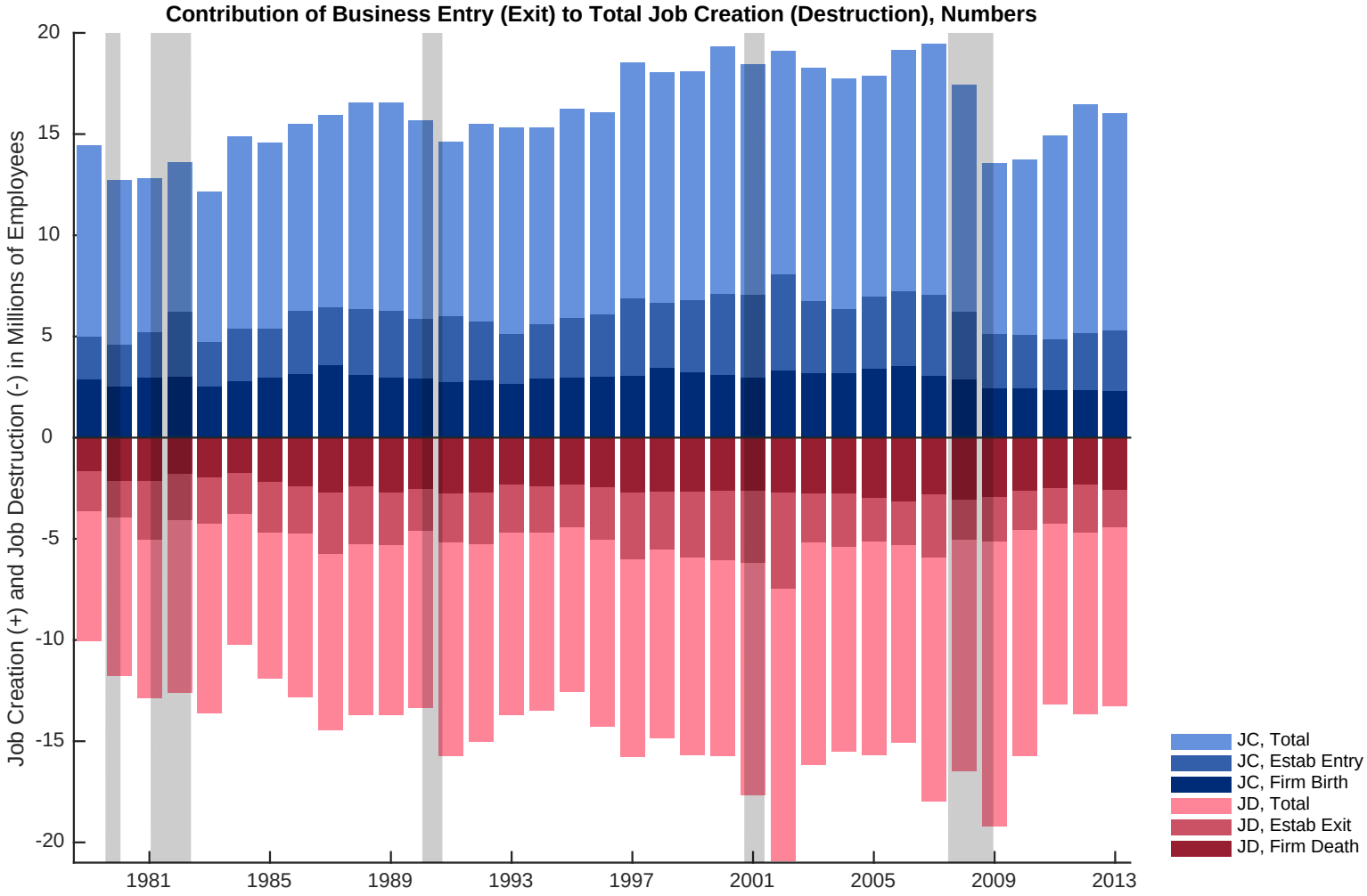

Contribution of Business Entry (Exit) to Total Job Creation (Destruction), Numbers
Job Creation (+) and Job Destruction (-) in Millions of Employees
20
15
10
5
0
-5
-10
-15
-20
1981
1985
1989
1993
1997
2001
2005
2009
2013
JC, Total
JC, Estab Entry
JC, Firm Birth
JD, Total
JD, Estab Exit
JD, Firm Death

Figure C.1:


History of Volumes of Firm Births and Deaths, Whole Economy
×10^5
6
5.5
5
4.5
4
3.5
3
2.5
1981
1985
1989
1993
1997
2001
2005
2009
2013
Births
Deaths
History of Volumes of Establishment Entrants and Exits, Whole Economy
Number of Establishments in Thousands
850
800
750
700
650
600
550
500
450
Establishment Entrants
Establishment Exits

Figure C.2:

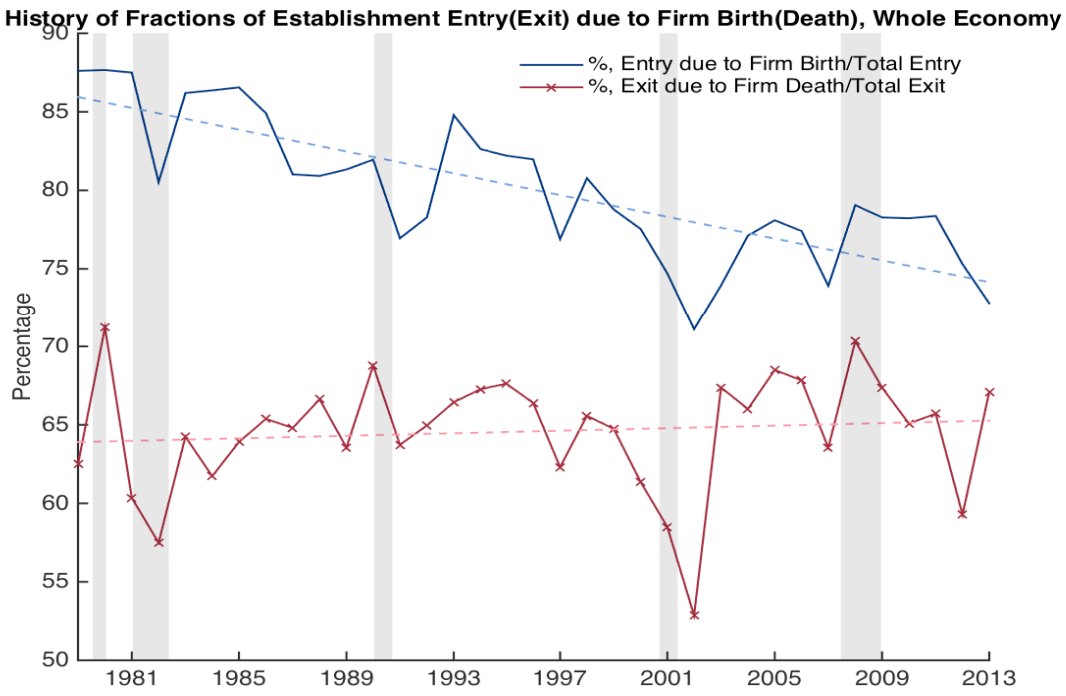
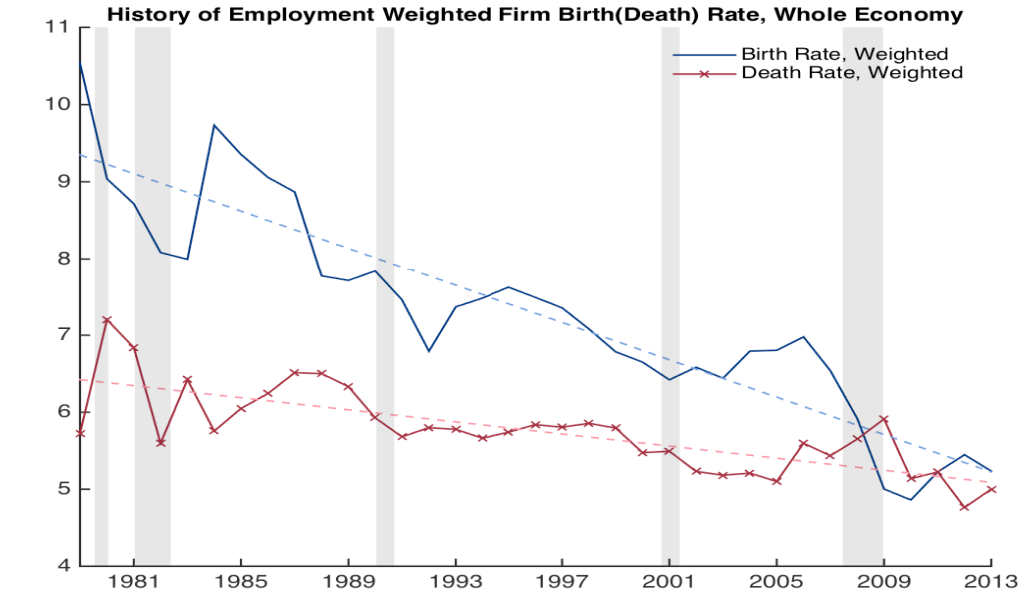

History of Fractions of Establishment Entry(Exit) due to Firm Birth(Death), Whole Economy
%, Entry due to Firm Birth/Total Entry
%, Exit due to Firm Death/Total Exit
Percentage
90
85
80
75
70
65
60
55
50
1981
1985
1989
1993
1997
2001
2005
2009
2013

Figure C.3:


History of Employment Weighted Firm Birth(Death) Rate, Whole Economy
Birth Rate, Weighted
Death Rate, Weighted
11
10
9
8
7
6
5
4
1981
1985
1989
1993
1997
2001
2005
2009
2013

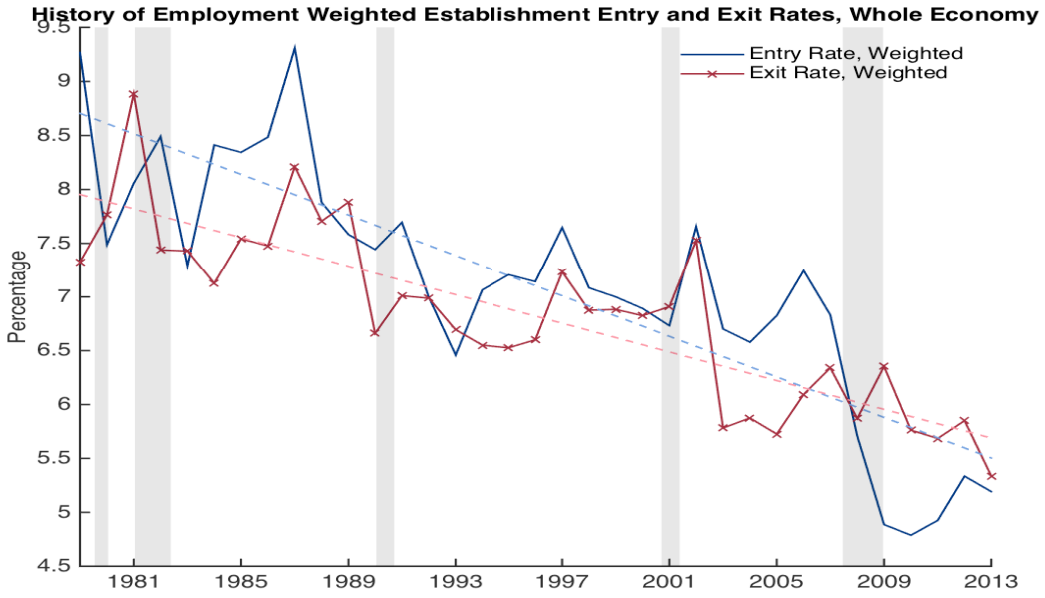

History of Employment Weighted Establishment Entry and Exit Rates, Whole Economy
Entry Rate, Weighted
Exit Rate, Weighted
Percentage
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
1981
1985
1989
1993
1997
2001
2005
2009
2013

Figure C.4:

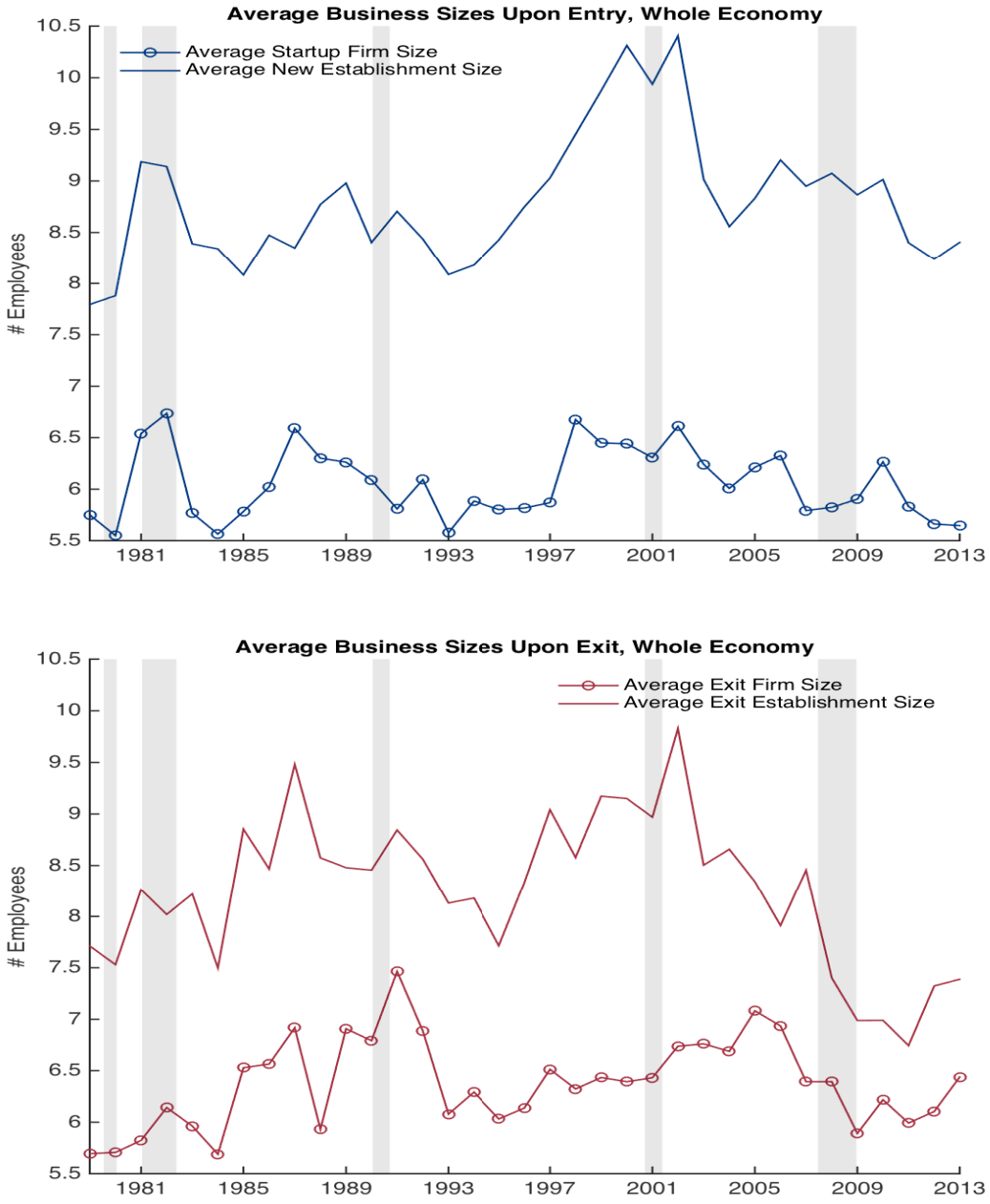

Average Business Sizes Upon Entry, Whole Economy
Average Startup Firm Size
Average New Establishment Size
Employees
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
1981
1985
1989
1993
1997
2001
2005
2009
2013
Average Business Sizes Upon Exit, Whole Economy
Average Exit Firm Size
Average Exit Establishment Size
Employees
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
1981
1985
1989
1993
1997
2001
2005
2009
2013

Figure C.5:

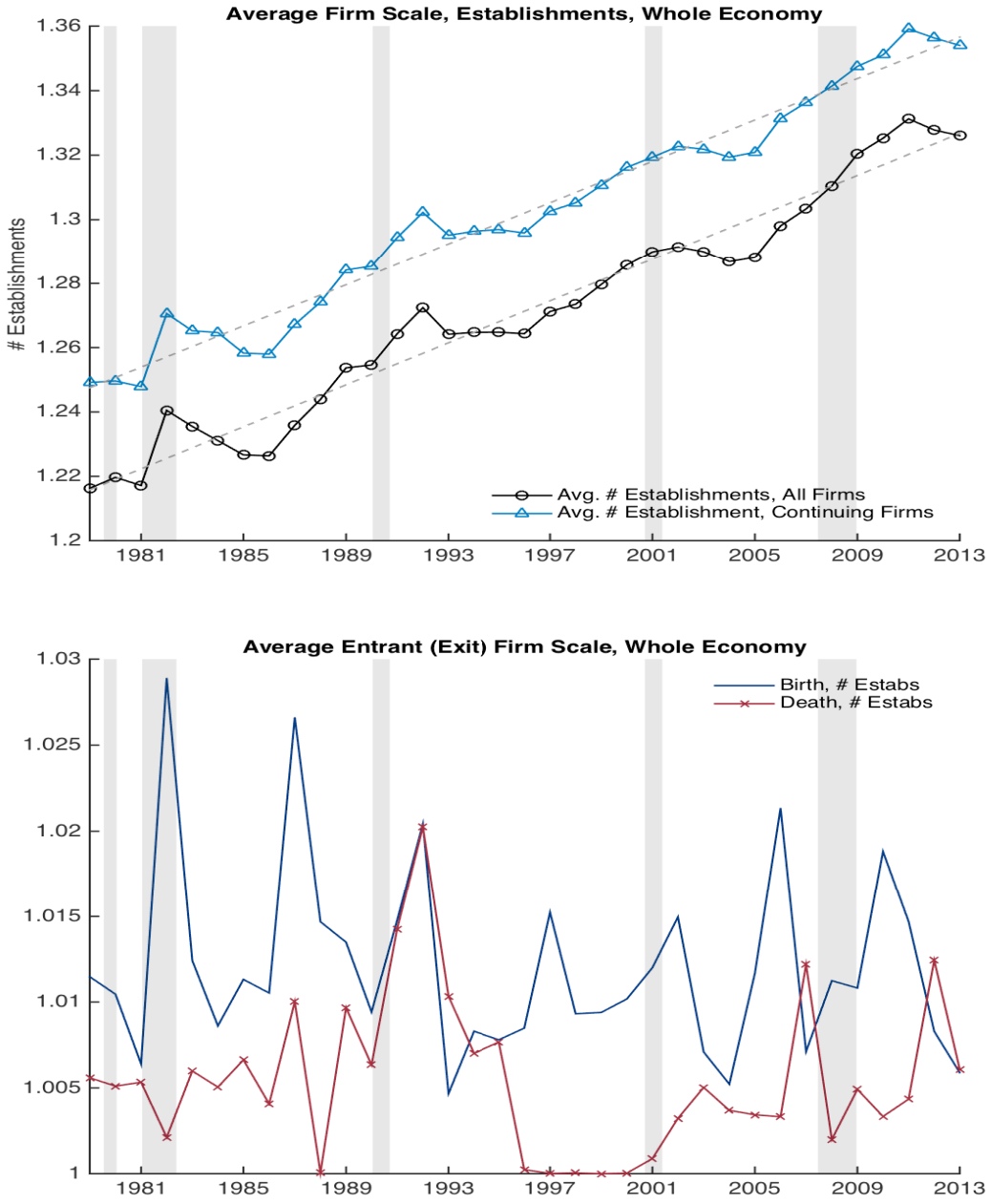
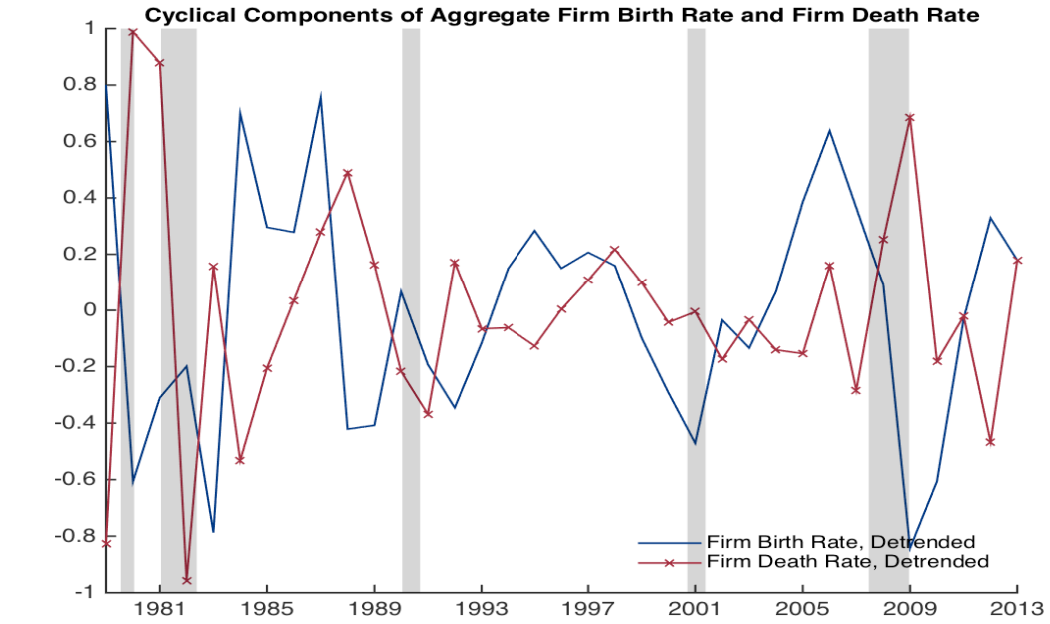

Average Firm Scale, Establishments, Whole Economy
Establishments
1.36
1.34
1.32
1.3
1.28
1.26
1.24
1.22
1.2
1981
1985
1989
1993
1997
2001
2005
2009
2013
Avg. # Establishments, All Firms
Avg. # Establishment, Continuing Firms
Average Entrant (Exit) Firm Scale, Whole Economy
1.03
1.025
1.02
1.015
1.01
1.005
1
Birth, # Estabs
Death, # Estabs

Figure C.6:


Cyclical Components of Aggregate Firm Birth Rate and Firm Death Rate
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1981
1985
1989
1993
1997
2001
2005
2009
2013
Firm Birth Rate, Detrended
Firm Death Rate, Detrended

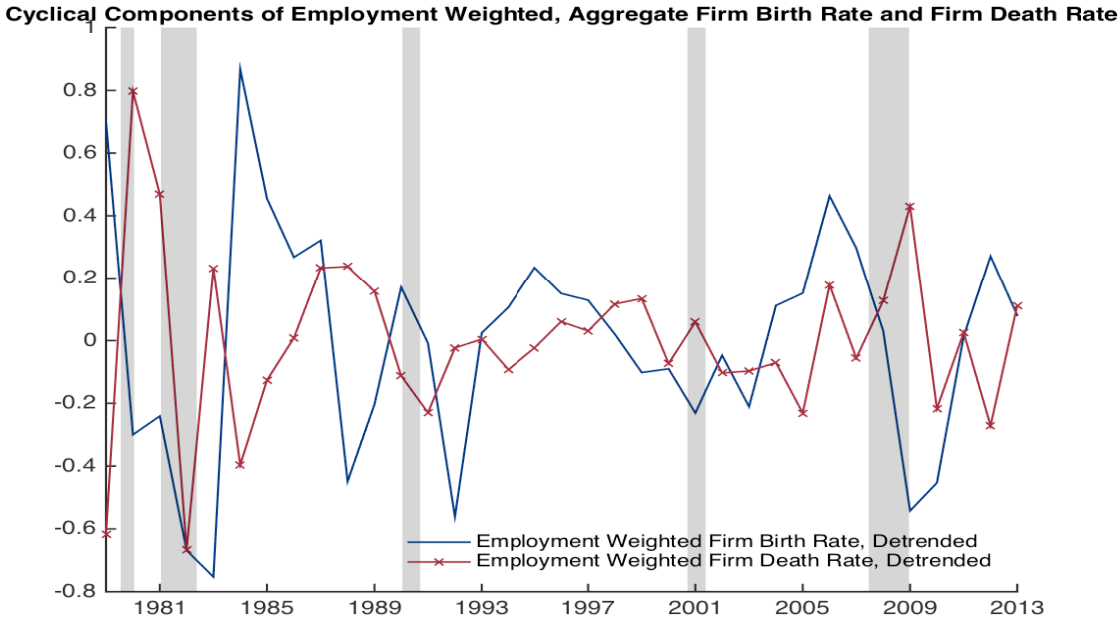

Cyclical Components of Employment Weighted, Aggregate Firm Birth Rate and Firm Death Rate
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
1981
1985
1989
1993
1997
2001
2005
2009
2013
Employment Weighted Firm Birth Rate, Detrended
Employment Weighted Firm Death Rate, Detrended

Figure C.7:

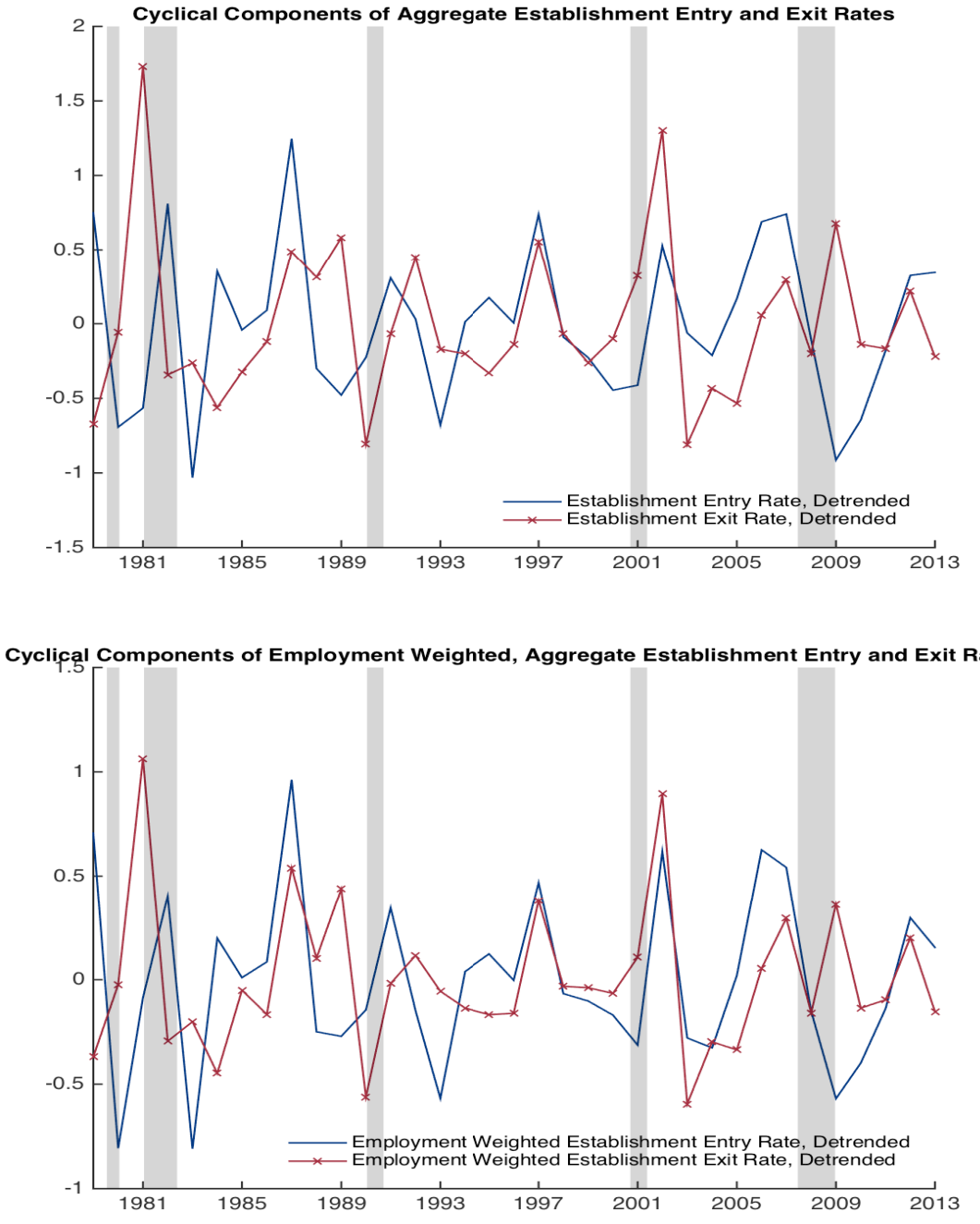
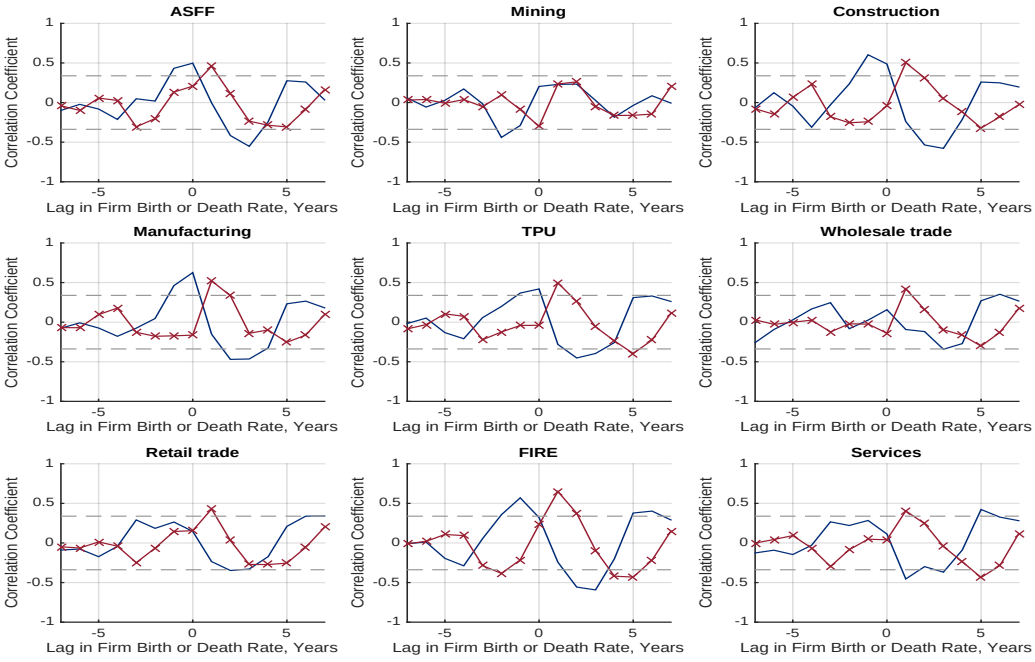

Cyclical Components of Aggregate Establishment Entry and Exit Rates
2
1.5
1
0.5
0
-0.5
-1
-1.5
1981
1985
1989
1993
1997
2001
2005
2009
2013
Establishment Entry Rate, Detrended
Establishment Exit Rate, Detrended
Cyclical Components of Employment Weighted, Aggregate Establishment Entry and Exit Rates
1.5
1
0.5
0
-0.5
-1
1981
1985
1989
1993
1997
2001
2005
2009
2013
Employment Weighted Establishment Entry Rate, Detrended
Employment Weighted Establishment Exit Rate, Detrended

Figure C.8:

I. gdp_t and firm birth/death rate at (t+Lag), by sector.



II. gdp_t and estab. entry/exit rate caused by continuing firms at (t+Lag), by sector.

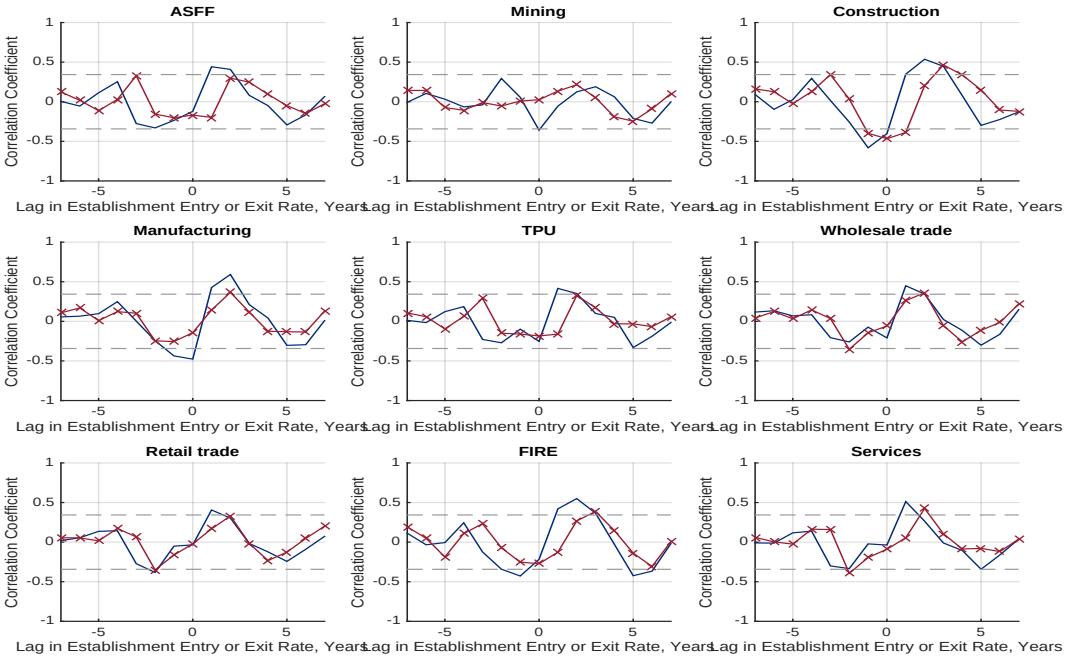
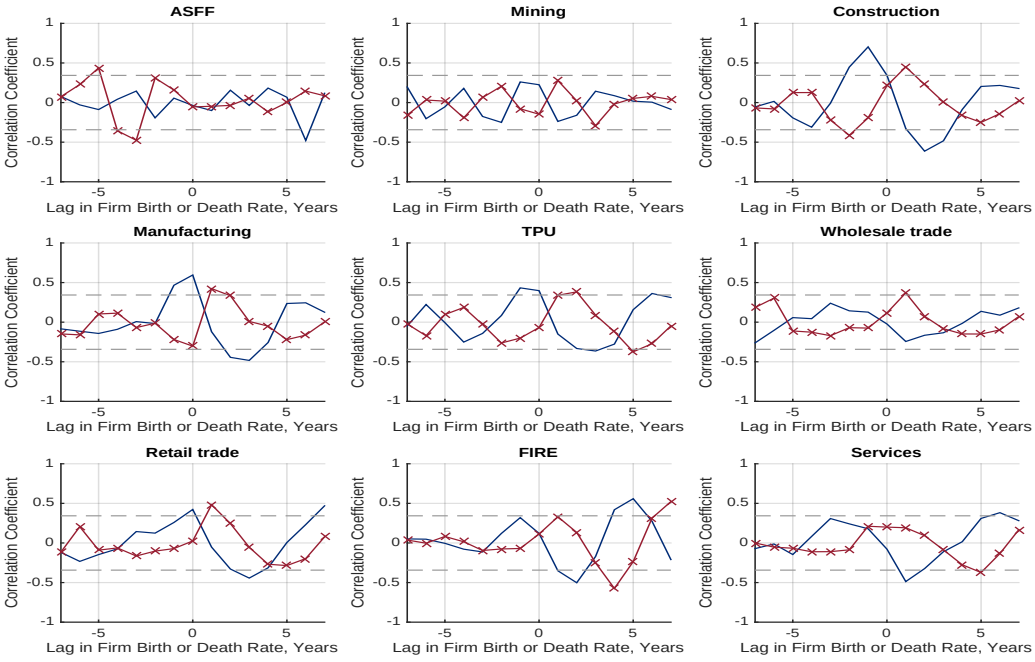


Figure C.9:

I. gdp_{it} and firm birth/death rate at (t+Lag), by sector.



II. gdp_{it} and estab. entry/exit rate caused by continuing firms at (t+Lag), by sector.

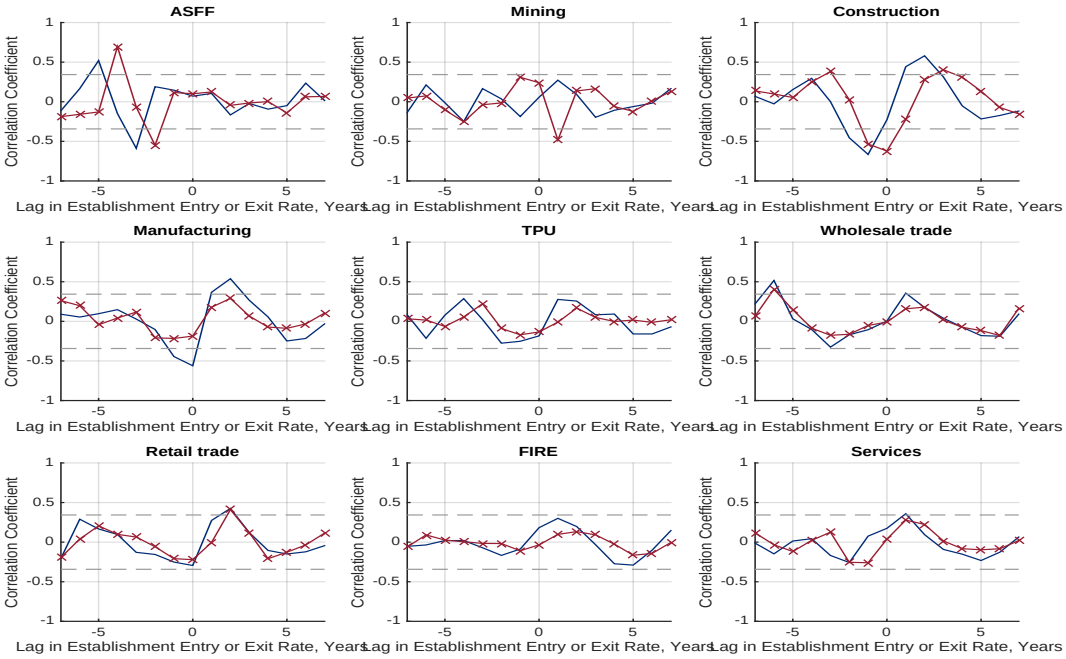
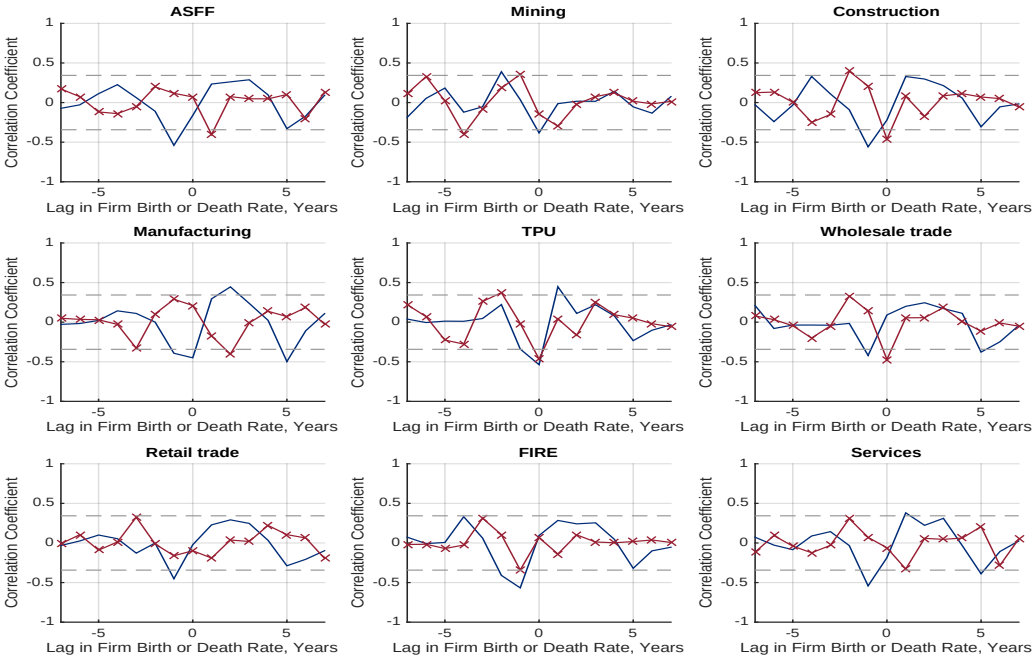


Figure C.10:

I. u_t and firm birth/death rate at (t+Lag), by sector.



II. u_t and estab. entry/exit rate caused by continuing firms at (t+Lag), by sector.

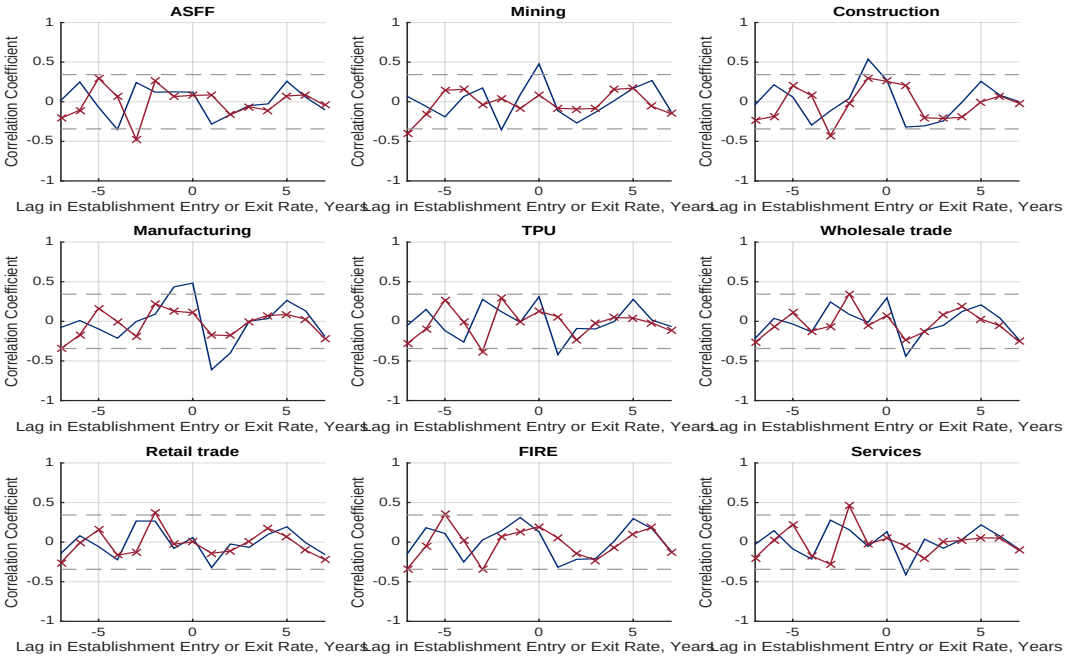
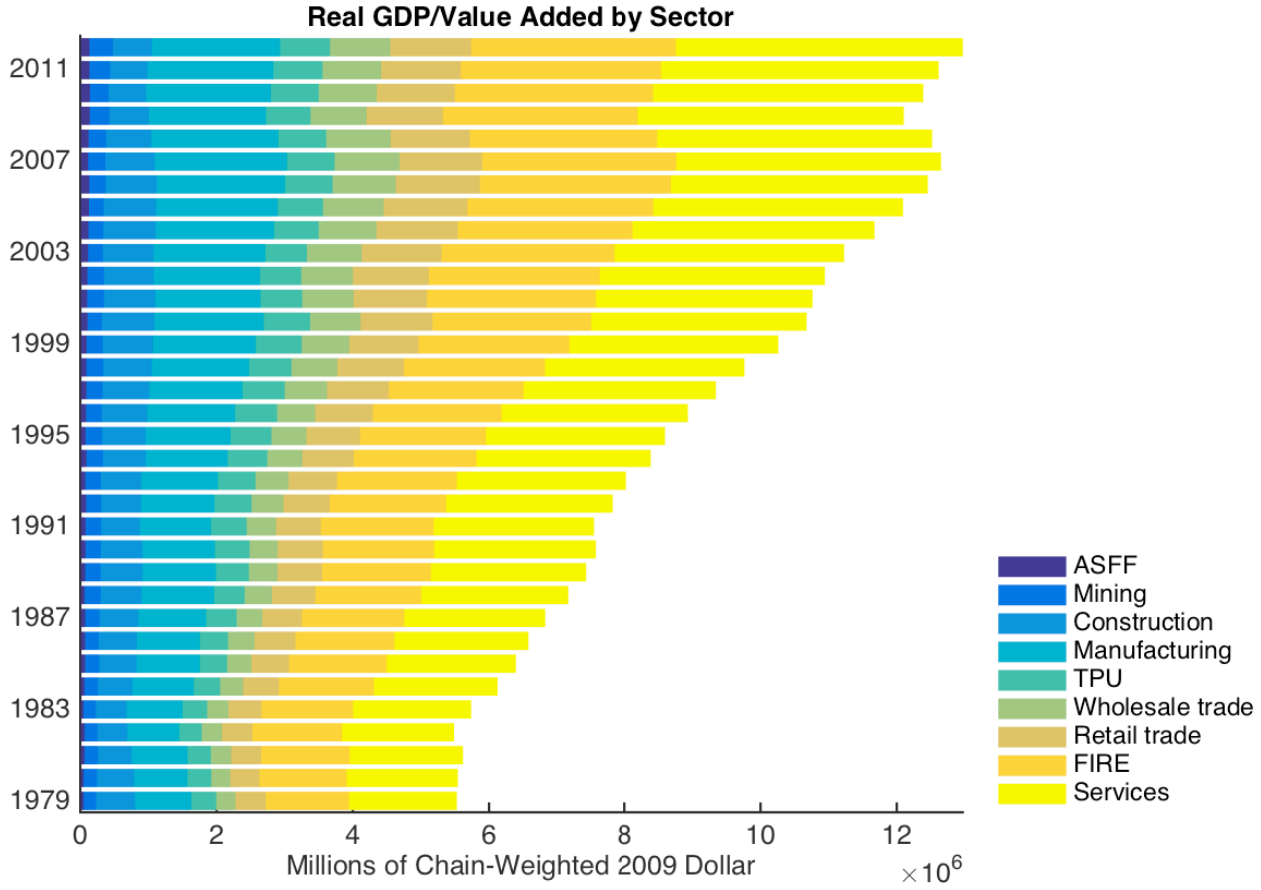
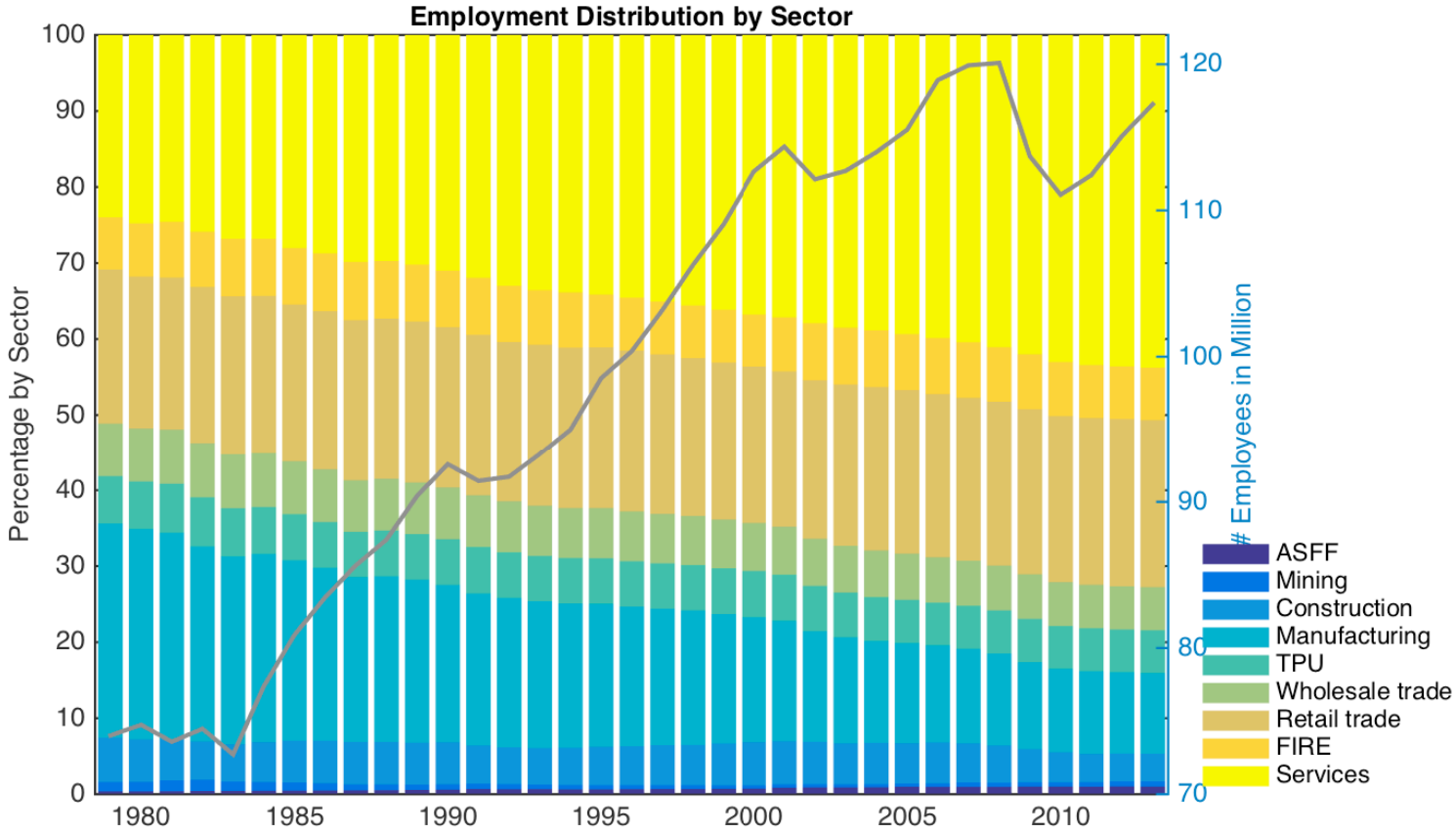
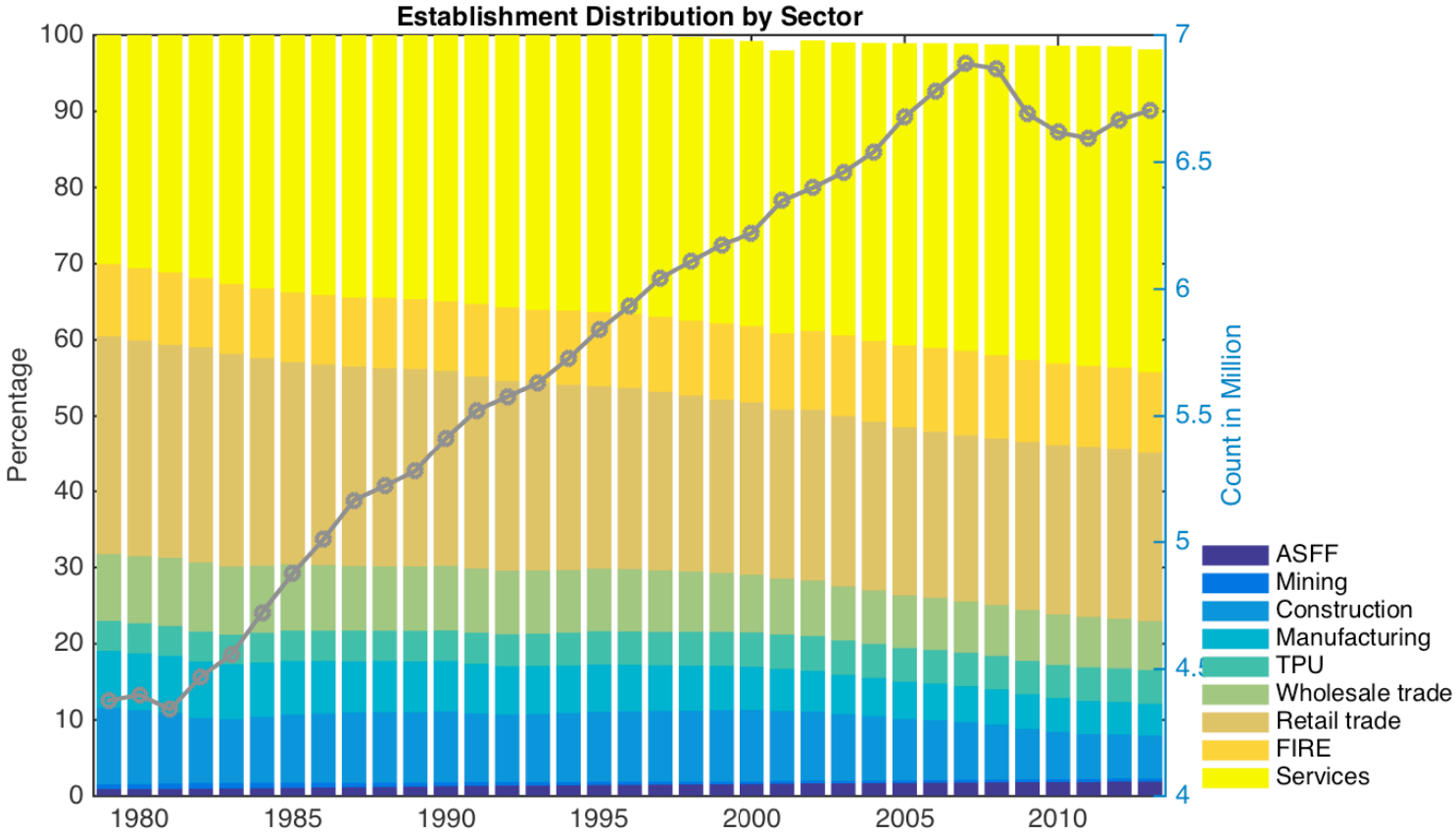
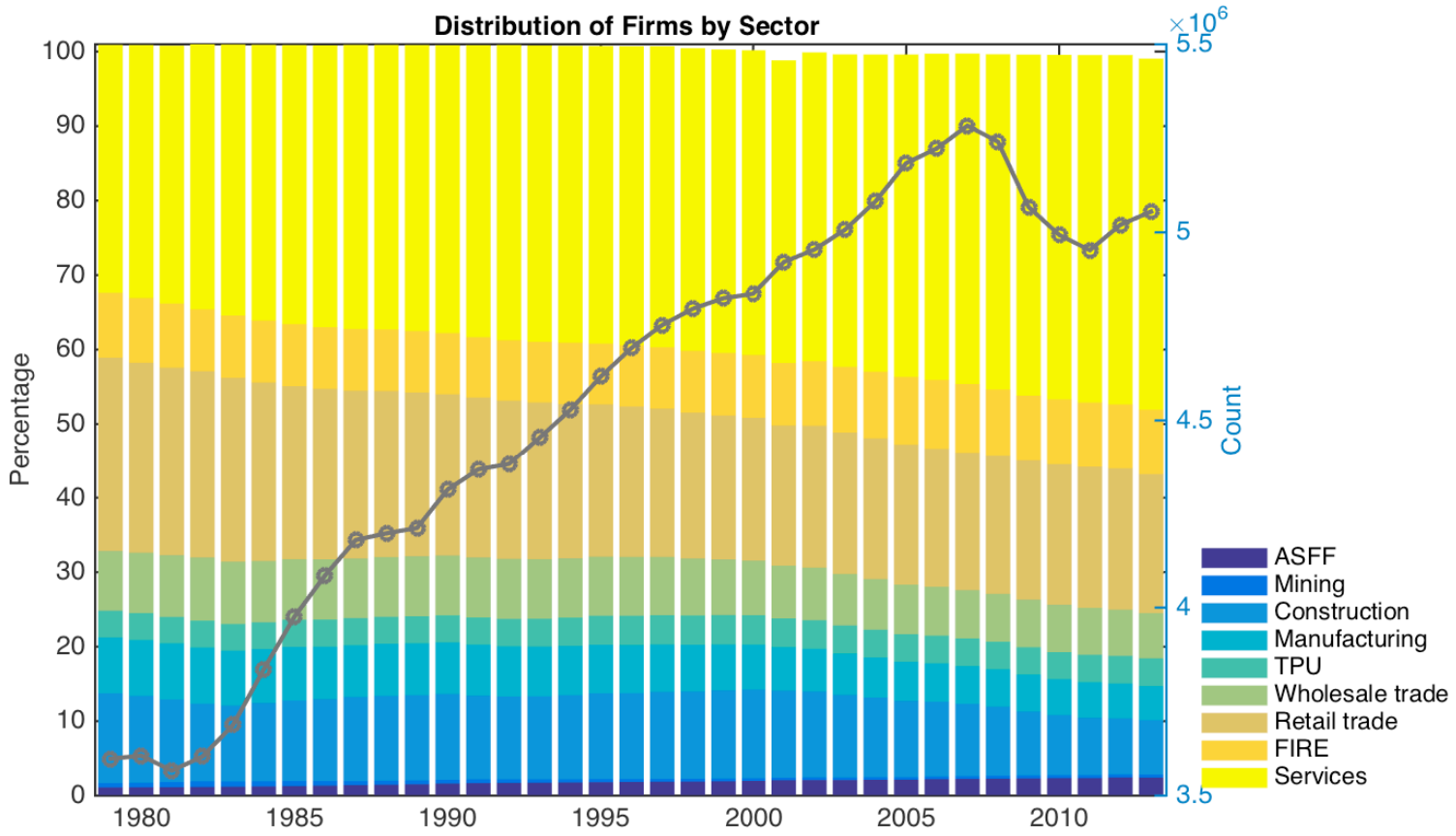


