

Web Appendix A.1 – NOT INTENDED FOR PUBLICATION

A. Alternative Measures of Business Dynamism

In the main paper focus on various moments of the distribution of firm growth rates. Here we conduct robustness analysis of the patterns of business dynamics using a variety of measures at both the establishment and firm levels. One measure we use is the job reallocation rate (the sum of job creation and destruction). It is a summary measure of the pace of reallocation and corresponds to an employment-weighted cross sectional absolute deviation measure of dispersion (centered at zero). We also compute the employment-weighted cross sectional standard deviation of firm (establishment) growth rates. We also compute percentiles of the employment-weighted firm growth rate distribution (*e.g.*, 90th percentile, 50th percentile and 10th percentile). Finally, we use the measure of within-firm (within-establishment) volatility developed in Davis et al. (2007) which we discuss below. All of the measures of volatility that we consider in this paper are employment weighted. Activity weighting measures of business dynamism is critical important given the highly skewed nature of business activity. Activity-weighted measures are relevant if the focus is on volatility that contributes to aggregate job, output and productivity growth.

The measure of within-firm volatility follows Davis et al. (2007). Let γ_{it} be the firm level growth rate and let $z_{it} = 0.5 * (E_{it} + E_{it-1})$ be the size of firm i at time t , where E_{it} is employment.¹ Let P_{it} denote the number of years from $t-4$ to $t+5$ for which $z_{it} > 0$. Define the

scaling quantity, $K_{it} = P_{it} / \sum_{\tau=-4}^5 z_{i,t+\tau}$, and the rescaled weights, $\tilde{z}_{it} = K_{it} z_{it}$. By construction,

$\sum_{\tau=-4}^5 \tilde{z}_{it} = P_{it}$. The within-firm volatility measure with a degrees-of-freedom correction is given by

$$\tilde{\sigma}_{it} = \left[\sum_{\tau=-4}^5 \left(\frac{\tilde{z}_{i,t+\tau}}{P_{it} - 1} \right) (\gamma_{i,t+\tau} - \bar{\gamma}_{it}^w)^2 \right]^{1/2}, \quad (1)$$

¹One difference with Davis et. al. (2007) is that we use a firm growth rate reflecting only organic growth. Davis et. al. (2007) used a growth rate that also reflected acquisitions, divestitures and firm entry and exit due to changes in ownership.

where $\bar{\gamma}_{it}^w$ is firm i 's size-weighted mean growth rate from $t-4$ to $t+5$, using the z_{it} as weights.

We construct this measure for all businesses in year t with a positive value for z_{it} . In other words, we compute (1) on the same set of firms as the contemporaneous dispersion measure. The average magnitude of firm volatility at a point in time can be calculated using equal weights or weights proportional to business size. Following Davis et al. (2007) and to be consistent with our other measures, we focus on size-weighted volatility. In the size-weighted measures, the weight for business i at time t is proportional to z_{it} . This measure is a modified version of the within-firm volatility measures computed by Comin and Philippon (2005) being inclusive of short-lived firms and entry and exit. We compute this measure at the establishment level in an analogous fashion.

Figure A.1 presents six different measures: firm- and establishment-level job reallocation, firm and establishment employment-weighted cross sectional standard deviations of growth rates, and within-firm and within-establishment measures of volatility. All measures exhibit a pronounced secular decline. The cross sectional measures exhibit more high-frequency cyclical variation. All measures decline by over 10 percent over the time period depicted. All measures are also highly correlated (all pairwise correlations exceed 0.9) including the cross sectional (e.g., job reallocation or cross sectional standard deviation) and within-business measures. For example, the correlation between the within-firm volatility measure and the job reallocation for firms is 0.93. Finally, it is apparent that firm-level measures are lower than establishment-level measures of volatility. This reflects the statistical aggregation that occurs across establishments of multi-establishment firms. It is striking, though, that the patterns are so highly correlated for establishment- and firm-level volatility. It might have been the case, for example, that the decline in firm volatility was due to an increased role of statistical aggregation since there has been a shift towards multi-unit establishment firms. In spite of the latter, we observe systematic declines in both firm- and establishment-level volatility.

B. The Changing Structure of the US Economy: The Role of Compositional Shifts

Methodological Approach

Our objective in this section is to quantify the contribution of compositional shifts by firm age and industry as well as other firm characteristics. This part of our analysis follows

closely that of Davis et al. (2007) and Decker et al. (2014), and as such our conclusions are similar to those found in those papers. We include similar analysis here since it helps provide a basis for our main analysis later in the paper. For this purpose, we consider 282 unique 4-digit NAICS (2002) industries, 7 unique firm age groups (0 through 5, and 6+), 8 firm size groups (1-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-000, and 1000+ employees), 50 states and the District of Columbia, 2 firm status groups (single or multiple location indicator), 3 chain groups (local, regional, or national capture based on whether the firm operates in multiple geographic locations) and 29 different years between 1982 and 2011.² Note that startups are simply those firms with age zero.

For this purpose, we focus on the establishment-level job flow measure—but robustness analysis (as well as a comparison with similar analyses in the recent literature) indicates that our findings are robust to using firm-level measures and to within-business vs. cross sectional measures of volatility. Changes in the pace of job flows can be readily decomposed using a shift-share decomposition. First we start with employment shares and job flows (job creation rate, job destruction rate and job reallocation rate measures) at a detailed cell level denoted by c . One can decompose job flow statistics for any given level of aggregation i as follows:

$$F_{it} - F_{it_0} = \Delta F_{it} = \sum_{c \in i} s_{ct_0} \Delta F_{ct} + \sum_{c \in i} F_{ct_0} \Delta S_{ct} + \sum_{c \in i} \Delta F_{ct} \Delta S_{ct}$$

where the change in the flow F from time t to the base year can be decomposed into three terms. The first term represents a within-cell component based on the change in flows for a particular cell between the current period t and the base period t_0 weighted by the initial shares of that cell. The second term represents a between-cell component that reflects changing shares, weighted by the flows in the base period. The third term represents a cross term relating changes in shares with changes in flows. We focus our attention on the overall and the within components. The difference between those two reflects the extent to which compositional changes (captured by both the between and the covariance terms) account for the difference.

² We thank Teresa Fort for the development of a methodology that reclassifies all establishments in the LBD to a consistent NAICS (2002) industry classification system. See Fort (2013) for details. Having a consistent classification system for our entire panel is critical for our analysis.

This shift-share methodology yields counterfactual job flows holding constant alternative classifications of cells at their initial level. Given our focus on the declining trends, we focus our attention on long differences in the actual and counterfactual flows on a peak-to-peak basis. Specifically, we focus on the long difference in the flows from the peak in the late 1980s to the peak just before the Great Recession. To mitigate the influence of higher frequency variation, we consider the 3-year averages at each of these peaks. In particular, we use the 3-year average for the 1987-89 period and the 3-year average for the 2004-06 period.

