From Population Growth to Firm Demographics:
Implications for Concentration, Entrepreneurship and the Labor Share

Hugo Hopenhayn
UCLA

Julian Neira
University of Exeter

Rish Singhania
University of Exeter

December 13, 2018

Abstract

The US economy has undergone a number of puzzling changes in recent decades. Large firms now account for a greater share of economic activity, new firms are being created at a slower rate, and workers are getting paid a smaller share of GDP. This paper shows that changes in population growth provide a unified quantitative explanation for these long-term changes. The mechanism goes through firm entry rates. A decrease in population growth lowers firm entry rates, shifting the firm-age distribution towards older firms. Heterogeneity across firm age groups combined with an aging firm distribution replicates the observed trends. Micro data show that an aging firm distribution fully explains i) the concentration of employment in large firms, ii) and trends in average firm size and exit rates, key determinants of the firm entry rate. An aging firm distribution also explains the decline in labor's share of GDP. In our model, older firms have lower labor shares because of lower overhead labor to employment ratios. Consistent with our mechanism, we find that the ratio of nonproduction workers to total employment has declined in the US.

J.E.L. Codes: J11, E13, E20, L16, L26
Keywords: Firm Dynamics, Entrepreneurship, Demographics, Concentration, Labor Share

1 Introduction

Three long-term changes in the US economy have attracted a great deal of attention. First, economic activity is being concentrated in fewer firms. For example, the fraction of workers employed by large firms increased by 6 percentage points since 1978. Second, the entrepreneurship rate — the ratio of new firms to total firms — has nearly halved since the 1970s. Third, the share of GDP going to labor, once thought to be stable, has declined since 1975. What explains these changes?

Our analysis begins by highlighting the importance of firm demographics in driving these aggregate trends. We first document that the increase in employment concentration is entirely due to changes in firm demographics: an aging firm distribution combined with heterogeneity in employment concentration by firm age. The data shows that there has been no change in employment concentration within firm-age categories. However, across age-categories, older firms have higher employment concentration. Therefore a shift in the age distribution towards older firms drives the increase in concentration. Next, we show that changes in firm demographics can also completely account for changes in two related variables: average firm size and the aggregate firm exit rate. Conditional on age, these variables have not changed over time. Nevertheless, because older firms are larger and exit at lower rates, an aging firm distribution leads to an increase in average firm size and a decline in the aggregate exit rate.

Next, we turn to the entrepreneurship rate. A simple accounting identity shows that the firm entry rate is equal to the aggregate exit rate minus the growth in average firm size, plus labor force growth,[1]

$$\underbrace{\lambda}_{\text{Entry Rate}} = \underbrace{\xi}_{\text{Exit Rate}} - \underbrace{\dot{e}}_{\text{AFS Growth}} + \underbrace{\dot{N}}_{\text{LF Growth}} . \tag{1}$$

The exit rate and average firm size are constant in stationary equilibria of standard firm dynamics models. Therefore, changes in labor force growth are a natural candidate to explain changes in the firm entry rate. Can a change in labor force growth, by itself, explain the drop in firm entry rates observed in the data? Qualitatively, yes. Quantitatively, no. US labor force growth has declined, but not by enough. Figure 1 shows US civilian labor force growth rates by decade. Since the 1970s, labor force growth has declined by 2pp, whereas the entry rate has declined by 6pp. The remaining 4pp decline in the entry

[1] This identity comes from the definition of average firm size, $e \equiv N/M$, where N is the number of workers and M is the number of firms. It follows that the growth rate in the number of firms equals the growth rate of the labor force minus the growth rate of average firm size, $\dot{M} = \dot{N} - \dot{e}$. The growth in the number of firms also depends on firm entry and exit, $\dot{M} = \lambda - \xi$. Combining these two equations leads to accounting identity (1).