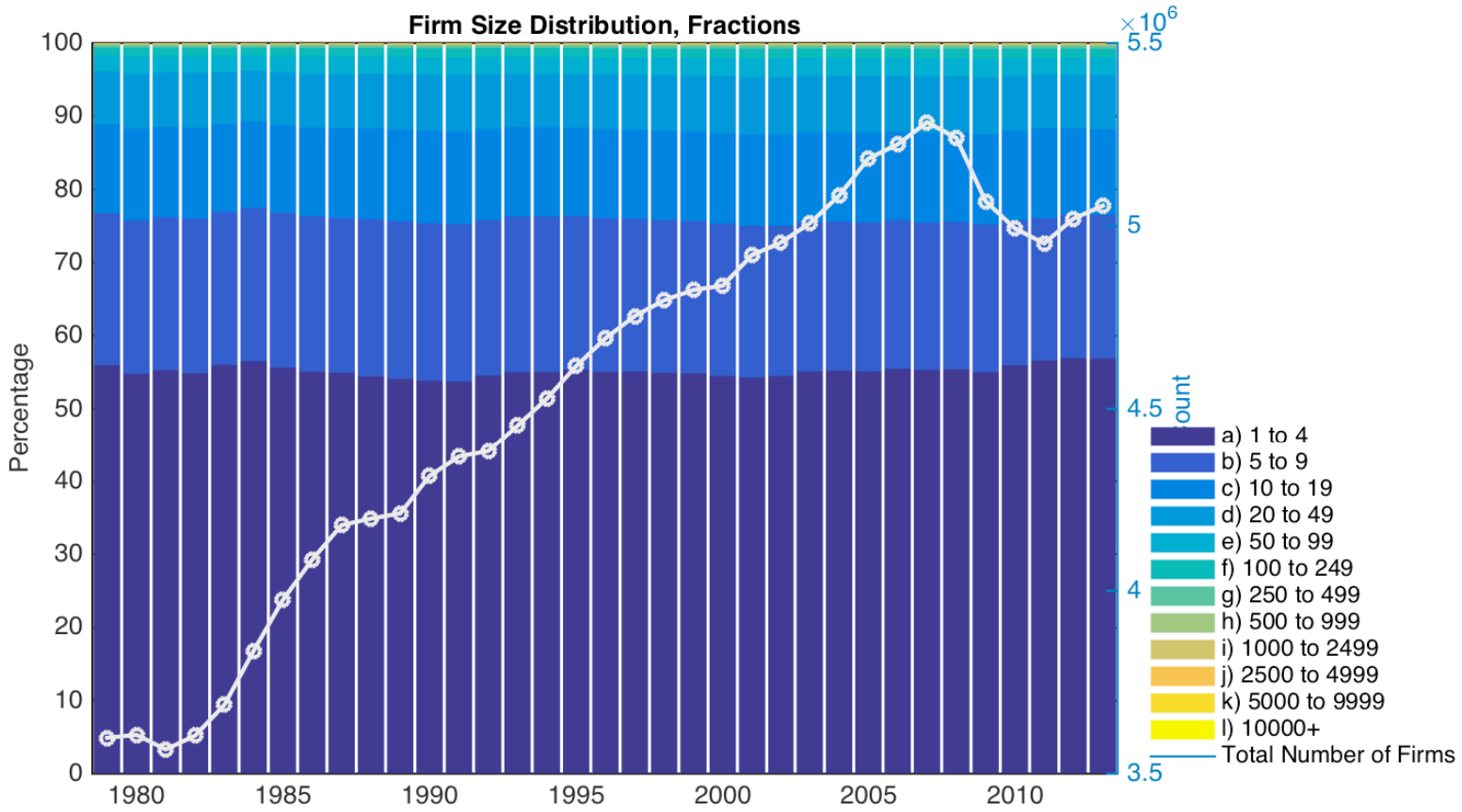
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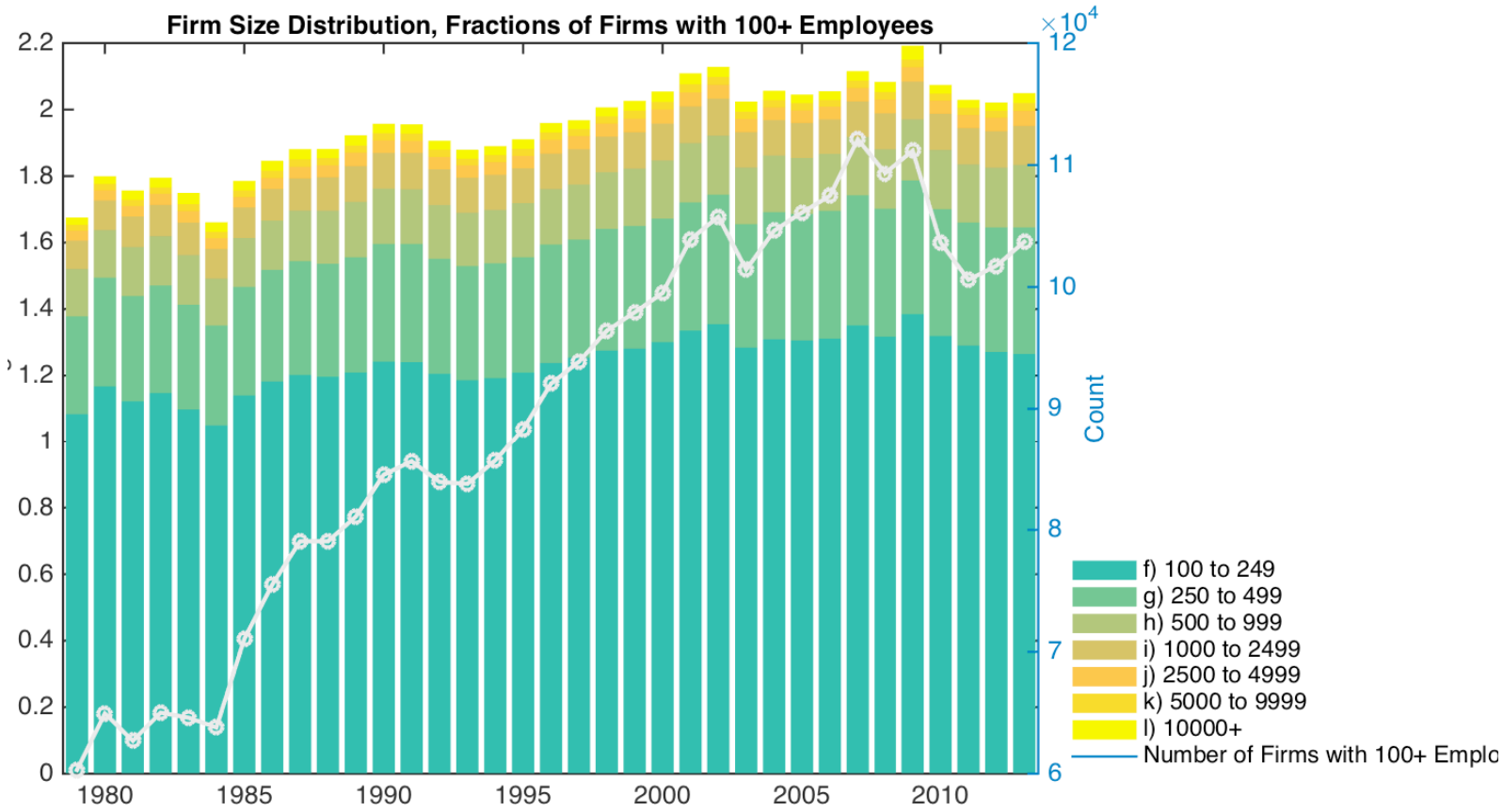