How Much of the Decline is Accounted for by the Changing Composition of Businesses?

Figure A.3 illustrates the percent in the decline of job flows explained by changes in composition for selected components and overall. The difference between the actual rate and the within component is the part that is explained by composition shifts. We first examine the impact of controlling for shifts in detailed industry, firm age, and firm size, one at a time by themselves, in order to examine their independent impact. Results for their combined full interaction with multi-unit status and firm status are also provided. Finally, we also include an interaction with geography.

How much of this decline can be explained by compositional shifts across detailed industries? As anticipated above, shifts in detailed industry composition actually work in the “wrong” direction. If the changing industrial structure were the only influence on the secular trends in job creation, destruction and reallocation rates, we should have seen these rates rise, not fall, over time as employment shifted from Manufacturing to Retail Trade and Services. The job creation rate should have increased by about 20 percent, the job destruction rate by about 4 percent and the reallocation rate by about 13 percent if the only effect operating was the shift in industrial composition.

In contrast, the shifting age composition plays a major role in accounting for the declining pace of business dynamics. The shifting age composition accounts for 32 percent of the observed decline in job creation, 20 percent of the decline in job destruction, and 26 percent of the decline in job reallocation. The change in the firm age composition is by far the most important of any of the individual factors we examine in accounting for the overall declines. The

implication is that understanding the sources of the declines in the pace of entrepreneurship is critically important for understanding the decline in business dynamism.

The shift in economic activity toward large firms has similar but more muted effects. The explanatory power for this composition effect alone is about 10 percent for job creation, job destruction and job reallocation. In interpreting the effects of size, it is important to remember that business size and business age are correlated. Young businesses are small, as documented in Haltiwanger, Jarmin and Miranda (2013). However, there are many mature small businesses so it is important to distinguish between those characteristics. Fort et al. (2013) show that the decline in the share of employment by young businesses (who are also small businesses) shows up in increased shares of mature business, both large and small. As such, there is less of a noticeable trend in the share of activity by business size as opposed to business age. In addition, Haltiwanger, Jarmin and Miranda (2013) show the high pace of job creation of small businesses is actually mostly captured by business age. So it is not that surprising that size contributes less than age.

It is apparent that there are offsetting composition effects, with shifts toward less volatile older, larger and multi-establishment firms working one way and shifts toward the Service and Retail Trade sectors as well as the shifts towards activity in the south and west working in the opposite direction. The two most important individual factors are firm age and industry—and they are working in opposite directions. In evaluating all of these effects simultaneously, additional considerations become important as well. While there has been a shift towards Services and Retail, these are sectors where the decline in the employment share of young firms has been the largest. Figure A.3 shows that the fully saturated compositional exercise accounts for about 15 percent of the respective decline in job creation, job destruction and job reallocation. This holds whether or not we include interactions with geography.

Taking stock, compositional shifts can account for part of the decline in job flows, but most of the decline remains unaccounted for by these factors. Even though only 15 percent of the decline in business volatility is accounted for by all compositional effects taken into account simultaneously, this relatively small combined effect masks substantial individual composition effects working in opposite directions. Shifts toward more mature firms account for about 26 percent of the decline in business volatility (as measured by the decline in reallocation) by itself,

but this is offset by the 13 percent increase in volatility due to the shift towards more volatile industries.

C. Changing Cohort Patterns for Publicly Traded Firms

Davis et al. (2007) showed that the rising volatility of publicly traded firms through 2000 is largely attributable to cohort effects. In particular, the 1980s and 1990s cohorts of new publicly traded firms were large, grew rapidly and exhibited very high volatility. These patterns are evident in Figures A.6 and A.7 which show the employment shares and the volatility of publicly traded firms using COMPUSTAT data so that a longer time series perspective can be provided. The contribution of the 1980s and 1990s cohorts highlighted by Davis et al. (2007) is evident. But also observe that after about the year 2000 there are substantial changes. First, the cohort of new IPOs post 2000 is small and did not grow rapidly. Second, the post-2000 cohort is much less volatile than the 1980s and 1990s cohorts. Third, the 1980s and 1990s (and all cohorts) exhibited substantial declines in volatility post 2000.³

The contribution of cohort effects is presented in Figure A.8. Figure A.8 was constructed as follows. First, an employment-weighted regression of firm volatility on year effects was estimated. Those year effects are by construction the aggregate employment-weighted within-firm volatility. Second, cohort effects for each year of entering cohort of publicly traded firms were added to the specification. The year effects from this regression are an indicator of the extent to which cohort effects account for the rise and fall of within-firm volatility for publicly traded firms. Cohort effects account for a substantial fraction of the rise in volatility through 2000 consistent with the findings in Davis et al. (2007). But cohort effects account for little of the decline. This is not surprising given Figure A.7, which shows a sharp decline in within-cohort volatility for all cohorts but especially the 1980s and 1990s cohorts.

³ Behavior of publicly traded firms reflects not only the behavior of existing public firms but also the margins of listing and delisting of public firms. See Doidge, Karolyi, and Stulz (2015) for a discussion of potential explanations for recent trends in both listing and delisting activity.