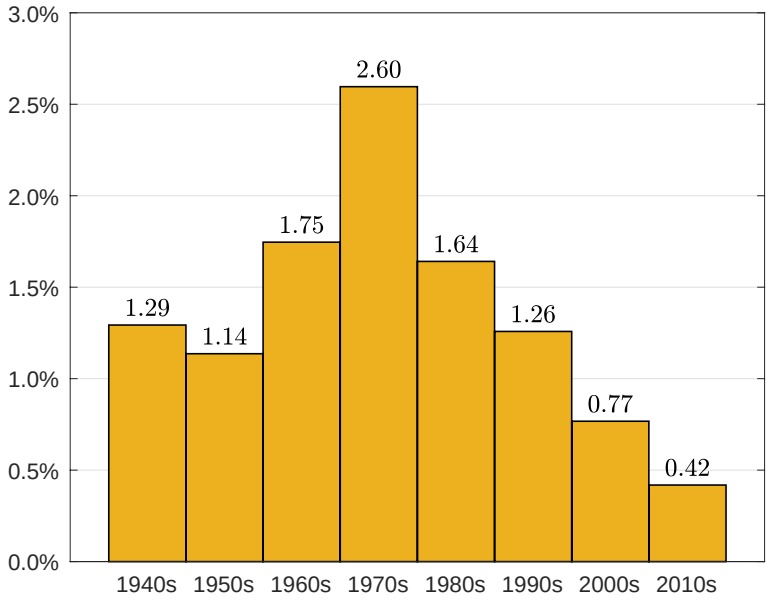


Figure 1: Civilian Labor Force Growth Rate

rate is accounted for by changes in the aggregate exit rate and changes in the growth rate of average firm size. A decline in labor force growth by itself can only account for a third of the decline in the firm entry rate. However, if the decline in labor force growth leads to changes in firm demographics, and therefore to changes in average firm size and aggregate exit rates, labor force growth can account for a larger extent of the decline in firm entry rates.

We show that changes in labor force growth lead to changes in firm demographics in a standard general equilibrium firm dynamics model. Consider an increase in labor force growth. To satisfy labor market clearing, the increase in labor supply must be met by a corresponding increase in labor demand. Incumbent firms are limited by scale, so they cannot absorb the entire increase in labor supply. The residual labor demand must therefore be satisfied by firm entry. Because total labor demand by incumbents depends on past entry, the history of past entry matters for current entry. As the entry rate changes, the age distribution of firms in the current, and therefore in future periods, is affected. A shift in the age distribution changes firm demographics only if there is heterogeneity in average firm size and exit rates by firm age. The standard model generates heterogeneity by firm age because it features selection and firm growth.

The calibrated model fed with the US labor force growth since in the 1940s replicates the 6pp. fall in firm entry rates starting in 1978. The rapid rise in labor force growth from the 1940s to the 1970s, seen in Figure 1, amplifies the effects of the subsequent decline in labor force growth. The rapid increase in labor force growth generates a rapid increase in the entry rate and in the number of firms. As these entrants age, they grow in size and

absorb more labor, leaving less room for potential startups to fill when labor force growth declines. Because the history of past entry matters, both the rise and fall of labor force growth are important to generate the 6pp. decline in firm entry rates.

The calibrated model generates an increase of concentration similar to the data. Specifically, the share of employment of firms with 250 employees or more increases by 7pp. vs 6pp. in the data. As in the data, the increase in concentration is entirely due to an aging firm distribution: conditional on age, there is no change in the share of employment of firms with 250+ employees. The role of age *vs.* size in firm concentration can be seen in the evolution of the share of employment within age-size categories. If the increase in concentration was because of size, the share of employment in large firms should increase, regardless of age. That is not the case in the data. The share of employment of young-large firms declined by 3 percentage points whereas the share employment of mature-small firms increased by 4.5 percentage points. The increase in concentration is driven by age, not size. Our model generates these changes in the share of employment by age-size categories.