Real GDP/Value Added by Sector
2011
2007
2003
1999
1995
1991
1987
1983
1979
0
2
4
6
8
10
12
Millions of Chain-Weighted 2009 Dollar
×10^6
ASFF
Mining
Construction
Manufacturing
TPU
Wholesale trade
Retail trade
FIRE
Services

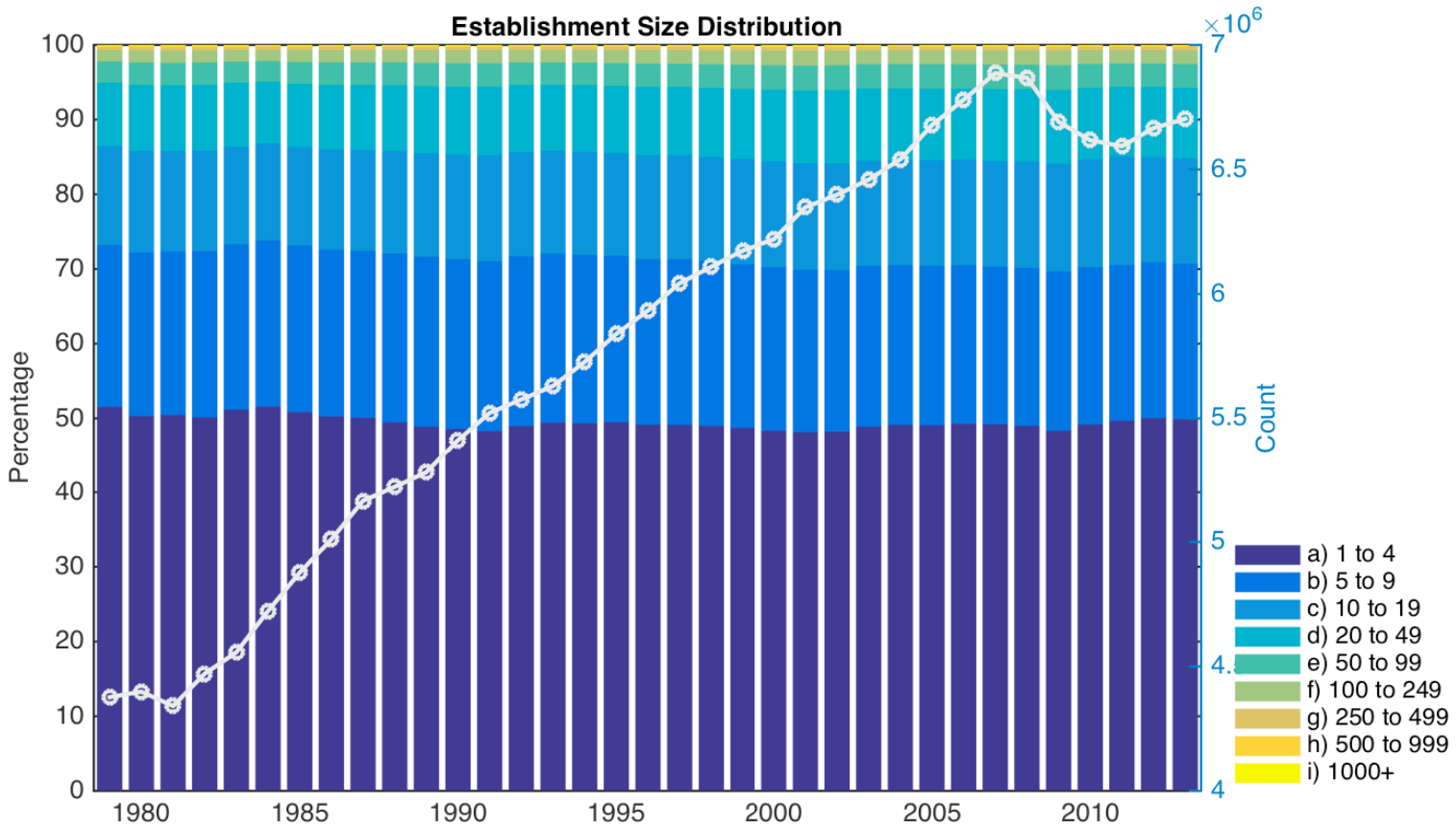

Employment Distribution by Sector
Percentage by Sector
Employees in Million
100
90
80
70
60
50
40
30
20
10
0
120
110
100
90
80
70
1980
1985
1990
1995
2000
2005
2010
ASFF
Mining
Construction
Manufacturing
TPU
Wholesale trade
Retail trade
FIRE
Services

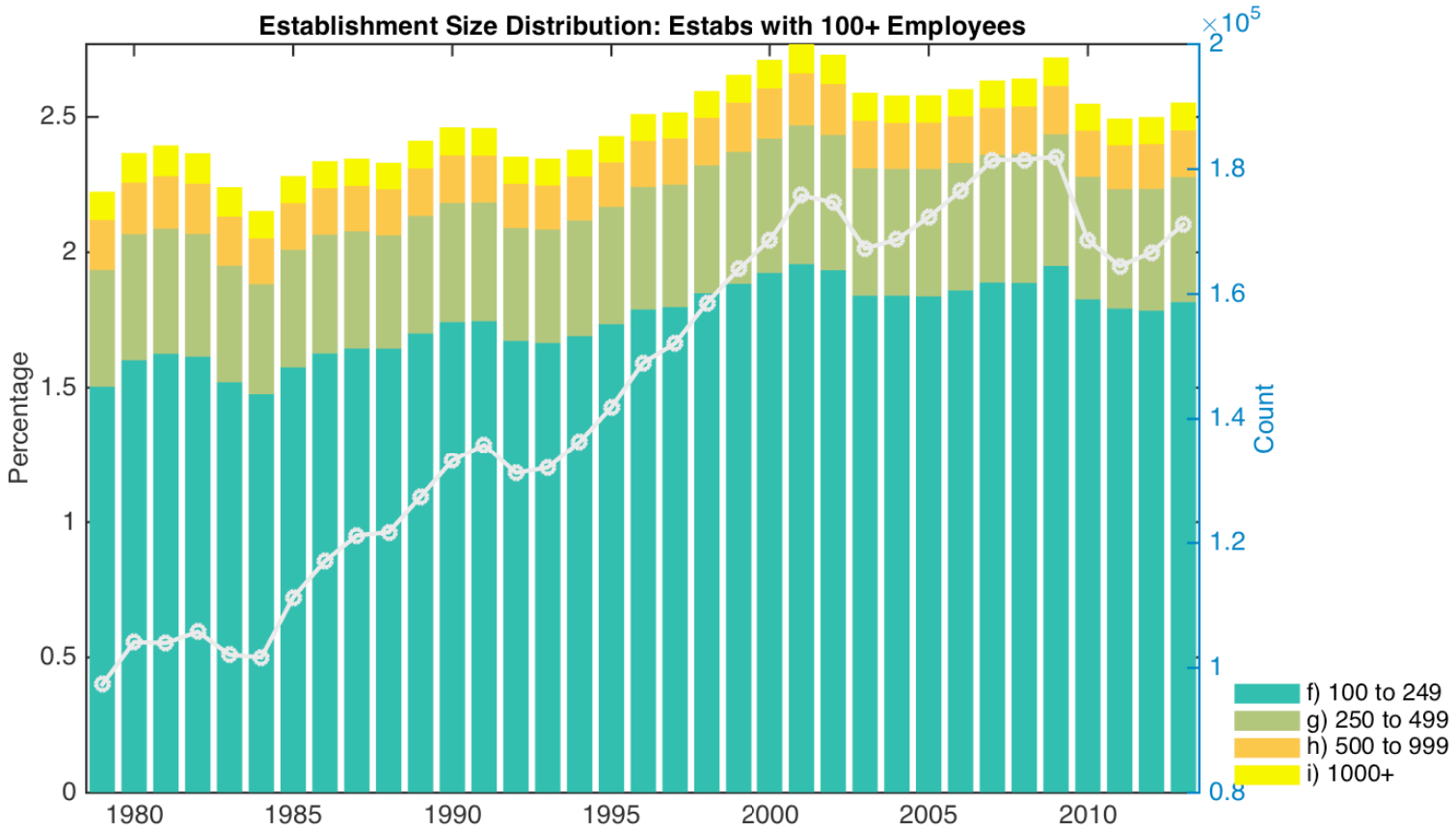

Establishment Distribution by Sector
Percentage
Count in Million
100
90
80
70
60
50
40
30
20
10
0
7
6.5
6
5.5
5
4.5
4
1980
1985
1990
1995
2000
2005
2010
ASFF
Mining
Construction
Manufacturing
TPU
Wholesale trade
Retail trade
FIRE
Services