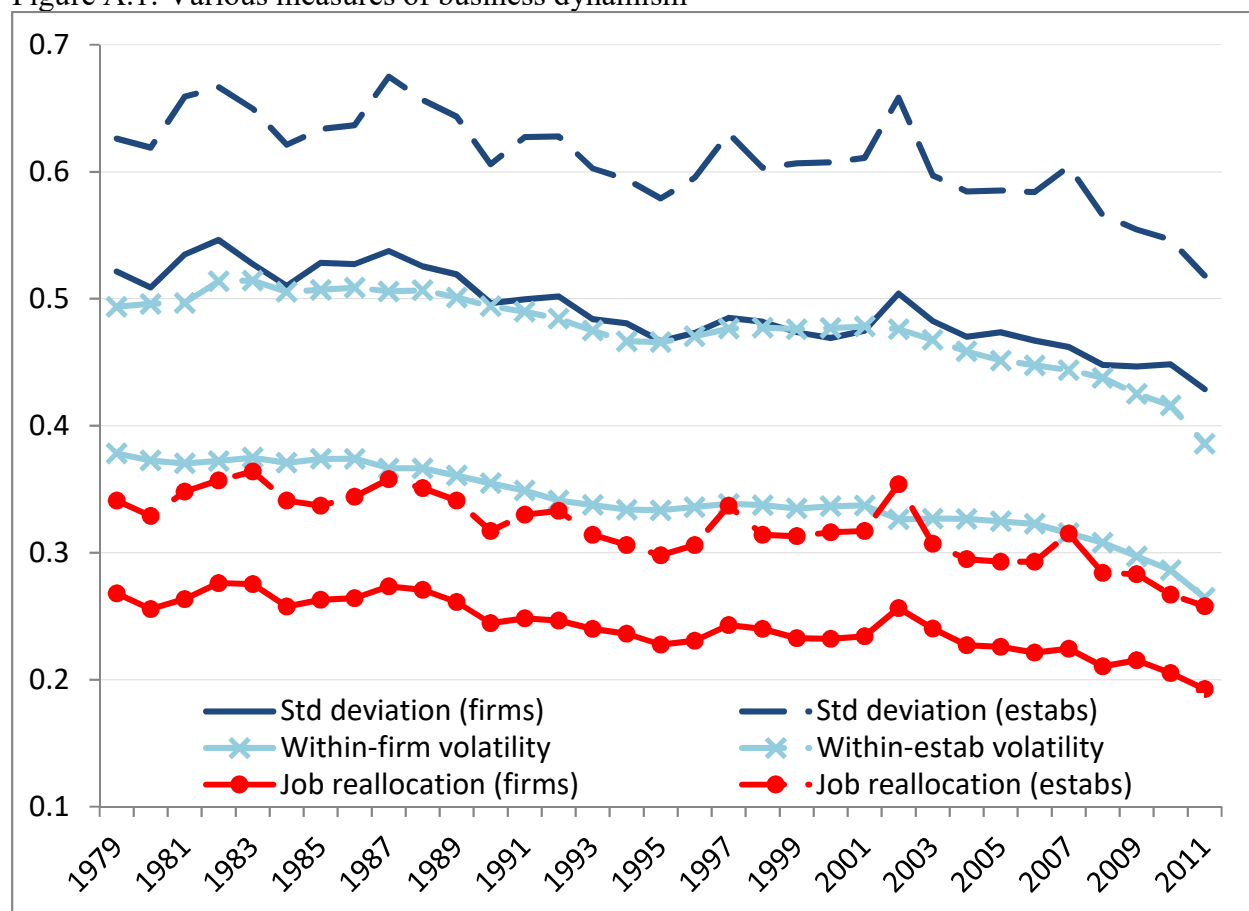
Web Appendix A.2: Tables and Figures – NOT INTENDED FOR PUBLICATION

Table A.1: High-Technology Industries

| NAICS Code | Industry |
|--|--|
| <i>Information and Communications Technology (ICT) High-Tech</i> | |
| 3341 | Computer and peripheral equipment manufacturing |
| 3342 | Communications equipment manufacturing |
| 3344 | Semiconductor and other electronic component manufacturing |
| 3345 | Navigational, measuring, electromedical, and control instruments manufacturing |
| 5112 | Software publishers |
| 5161 | Internet publishing and broadcasting |
| 5179 | Other telecommunications |
| 5181 | Internet service providers and Web search portals |
| 5182 | Data processing, hosting, and related services |
| 5415 | Computer systems design and related services |
| <i>Miscellaneous High-Tech</i> | |
| 3254 | Pharmaceutical and medicine manufacturing |
| 3364 | Aerospace product and parts manufacturing |
| 5413 | Architectural, engineering, and related services |
| 5417 | Scientific research-and-development services |

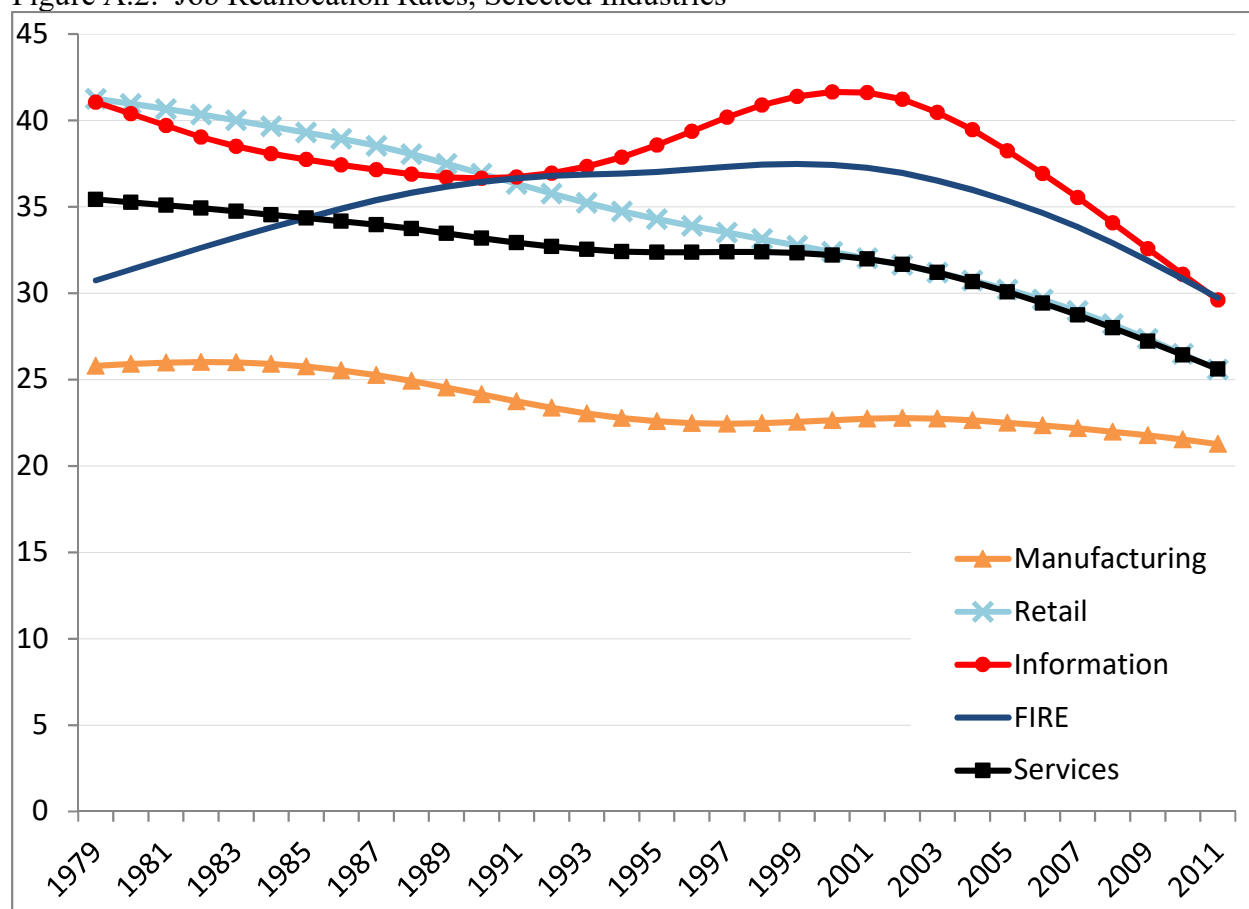
Source: Bureau of Labor Statistics, Hecker (2005)