Finally, we turn to the labor share. An aging firm distribution combined with a role for overhead labor generates a decline in the aggregate labor share. A firm's labor share can be broken down into the share of revenue paid to production labor and the share of revenue paid to overhead labor. With a Cobb-Douglas production function, profit maximization implies that the share paid to production labor is identical across firms. If the share paid to overhead labor is decreasing in firm size, then larger firms have lower labor shares. Because older firms are larger, an aging firm distribution shifts weight to firms with lower labor shares, leading to a decline in the aggregate labor share. Our mechanism suggests the decline in the labor share should be accompanied by a corresponding decline in the importance of nonproduction workers in total employment. Consistent with our mechanism, we find that the ratio of nonproduction workers to total employment in the US has declined since the 1970s. Furthermore, the magnitude of the decline in the model is similar to the one in the data.[2]

We close by discussing the sources of labor force growth. We decompose labor force growth into three components: birth rates sixteen years prior, the growth in participation rate, and a residual term that captures rates of migration, death and institutionalization. We find that birth rates sixteen years prior account for the bulk of changes in labor force growth. We conclude that the rise and fall of labor force growth is primarily due to the baby boom.

[2]Our mechanism is also consistent with findings by Autor, Dorn, Katz, Patterson and Van Reenen (2017), who document a negative relationship between firm size and firm labor share, and find that almost all of the decline of the labor share is due to between-firm reallocation rather than within-firm changes.

Related Literature. Our paper builds on a wealth of recent empirical evidence from seemingly disconnected strands of the literature. Pugsley and Şahin (2018) document that the decline in the startup rate is widespread across sectors and regions and is linked to the aging of the firm distribution. Karabarbounis and Neiman (2014) find that the decline in the labor share is primarily a within-industry rather than a cross-industry phenomenon. Grullon, Larkin and Michaely (2017) document increased concentration across most U.S. industries, whereas Barkai (2017) documents a positive correlation between industry concentration and the decline in the labor share. Our paper incorporates all of these empirical findings into one unified explanation.

We are not the first paper to propose changes in labor force growth as an explanation for the decline in the firm entry rate.[3] Karahan, Pugsley and Şahin (2018) find a positive correlation between the decline in entry rates and the decline in labor force growth across states, and perform steady-state comparisons in a Hopenhayn (1992a)-style model. There are two main differences between our papers. First, we aim to explain a broader set of facts, such as the increase in concentration and the decline of the labor share. Second, our study focuses on transitional dynamics, which have an important quantitative role; the rise in labor force growth from the 1940s to the 1970s amplifies subsequent aggregate changes by about 50 percent.

To the best of our knowledge, ours is the first paper that aims to jointly explain trends of entrepreneurship, concentration, and the labor share. Alternative explanations have been proposed for a subset of these trends.[4] One related, but distinct, explanation is that of the aging of the workforce (Liang, Wang and Lazear, 2018; Kopecky, 2017; Engbom, 2017). We note that a decline in labor force growth is a different phenomenon than an aging workforce. Another explanation that has gained considerable attention is that of the rise in market power, as measured by increasing markups (Loecker and Eeckhout, 2017). Our framework features a competitive setting, and thus generates an increasing concentration without decreasing competition.

The rest of the paper is organized as follows. Section 2 presents the data exploration, where we conclude that firm aging is primarily responsible for the change in average firm size, exit, and concentration. Section 3 develops the model and presents our theoretical results. Section 4 reports the calibration and the fit along non-targeted moments. Section 5 discusses the sources of labor force growth and the decline of manufacturing employment.

[3]Other explanations for the decline in entrepreneurship include the decline in corporate taxes (Neira and Singhania, 2017), the decline in interest rates, (Liu, Mian and Sufi, 2018; Chatterjee and Eyigungor, 2018), and skill-biased technical change (Salgado, 2018; Jiang and Sohail, 2017).

[4]Explanations specific to the labor share decline include an increase in firm-level volatility (Hartman-Glaser, Lustig and Xiaolan, 2016), the treatment of intangible capital (Koh, Santaeulalia-Llopis and Zheng, 2015), the decline in the relative price of capital (Karabarbounis and Neiman, 2014), capital accumulation (Piketty and Zucman, 2014), and import competition and globalization (Elsby, Hobijn and Sahin, 2013).

Section 6 concludes.