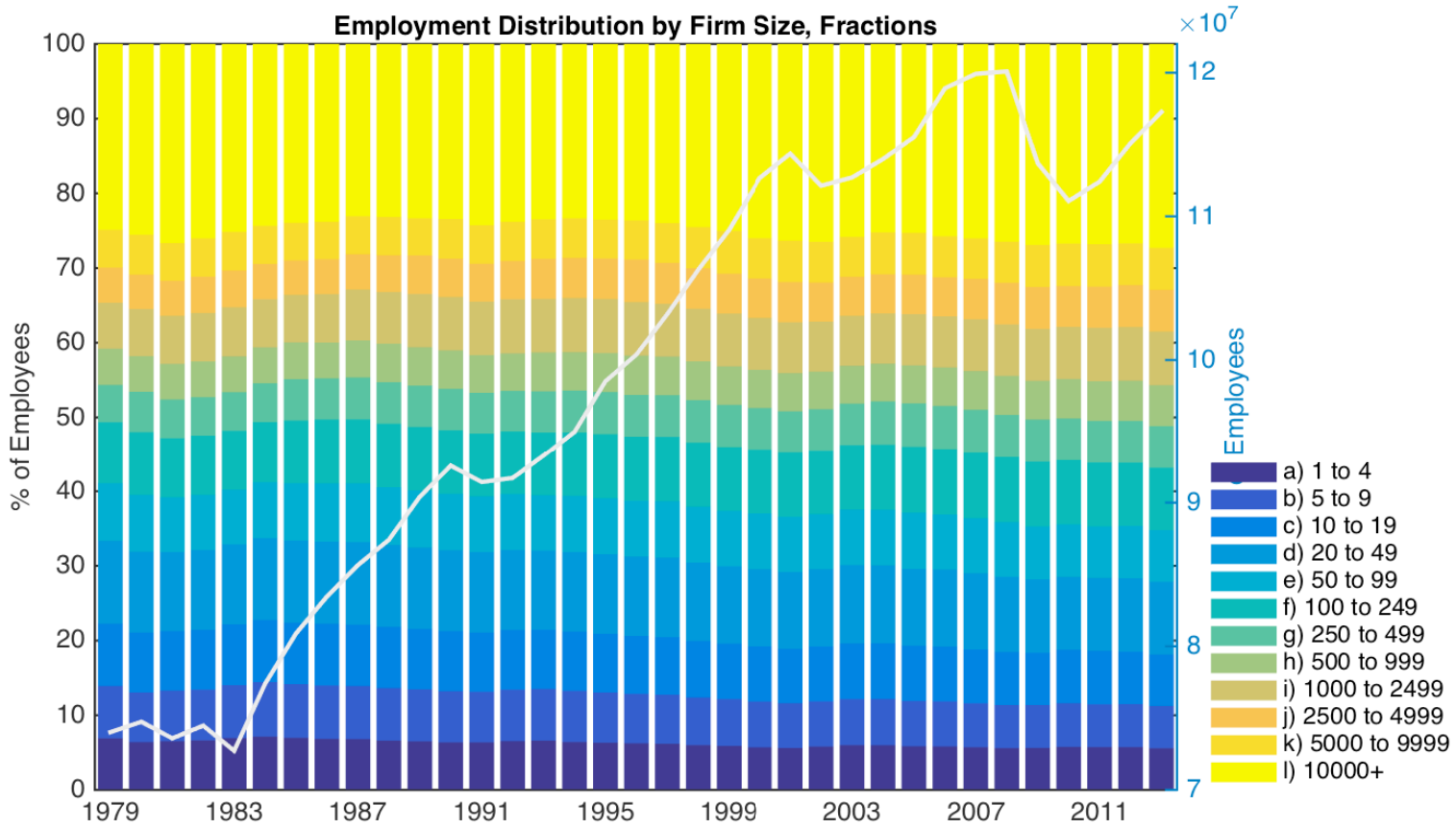

Distribution of Firms by Sector
Percentage
Count
×10^6
100
90
80
70
60
50
40
30
20
10
0
5.5
5
4.5
4
3.5
1980
1985
1990
1995
2000
2005
2010
ASFF
Mining
Construction
Manufacturing
TPU
Wholesale trade
Retail trade
FIRE
Services


Firm Size Distribution, Fractions
Percentage
Count
×10^6
100
90
80
70
60
50
40
30
20
10
0
5.5
5
4.5
4
3.5
1980
1985
1990
1995
2000
2005
2010
a) 1 to 4
b) 5 to 9
c) 10 to 19
d) 20 to 49
e) 50 to 99
f) 100 to 249
g) 250 to 499
h) 500 to 999
i) 1000 to 2499
j) 2500 to 4999
k) 5000 to 9999
l) 10000+
Total Number of Firms


Firm Size Distribution, Fractions of Firms with 100+ Employees
×10^4
Count
f) 100 to 249
g) 250 to 499
h) 500 to 999
i) 1000 to 2499
j) 2500 to 4999
k) 5000 to 9999
l) 10000+
Number of Firms with 100+ Emplo


Establishment Size Distribution
Percentage
Count
×10^6
100
90
80
70
60
50
40
30
20
10
0
7
6.5
6
5.5
5
4.
4
1980
1985
1990
1995
2000
2005
2010
a) 1 to 4
b) 5 to 9
c) 10 to 19
d) 20 to 49
e) 50 to 99
f) 100 to 249
g) 250 to 499
h) 500 to 999
i) 1000+


Establishment Size Distribution: Estabs with 100+ Employees
Percentage
Count
×10^5
2
1.8
1.6
1.4
1.2
1
0.8
2.5
2
1.5
1
0.5
0
1980
1985
1990
1995
2000
2005
2010
f) 100 to 249
g) 250 to 499
h) 500 to 999
i) 1000+


Employment Distribution by Firm Size, Fractions
% of Employees
Employees
×10^7
100
90
80
70
60
50
40
30
20
10
0
12
11
10
9
8
7
1979
1983
1987
1991
1995
1999
2003
2007
2011
a) 1 to 4
b) 5 to 9
c) 10 to 19
d) 20 to 49
e) 50 to 99
f) 100 to 249
g) 250 to 499
h) 500 to 999
i) 1000 to 2499
j) 2500 to 4999
k) 5000 to 9999
l) 10000+

D More Tables

Table D.1: Cyclicality in Average Number of Establishments in a Firm

	gdp_t	ΔGDP_t	u_t
ABSOLUTE NUMBER OF ESTABLISHMENTS			
Average Scale of a Startup Firm	-0.1409	-0.2677	0.1249
Average Scale of a Closing Firm	-0.0957	-0.0460	0.0639
RELATIVE TO CONTINUERS IN PERCENTAGE			
Scale of a Startup Firm Relative to a Continuer	0.0293	-0.1168	0.0877
Scale of a Closing Firm Relative to a Continuer	0.1357	0.1942	-0.0072

All series are detrended using an HP filter with smoothing parameter 6.25. Linear detrending does not change the results substantially.

Table D.2: Regressions by Size: Job Creation Rate Due to Firm Birth

	Cyclical Indicators as Regressors				
	AGGREGATE			SECTORAL	
Firm Size Group	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	0.1491	0.0107	-0.4947	0.1248^{**}	0.1041^{***}
b) 5 to 9	0.1841^{***}	0.0378	-0.4625^{**}	0.0549^{*}	0.0570^{***}
c) 10 to 19	0.1838^{***}	0.0069	-0.3854^{**}	0.0318	0.0366^{**}
d) 20 to 49	0.1131^{**}	-0.0260	-0.2946^{*}	0.0315	0.0325^{**}
e) 50 to 99	0.0322	-0.0393	-0.1271	-0.0017	0.0215
f) 100 to 249	0.0728	-0.1032^{***}	-0.1038	0.0494^{*}	0.0393^{**}
g) 250 to 499	-0.0601	0.0175	0.4074^{**}	0.0230	0.0247
h) 500 to 999	-0.0748^{*}	0.0178	0.2475^{*}	-0.0043	-0.0074
i) 1000 to 2499	-0.0179	-0.0637	-0.0052	0.0182	-0.0095
j) 2500+	0.0157	-0.1255^{***}	-0.3647	-0.5002	0.0008^{***}

Table D.3: Regressions by Size: Job Destruction Rate Due to Firm Death

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Firm Size Group	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.0150	-0.1166^{***}	0.1069	-0.0045	-0.0638^{***}
b) 5 to 9	-0.0320	-0.0751^{***}	0.2176^{***}	0.0009	-0.0317^{***}
c) 10 to 19	-0.0431^{*}	-0.0486^{***}	0.2519^{***}	-0.0396^{***}	-0.0371^{***}
d) 20 to 49	-0.0974^{***}	-0.0328^{*}	0.3709^{***}	-0.0246	-0.0382^{***}
e) 50 to 99	0.0164	0.0198	0.1393	-0.0193	-0.0364^{*}
f) 100 to 249	0.0678	-0.0025	-0.0427	-0.0061	-0.0293
g) 250 to 499	0.2291	-0.0818	-1.0745	0.4456^{**}	0.0717
h) 500 to 999	-0.3350	0.2007	1.1715	-0.6167	0.1306
i) 1000 to 2499	-0.5017	-0.2558	0.4602	-0.4303	-0.4309
j) 2500 to 4999	1.3695	2.0570	-6.6200	1.7528	0.6099

Age Controlled j) 2500-4999

Table D.4: Regressions by Firm Age: Establishment Exit Rate due to Firm Death

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.1457	-0.0055	0.8809^{**}	-0.1099^{**}	-0.0841^{**}
c) 2	-0.0025	-0.0444	-0.0786	-0.0634^{*}	-0.0164
d) 3	0.0251	-0.0144	0.2136	-0.0201	-0.0239^{*}
e) 4	0.0860	-0.0526^{*}	0.0159	-0.0317	-0.0205
f) 5	0.1718^{***}	-0.0016	-0.0832	-0.0055	-0.0087
g) 6 to 10	0.0569^{*}	-0.0784^{***}	-0.0356	-0.0072	-0.0020
h) 11 to 15	0.0816^{***}	-0.0508^{***}	-0.1573^{**}	-0.0001	-0.0097
i) 16 to 20	0.0379	-0.0336^{*}	-0.1302^{*}	-0.0154	-0.0073
j) 21 to 25	0.0649^{**}	-0.0244	-0.1456^{*}	0.0036	0.0152^{*}
k) 26+	0.1043^{***}	-0.0195	-0.2309^{***}	0.0024	-0.0101

Table D.5: Regressions by Firm Age: Job Destruction Rate due to Firm Death

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.2011^{*}	-0.0524	0.9820^{**}	0.0021	-0.1163^{***}
c) 2	-0.0272	-0.0912	-0.0157	0.0008	-0.0334
d) 3	-0.0258	-0.0531^{*}	0.3281^{*}	0.0108	-0.0451^{***}
e) 4	0.0136	-0.0622^{**}	0.1732	-0.0193	-0.0491^{***}
f) 5	0.1337^{***}	-0.0327	-0.0527	0.0097	-0.0169
g) 6 to 10	0.0102	-0.0966^{***}	0.0712	-0.0097	-0.0149
h) 11 to 15	0.0617^{**}	-0.0556^{***}	-0.1062	0.0090	-0.0310^{***}
i) 16 to 20	0.0541^{*}	-0.0204	-0.0883	-0.0068	-0.0073
j) 21 to 25	0.0655^{**}	-0.0211	-0.1109	-0.0263^{*}	-0.0066
k) 26+	0.1257^{***}	-0.0157	-0.2356^{***}	0.0287^{*}	-0.0081

Table D.6: Regressions by Firm Size without Controlling for Firm Age: Firm Death Rate

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	0.0465	-0.1150^{***}	0.1465	0.0284	-0.1024^{***}
b) 5 to 9	-0.0187	-0.0365	0.1491	0.0144	-0.0145
c) 10 to 19	0.0233	-0.0340	0.0180	0.0140	-0.0022
d) 20 to 49	0.0191	-0.0323	-0.0165	0.0112	-0.0027
e) 50 to 99	0.0624^{*}	-0.0605^{***}	-0.1622	0.0471^{***}	0.0223^{**}
f) 100 to 249	0.0615	-0.0410^{*}	-0.0261	0.0117	-0.0117
g) 250 to 499	0.0498	0.0071	-0.0769	0.0280	0.0401^{***}
h) 500 to 999	0.0054	-0.0007	0.0435	-0.0012	0.0009
i) 1000 to 2499	-0.0138	-0.0070	-0.0344	0.0119	0.0139
j) 2500+	0.0158	0.0037	-0.0266	0.0798	-0.0000

Table D.7: Regressions by Sector: Job Creation Rate due to Establishment Entry

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
ASFF	0.3336^{***}	-0.0794	-0.9763^{***}	0.0369	0.0296^{*}
Mining	0.1868	-0.4956^{***}	-0.7780^{*}	0.0664	0.0808^{**}
Construction	0.0294	0.1656^{***}	0.1008	0.0190	0.0823^{***}
Manufacturing	0.0824^{*}	0.0482^{*}	-0.2140	0.0500^{**}	0.0323^{**}
TPU	-0.3207^{***}	0.0507	1.1022^{***}	-0.1259^{***}	-0.0065
Wholesale trade	-0.0111	-0.1019^{**}	-0.2005	-0.0142	-0.0244
Retail trade	0.1563	-0.2107^{**}	-0.9202^{*}	0.0246	-0.0092
FIRE	0.0459	-0.0049	-0.2314	0.2714^{**}	0.1970^{***}
Services	0.0212	0.0205	-0.0636	-0.0118	0.0255

ASFF stands for agricultural services, forestry, fishing. TPU stands for transportation and public utilities. FIRE stands for finance, insurance, real estate.

Table D.8: Regressions by Sector: Job Destruction Rate due to Establishment Exit

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
ASFF	-0.0288	-0.2296^{***}	0.0835	0.0057	-0.0198
Mining	-0.4193^{***}	0.0946	1.8563^{***}	-0.0030	0.0714^{***}
Construction	-0.2735^{***}	-0.3694^{***}	0.3037	-0.0862^{***}	-0.1545^{***}
Manufacturing	-0.1409	-0.0908	0.6444^{**}	-0.0849^{*}	-0.0964^{***}
TPU	-0.0986^{*}	-0.0039	0.2847^{*}	-0.0213	-0.0820^{***}
Wholesale trade	0.0183	-0.0761	-0.0194	0.0850^{**}	-0.0073
Retail trade	0.0734	-0.0289	-0.1961	-0.0077	-0.0312
FIRE	0.1119	0.0934^{**}	0.3361	-0.1888^{**}	0.1623^{***}
Services	0.0206	-0.0232	0.0521	0.0969^{*}	-0.0457

ASFF stands for agricultural services, forestry, fishing. TPU stands for transportation and public utilities. FIRE stands for finance, insurance, real estate.