Figure A.1: Various measures of business dynamism



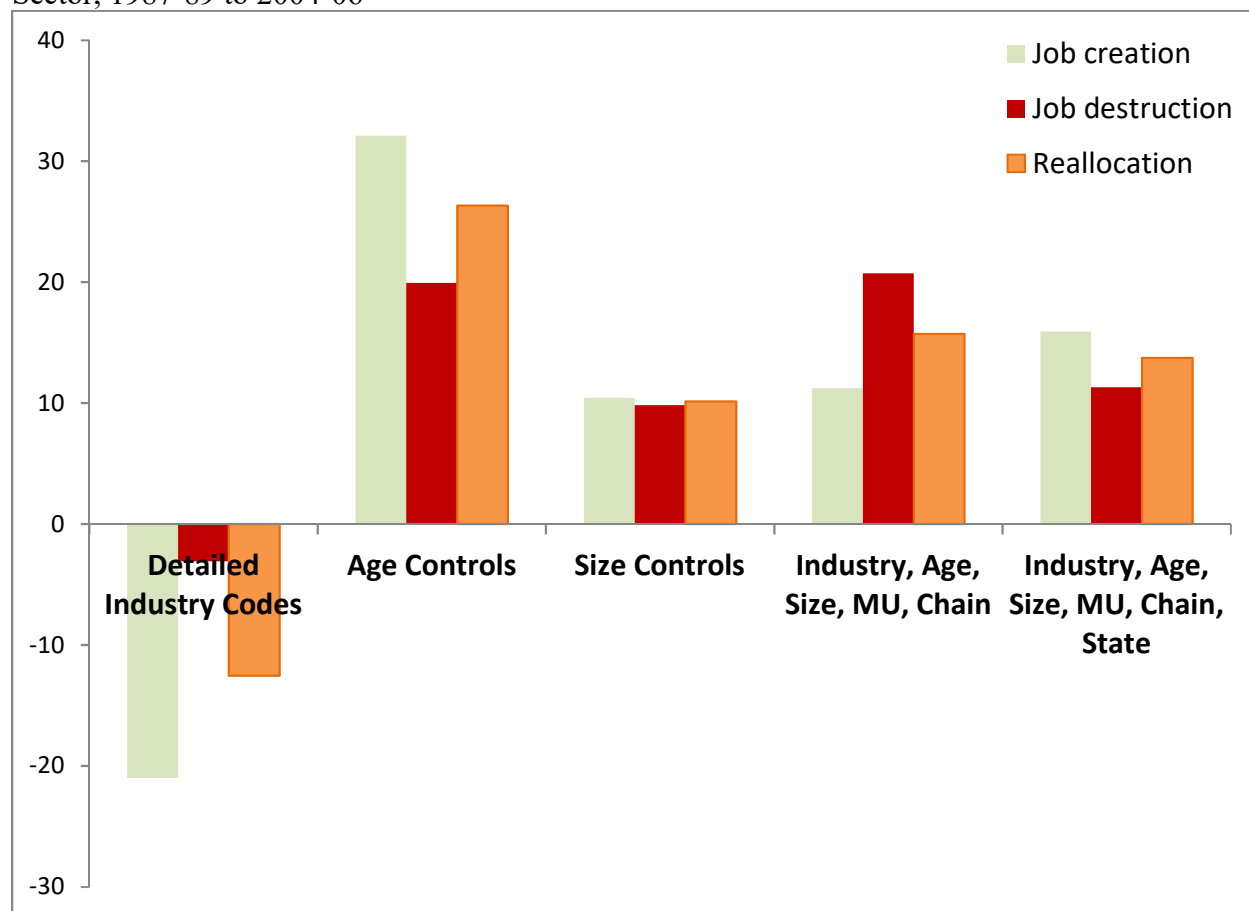
Note: Y axis does not start at zero. Author calculations from the Longitudinal Business Database.

Figure A.2: Job Reallocation Rates, Selected Industries



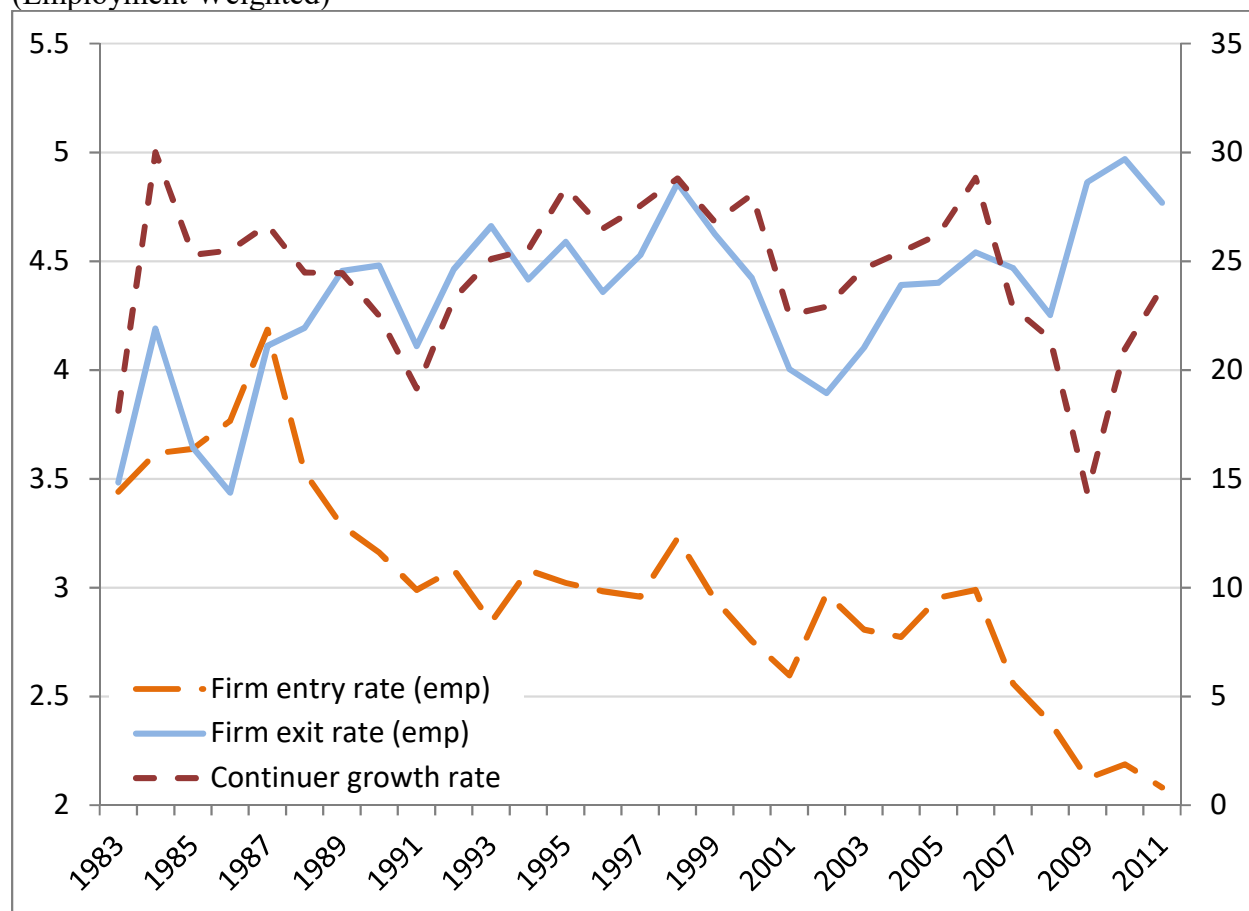
Note: Data are HP trends using parameter set to 100. Industries are defined on a consistent NAICS basis. Data include all firms (new entrants, continuers, and exiters). Author calculations from the Longitudinal Business Database.