2 Data

We obtain data on firms from the Business Dynamics Statistics (BDS) produced by the US Census Bureau. The BDS dataset has near universal coverage of private sector firms with paid employees in the US from 1977-2014.

We start by looking at the time series evolution of concentration, average firm size and the aggregate exit rate in US data; see top panel of Figure 2. We measure concentration as the share of employment by firms with 250+ employees. Figure 2 shows that concentration in the US has increased from about 51% to 57%. Average firm size in the US has increased steadily from about 20 employees to about 24 employees. The aggregate exit rate has declined steadily from about 9.5 percentage points to about 7.5 percentage points.

What is driving the aggregate trends? The bottom panel of Figure 2 shows concentration, average firm size and exit rates broken down by firm age over time. The figure shows that, conditional on age, these variables have changed little. For example, a typical five year old firm has the same size in 1980 and 2014, with no discernible trend. The same pattern holds for concentration and exit rates: conditional on age, concentration and exit rates do not exhibit a trend over the 1977-2014 time period. It follows that the aggregate trends in concentration, average firm size and exit rates are not being driven by changes in the corresponding variables within firm-age categories.

The bottom panel of Figure 2 also shows how each variable evolves with firm age. Concentration and average firm size increase with firm age. Firm exit rates decrease with firm age. These patterns suggest that changes in the age composition of firms drive the aggregate trend in each variable. In order to investigate this formally, we regress

$$y_{ajt} = \beta_0 + \beta_y \, year + \sum_a \beta_a \, age + \sum_j \beta_j \, sector + \sum_a \sum_j \beta_{aj} (age \times sector) + \varepsilon_{ajt}$$

where y_{ajt} equals the share of employment by firms with 250+ employees, log average firm size or firm exit rates. We start with a specification that features *year* with an intercept term. The coefficient on *year* captures the aggregate trend in dependent variable. We then add age controls and see how the year coefficient changes. For the average firm size and firm exit rate regressions, we add further controls for sector and age-sector interaction effects in successive specifications.[5]

[5]To protect the identity of firms, the Business Dynamics Statistics do not report data on share of employment by firm size, age and sector. Therefore, we cannot include controls for sector and age-sector interactions in the concentration regression.