Table D.9: Regressions by Size: Job Creation Rate due to Establishment Entry

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Establishment Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	0.0575	0.0136	−0.2648	0.0648	0.0820**
b) 5 to 9	0.1204*	−0.0377	−0.3667*	0.0522*	0.0539***
c) 10 to 19	0.1476**	−0.0331	−0.3630	0.0327	0.0433**
d) 20 to 49	0.1266**	−0.0425	−0.3190	0.0363	0.0482***
e) 50 to 99	−0.0244	−0.0377	0.0567	0.0802**	0.0624***
f) 100 to 249	0.0143	−0.0442	−0.0355	0.0264	0.0632***
g) 250 to 499	−0.0651	0.0572	0.3715	−0.0573	0.0120
h) 500 to 999	−0.0403	−0.0284	−0.1662	0.0306	0.0141
i) 1000+	−0.1399	−1.0353***	−2.4888	−0.5690	−0.0332

Table D.10: Regressions by Size: Job Destruction Rate due to Establishment Exit

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Establishment Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	−0.1401***	−0.2359***	0.3160***	−0.0453***	−0.1097***
b) 5 to 9	−0.0530*	−0.1156***	0.2503***	−0.0061	−0.0544***
c) 10 to 19	−0.0351	−0.0462**	0.2210**	−0.0398***	−0.0464***
d) 20 to 49	−0.0765**	−0.0309	0.3375***	−0.0346*	−0.0422***
e) 50 to 99	−0.0542	0.0086	0.3899*	−0.0070	−0.0375*
f) 100 to 249	−0.1682	−0.0259	0.6021	−0.0792	−0.0019
g) 250 to 499	0.1129	−0.0224	−0.0034	0.0548	0.0399
h) 500 to 999	0.3019**	0.0343	−0.4420	0.1050	0.0543
i) 1000+	−0.1604*	0.0342	0.7450***	−0.1086**	−0.0585*

Table D.11: Regression by Parent Firm Size: Establishment Entry Rate

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.0521^{***}	0.0272^{**}	0.0833	-0.0453^{***}	0.0081
b) 5 to 9	-0.0267^{**}	-0.0231^{***}	-0.0474	-0.0059	0.0062
c) 10 to 19	-0.0811^{***}	-0.0894^{***}	0.0969	-0.0163^{*}	-0.0114^{*}
d) 20 to 49	-0.0166	-0.2157^{***}	-0.2791^{**}	0.0209	-0.0150
e) 50 to 99	-0.0764	-0.3001^{***}	0.0219	0.0228	-0.0612^{**}
f) 100 to 249	0.2577^{**}	-0.1825^{**}	-0.3794	0.1992^{***}	0.0490
g) 250 to 499	-0.0140	0.1045	0.1959	-0.0951	0.0224
h) 500 to 999	-0.0723	0.0421	0.3861	0.0632	0.1164
i) 1000 to 2499	0.3384	-0.0417	-1.5724	-0.1209	-0.0709
j) 2500 to 4999	0.8584^{***}	-0.0544	-1.8437^{*}	0.5137^{***}	-0.0281
k) 5000 to 9999	1.2863^{*}	-0.2057	-2.1199	0.9183^{*}	0.3199
l) 10000+	1.9217^{**}	-0.1227	-3.0227	1.5379^{**}	0.6885

Table D.12: Regression by Parent Firm Size: Job Creation Rate due to Establishment Entry

	Cyclical Indicators as Regressors				
	AGGREGATE			SECTORAL	
Parent Firm Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.0448^{**}	0.0332^{***}	0.0401	-0.0349^{***}	0.0086
b) 5 to 9	-0.0126	-0.0065	-0.0840^{*}	-0.0039	0.0106^{**}
c) 10 to 19	-0.0533^{***}	-0.0327^{***}	0.0676	-0.0185^{**}	-0.0043
d) 20 to 49	0.0294	-0.0725^{***}	-0.2383^{***}	0.0070	-0.0014
e) 50 to 99	-0.0398	-0.0491	0.0754	0.0275	-0.0152
f) 100 to 249	0.1103	0.0184	-0.0769	0.0713	0.0346
g) 250 to 499	-0.1252	0.2874^{**}	0.1222	-0.1015	0.0944
h) 500 to 999	-0.1398	0.1258	0.2661	0.0132	0.1254
i) 1000 to 2499	0.1623	-0.2226	-0.9708	0.0570	-0.1099
j) 2500 to 4999	0.4896^{*}	0.1339	-0.9184	0.2732^{*}	0.0490
k) 5000 to 9999	1.0933^{***}	-0.0191	-1.9543	0.3885	-0.0074
l) 10000+	1.7020^{**}	-0.0314	-2.7059	1.2163^{**}	0.6415^{*}

Table D.13: Regression by Parent Firm Size: Establishment Exit Rate

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.0881^{**}	-0.2666^{***}	0.1365	-0.0399^{**}	-0.1106^{***}
b) 5 to 9	-0.0241	-0.0796^{***}	0.1645^{**}	-0.0035	-0.0334^{***}
c) 10 to 19	0.0165	-0.0246	0.0953	-0.0316^{**}	-0.0332^{***}
d) 20 to 49	0.0029	0.0001	0.1292	-0.0030	-0.0325^{***}
e) 50 to 99	0.1635^{***}	0.0696^{**}	-0.1329	0.0320	-0.0453^{**}
f) 100 to 249	0.0326	0.1592^{***}	0.3444	0.0221	0.0713^{**}
g) 250 to 499	0.1418	-0.0653	-0.2133	0.0941	-0.0518
h) 500 to 999	-0.0703	0.1766	1.0879	-0.1301	-0.0074
i) 1000 to 2499	0.2354	-0.0969	-0.5968	0.0509	-0.1443^{**}
j) 2500 to 4999	0.3601	-0.2366	-1.6084^{*}	0.1659	-0.1466
k) 5000 to 9999	0.1712	-0.4449^{**}	-0.3995	0.3909	-0.0412
l) 10000+	0.2429	0.2173	-1.0038	-0.0181	0.2313

Table D.14: Regression by Parent Firm Size: Job Destruction Rate due to Establishment Exit

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Size	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
a) 1 to 4	-0.1016^{***}	-0.2429^{***}	0.1715^{*}	-0.0309^{**}	-0.1037^{***}
b) 5 to 9	-0.0394	-0.1253^{***}	0.1532^{*}	-0.0044	-0.0468^{***}
c) 10 to 19	-0.0243	-0.0781^{***}	0.1429^{*}	-0.0420^{***}	-0.0499^{***}
d) 20 to 49	-0.0602^{*}	-0.0598^{***}	0.2186^{**}	-0.0162	-0.0527^{***}
e) 50 to 99	0.0673	-0.0126	0.0173	0.0020	-0.0666^{***}
f) 100 to 249	-0.0046	0.0011	0.2055	0.0111	0.0205
g) 250 to 499	0.2104	0.0738	-0.1839	0.1577	-0.0316
h) 500 to 999	0.0023	0.1484	0.7875	-0.0214	0.0009
i) 1000 to 2499	0.2262	-0.0650	-0.4696	0.1214	-0.0048
j) 2500 to 4999	0.1728	-0.2062	-1.0309	0.1445	-0.1102
k) 5000 to 9999	0.3336	-0.3448^{**}	-0.9265	0.3286^{*}	0.0075
l) 10000+	0.0684	0.3148	-0.6138	-0.1207	0.2238

Table D.15: Regressions by Establishment Age: Job Destruction Rate due to Establishment Exit

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Establishment Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.2754^{***}	-0.1155^{*}	1.1401^{***}	-0.0334	-0.0818^{***}
c) 2	-0.1841^{**}	-0.0467	0.6593^{**}	-0.1005^{***}	-0.0555^{**}
d) 3	0.0628	-0.0509	0.0410	0.0236	-0.0358^{*}
e) 4	0.0425	-0.1262^{***}	0.3967^{**}	-0.0173	-0.0861^{***}
f) 5	0.0922^{*}	-0.0642^{**}	-0.0190	0.0158	-0.0320^{**}
g) 6 to 10	0.0950^{**}	-0.0767^{***}	-0.1541	0.0193	0.0066
h) 11 to 15	0.0105	-0.0135	0.0035	0.0040	-0.0202^{*}
i) 16 to 20	0.0469	-0.0387	-0.0675	-0.0274	-0.0263^{*}
j) 21 to 25	0.0437	-0.0690^{**}	-0.1298	-0.0251	-0.0306^{*}
k) 26+	0.0964^{**}	-0.0262	-0.1873^{*}	0.0252	-0.0085

Table D.16: Regressions by Parent Firm Age: Establishment Entry Rate

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	0.0827	-0.1174	-0.3831	0.1198	0.0667
c) 2	0.0764	-0.0921	0.0210	0.0102	0.0021
d) 3	-0.0498	-0.1513^{***}	0.2075	-0.0331	-0.0280
e) 4	0.0629	-0.3139^{***}	-0.5656	0.0008	-0.0318
f) 5	0.0498	-0.2702^{***}	-0.4344	0.0328	-0.0320
g) 6 to 10	-0.0192	-0.1308^{***}	0.0914	-0.0183	-0.0222
h) 11 to 15	0.0904	-0.1245^{*}	-0.2316	0.0689	-0.0033
i) 16 to 20	0.0167	0.0243	0.2091	-0.0029	0.0013
j) 21 to 25	0.2433^{**}	0.0025	-0.4348	0.0690	-0.0145
k) 26+	0.0912	0.0160	-0.0138	0.1059^{*}	0.0534

Table D.17: Regressions by Parent Firm Age: Job Creation Rate due to Establishment Entry

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	0.2992^{***}	0.0748	-0.4751	0.1284^{**}	0.0732^{*}
c) 2	0.1182	-0.0452	-0.0728	0.0210	0.0110
d) 3	-0.0308	-0.1025^{***}	0.0288	-0.0178	-0.0134
e) 4	-0.0896	-0.1830^{***}	-0.0444	-0.0345	-0.0358^{*}
f) 5	-0.0746	-0.1808^{***}	-0.1989	-0.0128	-0.0290^{*}
g) 6 to 10	-0.0296	-0.0201	0.0838	-0.0100	-0.0086
h) 11 to 15	0.1147	-0.0587	-0.2605	0.0323	-0.0131
i) 16 to 20	0.0030	0.0602^{*}	0.1128	-0.0070	0.0040
j) 21 to 25	0.0346	0.0087	-0.0701	0.0076	-0.0116
k) 26+	0.0257	0.0620^{*}	0.1940	0.0703^{**}	0.0474^{**}

Table D.18: Regressions by Parent Firm Age: Establishment Exit Rate

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.1492	-0.0326	1.0334^{**}	-0.0348	-0.1072^{***}
c) 2	-0.0328	-0.0171	0.0362	-0.0262	-0.0572^{*}
d) 3	0.0742	-0.0210	0.0781	0.0197	-0.0565^{***}
e) 4	0.1355^{*}	-0.1088^{***}	0.1069	-0.0065	-0.1019^{***}
f) 5	0.1425^{**}	-0.0605	0.1275	0.0175	-0.0316
g) 6 to 10	0.0363	-0.1086^{***}	-0.0883	-0.0237	-0.0373^{*}
h) 11 to 15	0.0878	-0.0362	-0.2372	-0.0182	-0.0825^{***}
i) 16 to 20	0.1134	-0.0883^{*}	-0.3453	-0.0025	-0.0167
j) 21 to 25	0.0878	-0.1480^{***}	-0.3177	-0.0597	-0.0769^{***}
k) 26+	0.0296	-0.0521	0.0112	0.1057^{***}	0.0537^{*}

Table D.19: Regressions by Parent Firm Age: Job Destruction Rate due to Establishment Exit

	Cyclical Indicators as Regressors				
	Aggregate			Sectoral	
Parent Firm Age	gdp_t	ΔGDP_t	u_t	gdp_{it}	ΔGDP_{it}
b) 1	-0.2396^{*}	-0.1085	1.2021^{***}	-0.0530	-0.1692^{***}
c) 2	-0.0382	-0.0682	-0.0854	-0.0085	-0.0641^{*}
d) 3	-0.0312	-0.0998^{**}	0.2984	0.0171	-0.0680^{***}
e) 4	0.0244	-0.1586^{***}	0.2487	-0.0301	-0.1096^{***}
f) 5	0.1441^{**}	-0.1280^{***}	-0.1928	0.0100	-0.0503^{***}
g) 6 to 10	0.0147	-0.1397^{***}	-0.0591	-0.0305	-0.0497^{***}
h) 11 to 15	0.0995^{**}	-0.0148	-0.1301	0.0267	-0.0551^{***}
i) 16 to 20	0.0500	-0.0827^{**}	-0.1711	-0.0098	-0.0255
j) 21 to 25	0.0929^{*}	-0.0856^{**}	-0.2639^{*}	-0.0396	-0.0459^{**}
k) 26+	0.0718^{*}	-0.0345	-0.0572	0.0581^{**}	0.0295^{*}