Figure A.3: Percent of Decline in Job Flows Accounted for by Composition Effects, Private Sector, 1987-89 to 2004-06



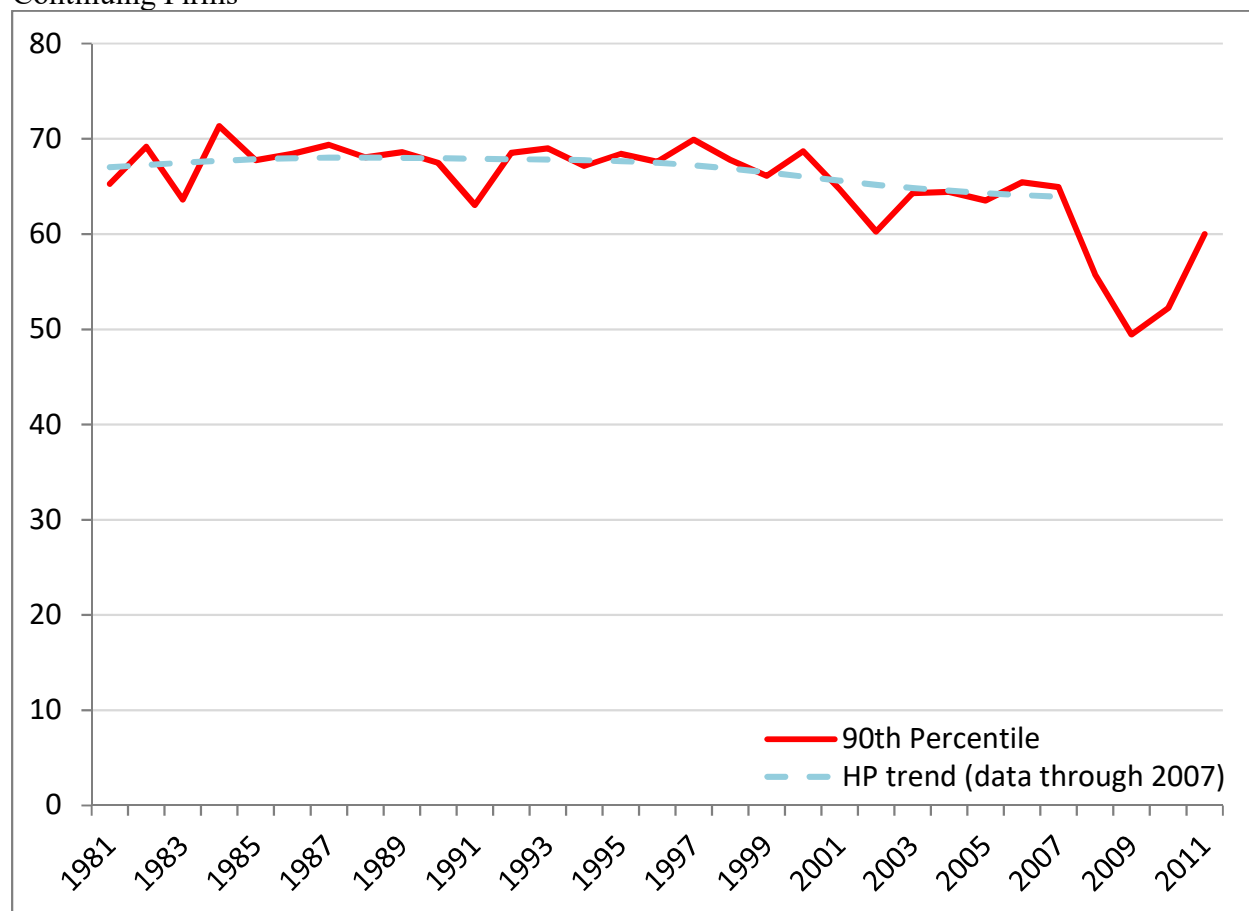
Note: Author calculations from the Longitudinal Business Database.

Figure A.4: Young Firm Entry Rate, Exit Rate, and Survival-Conditional Growth Rate (Employment Weighted)



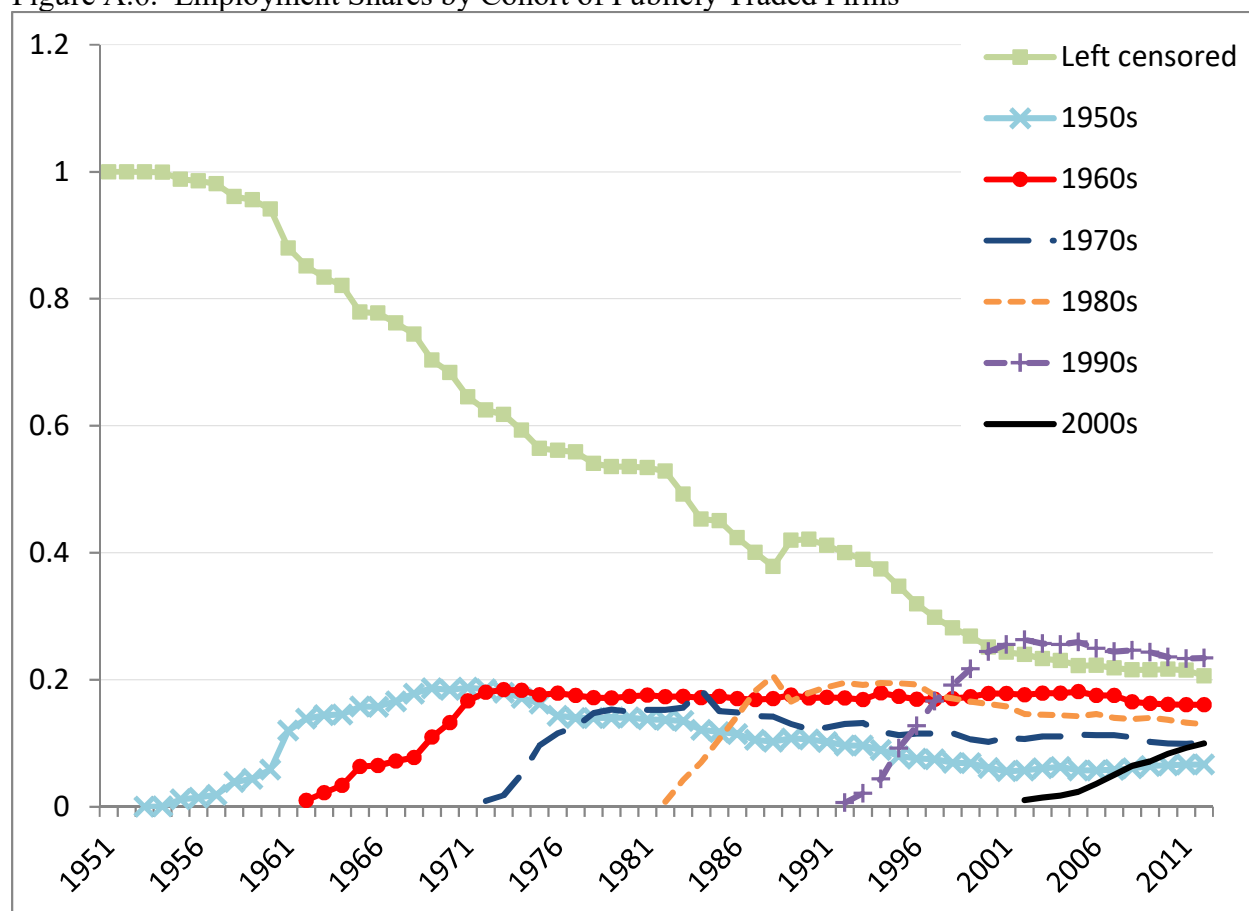
Note: Y axis does not begin at zero. Young firms have age less than 5. Firm entry rate is new firm employment as a percent of all employment. Firm exit rate is employment at exiting young firms as a percent of all employment. Continuer growth rate is employment-weighted average growth rate among continuing young firms (*i.e.*, non-entering, non-exiting young firms). Author calculations from the Longitudinal Business Database.