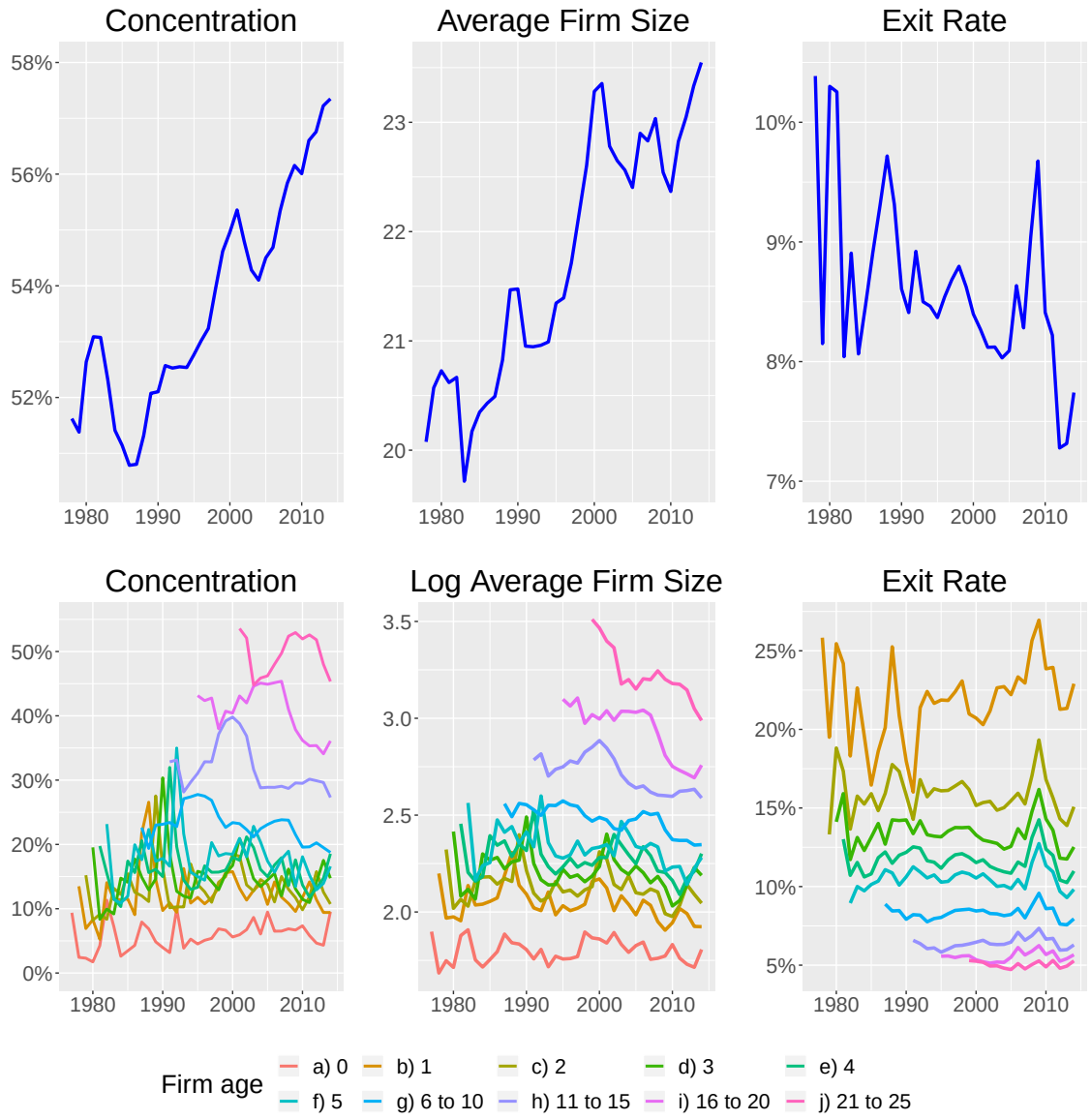


Figure 2

Source. US Business Dynamics Statistics.
Notes. Concentration is the share of employment in firms with 250+ employees. Concentration within an age category is share of employment in firms with 250+ employees within the age category divided by total employment in the age category. Average firm size is number of workers per firm.

We summarize our regression results here. (The regression tables are presented in Tables 4-6 in Appendix B.) When we regress the share of employment of firms size 250+ on *year*, with no controls, we find that the trend coefficient is 0.3% per year. This coefficient captures the average trend in share of employment across age groups and sectors. It is statistically significant. Once we control for firm age, however, the trend disappears. The coefficients on firm-age dummies indicate that the share of employment at 250+ firms is increasing with firm age. The R^2 of the concentration regression jumps from 0.08 in the no-controls

specification to 0.976 in the specification with age controls.

The results for log average firm size are stronger. In the no-controls specification, we find that the coefficient on *year* is positive, 0.6%, and statistically significant. Once we control for firm age, however, the year coefficient becomes negative, -0.5%, while remaining statistically significant at the 1% level. The negative trend in average firm size remains unchanged when we include controls for sector and age-sector interactions. The coefficient on each age category is positive and statistically significant at the 1% level. As suggested by the bottom panel of Figure 2, the coefficients increase with firm age. This is exactly the pattern one would expect if firm aging was driving the increase in average firm size over time. As firms age, they get larger. Therefore an increase in the share of older firms shifts the composition towards larger firms, leading to an increase in average firm size in the aggregate.

The results for firm exit rate are similar to average firm size. The no-controls specification indicates that firm exit rates decline by 0.15 percentage points every year. The addition of firm-age controls brings the year-coefficient close to zero. The inclusion of sector and age-sector controls leaves the coefficient unchanged. The age regressions confirm that older firms exit at lower rates. It follows that an increase in the share of older firms will lead to a decline in the aggregate exit rate.