Figure A.5: High-Growth Young Firms (90th Percentile of Employment-weighted Distribution), Continuing Firms



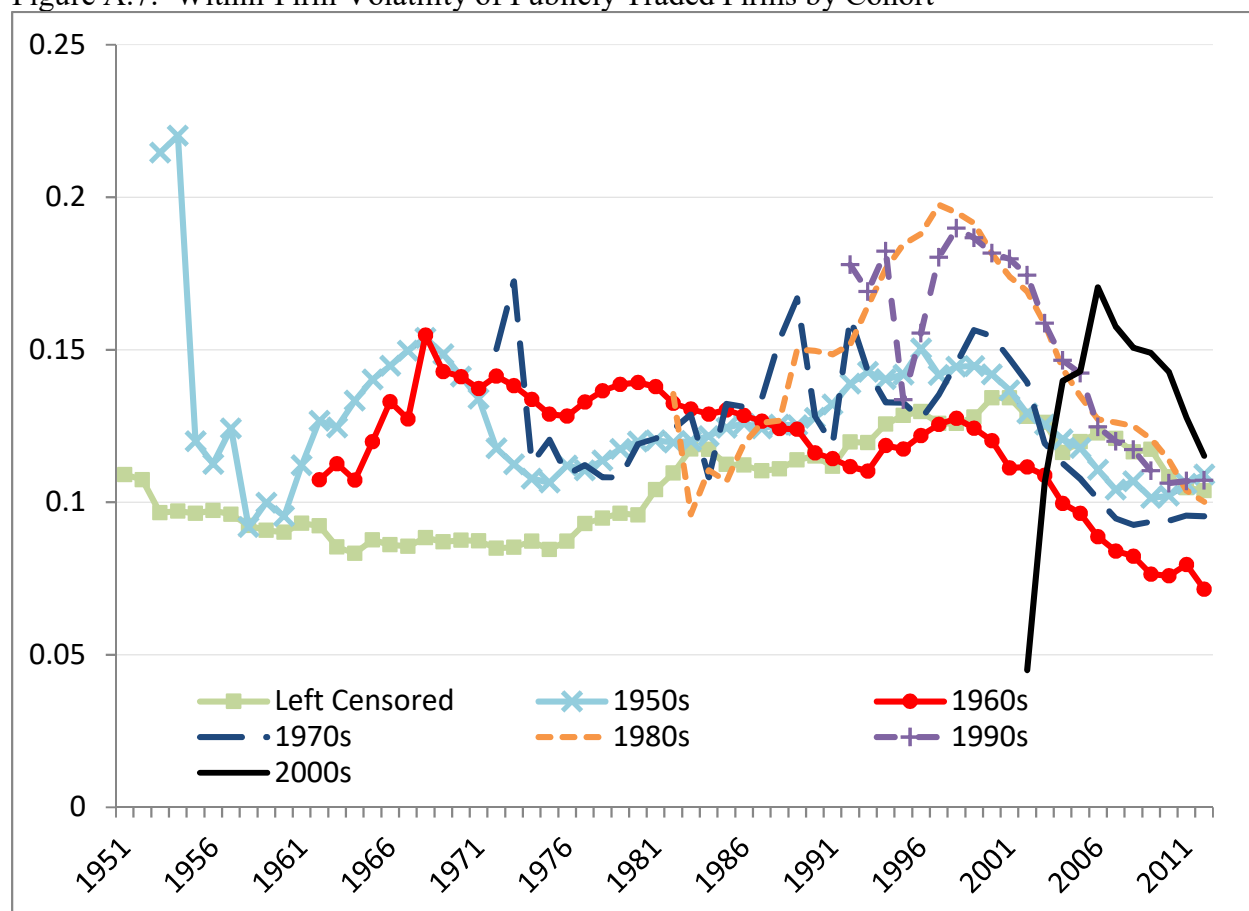
Note: The 90th percentile is based on the employment-weighted distribution of firm employment growth rates. HP filter with parameter 100 has 2007 as endpoint. Young firms have age less than 5. Data include continuers only. Author calculations from the Longitudinal Business Database. Compare to Figure 10 in the body of the text.

Figure A.6. Employment Shares by Cohort of Publicly Traded Firms



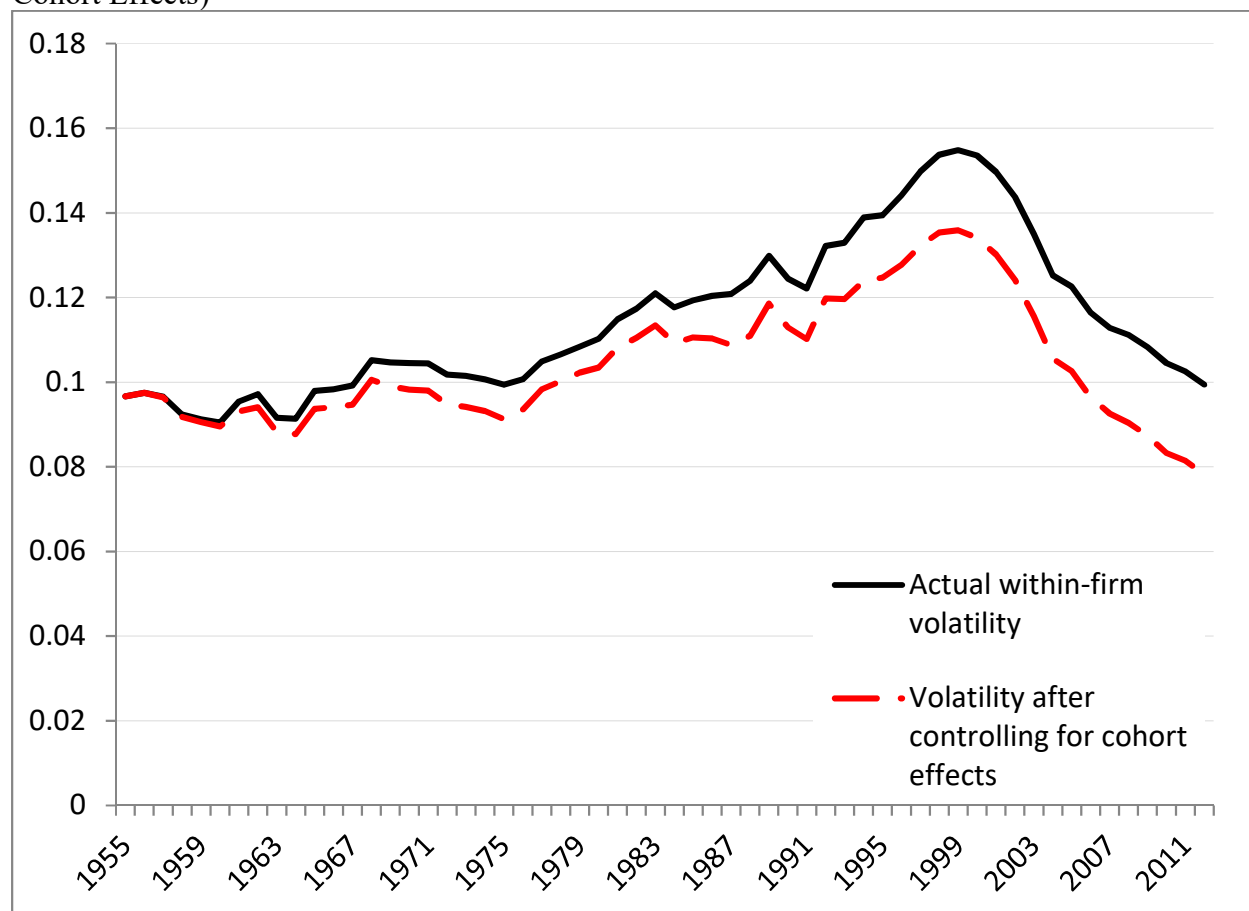
Note: Cohorts are defined by decade of initial public offering. Author calculations from Compustat.

Figure A.7: Within-Firm Volatility of Publicly Traded Firms by Cohort



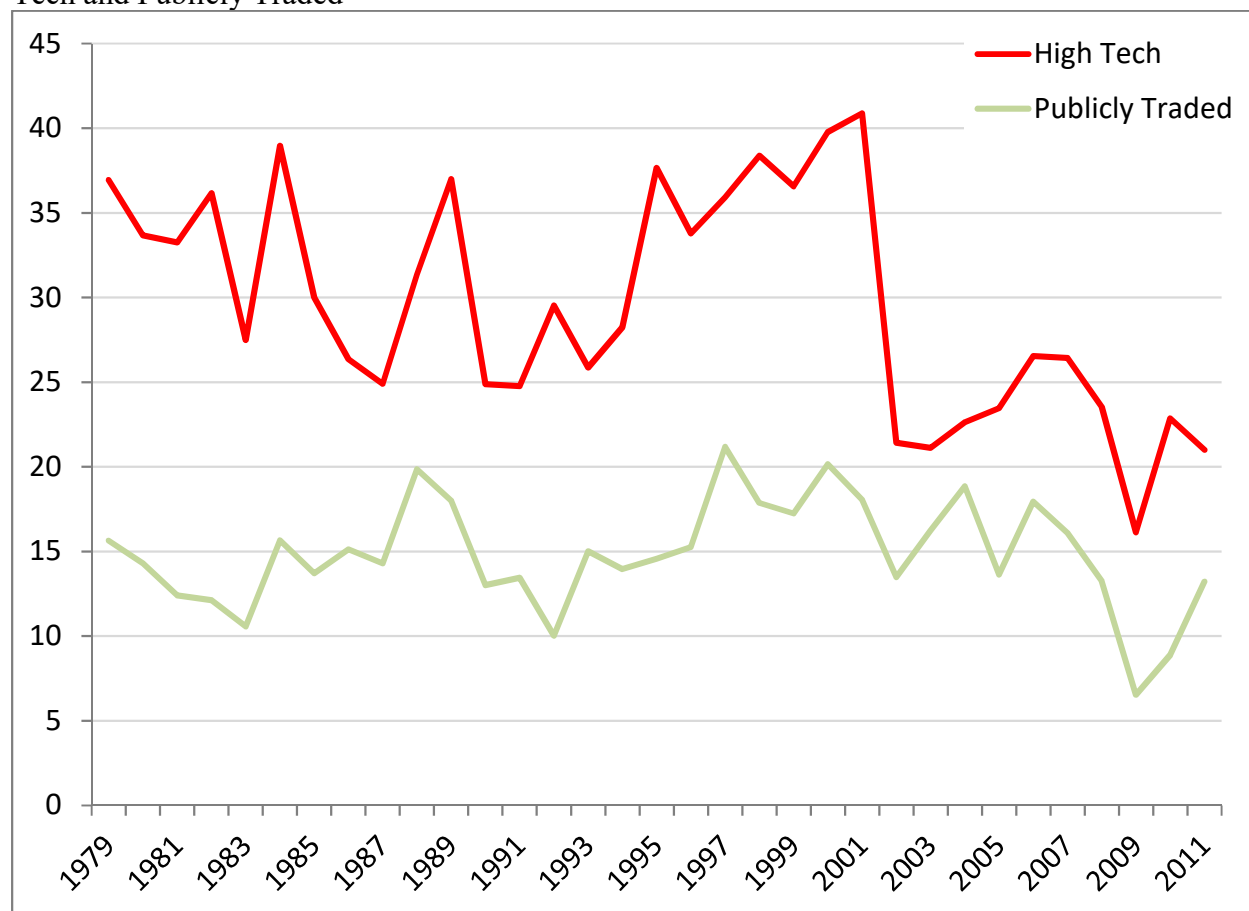
Note: Cohorts are defined by decade of initial public offering. Author calculations from Compustat.

Figure A.8: Within-Firm Volatility for Publicly Traded Firms (Overall and Controlling for Cohort Effects)



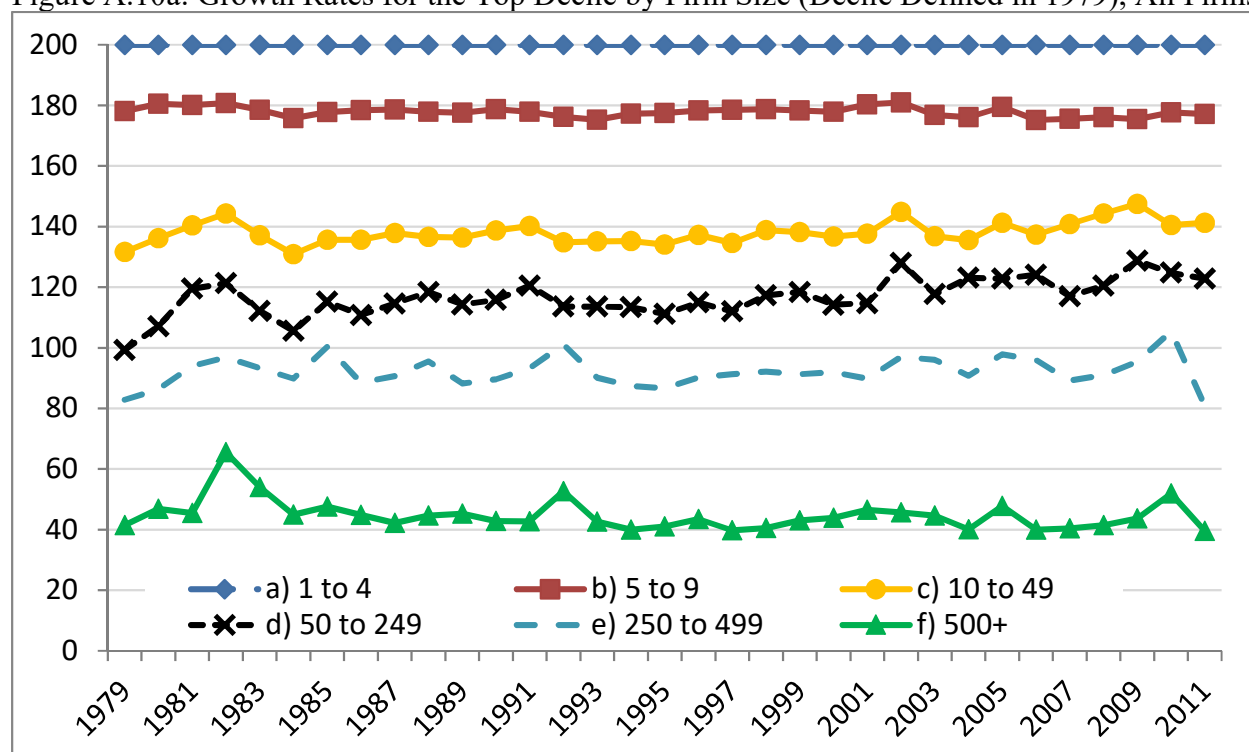
Note: Author calculations from Compustat.

Figure A.9: High-Growth Firms (90th Percentile of Employment-weighted Distribution), High Tech and Publicly Traded



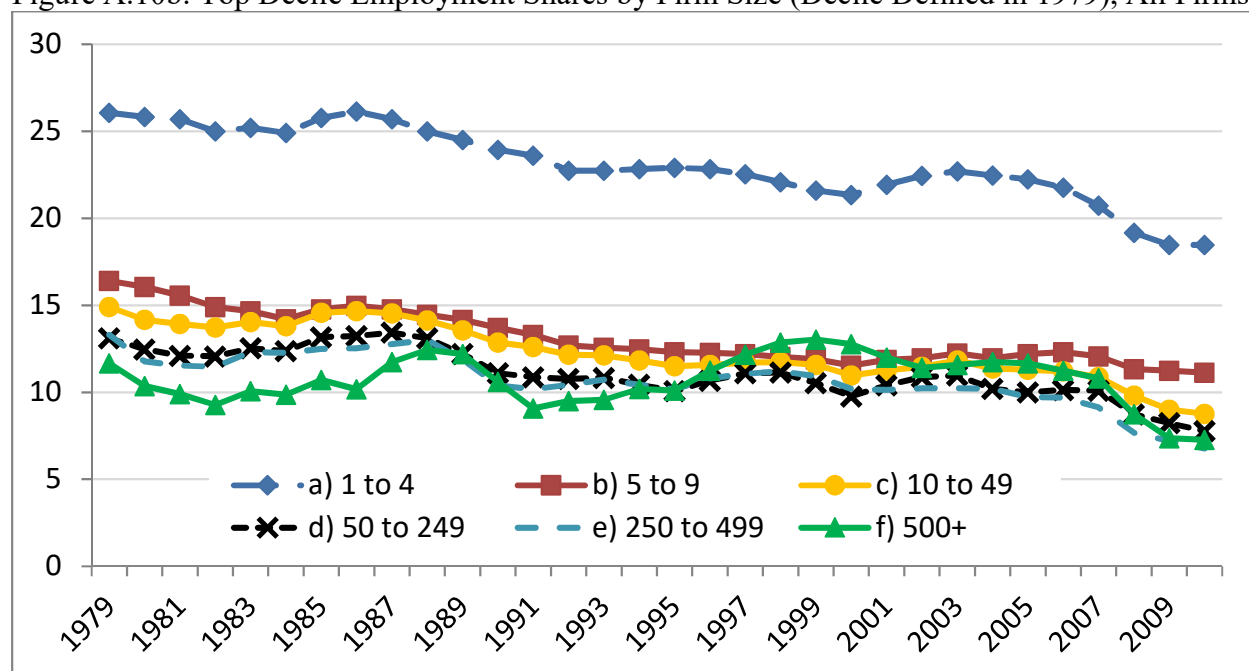
Note: The 90th percentile is based on the employment-weighted distribution of firm employment growth rates. High tech is defined as in Hecker (2005) (see Table A.1). Data include all firms (new entrants, continuers, and exiters). Author calculations from Compustat and the Longitudinal Business Database. Compare to Figure 14 in the body of the text.

Figure A.10a: Growth Rates for the Top Decile by Firm Size (Decile Defined in 1979), All Firms



Note: Chart depicts employment-weighted average growth rates by size class for firms with growth rates exceeding the 90th percentile (employment-weighted distribution) as of 1979. Author calculations from the Longitudinal Business Database.

Figure A.10b: Top Decile Employment Shares by Firm Size (Decile Defined in 1979), All Firms



Note: Chart depicts the share of employment of each size class that is at firms with growth rates exceeding the 90th percentile (employment-weighted distribution) as of 1979, as 3-year centered moving averages. Author calculations from the Longitudinal Business Database.