The regression results indicate that firm aging is the primary driver of the trends in concentration, average firm size and exit rate. Figure 3 presents direct evidence that US firms are aging. The figure shows that the share of firms aged 11+ has risen steadily from 32 percent in 1986 to 48 percent in 2014. Why are US firms aging? The next section presents a firm dynamics model that shows how changes in population growth can generate firm aging.

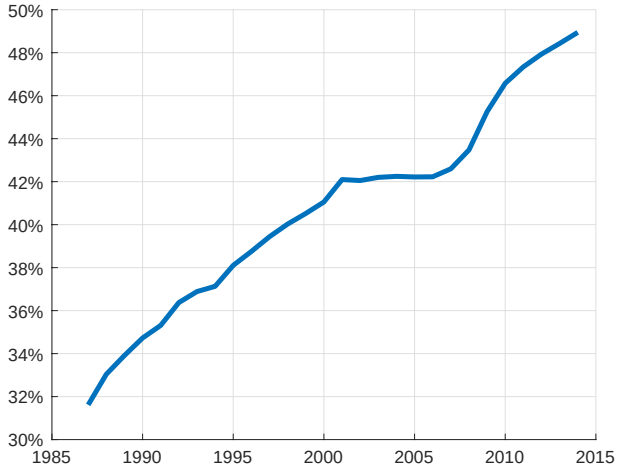


Figure 3: Share of Firms of Age 11+

3 The Model

There is a single homogenous good and a fixed endowment of a resource (labor) N_t inelastically supplied that is also the numeraire. A production unit has production function $s_{it}f\left(n_{it}\right)$ where s_{it} corresponds to a productivity shock, that follows a Markov process with conditional distribution $F\left(s_{t+1}|s_t\right)$, independent across firms. In addition, production units have a fixed cost c_f denominated in units of labor. which can include an entrepreneur and other labor overhead. If a production unit is shut down, its residual value is normalized to zero. All agents in the economy have common discount factor β.

Assumption 1. *The conditional distribution F is continuous and strictly decreasing in s_t.*

Let $c\left(s,q\right)$ and $\pi\left(s,p\right)$ denote cost and profit functions derived from the above technology, where q is output and p the price of the good in terms of labor and let $n\left(s,p\right)$ denote labor demand. Assume the last two functions are continuous and strictly increasing in s and p. The value of a production unit is given by the Bellman equation:

$$v\left(s,\mathbf{p}_t\right)=\max\left\{0,\pi\left(s,p_t\right)+\beta Ev\left(s',\mathbf{p}_{t+1}|s\right)\right\}$$

when confronted with a deterministic path of prices $\mathbf{p}_t=\left\{p_\tau\right\}_{\tau\geq t}$ Here zero is the value of exit while the right hand side under the maximization is the continuation value of this productive unit. As shown in Hopenhayn (1992b), the value function is strictly increasing in s and p_t when nonzero. Letting

$$s_t^*=\inf\left\{s|\pi\left(s,p_t\right)+\beta Ev\left(s',\mathbf{p}|s\right)>0\right\}, \tag{2}$$

a production unit is shut down iff $s\leq s_t^*$.

The technology for entry of a new productive unit is as follows. Upon paying a cost of entry of c_e units of labor, the initial productivity is drawn from distribution G, independently across entrants and time. Prior to entry, the expected value of an entrant net of the entry cost

$$v^e\left(\mathbf{p}_t\right)=\int v\left(s,\mathbf{p}_t\right)dG\left(s\right)-c_e. \tag{3}$$

Let μ_t denote the measure of productive units operating at time t, where for a fixed set A of firm types, $\mu_t\left(A\right)$ measures the magnitude of firms that at time t have $s_{it}\in A$. Given an initial measure μ_0, the exit thresholds s_t^* together with entry flows m_t determine uniquely the sequence of measures $\left\{\mu_t\right\}$ as follows. For any set of productivities A, define recursively

$$\mu_{t+1}\left(A\right)=m_{t+1}\left(\int_{s\epsilon A,s\geq s_{t+1}^*}dG\left(s\right)\right)+\int\int_{s\epsilon A,s\geq s_{t+1}^*}dF\left(s|x\right)d\mu\left(x\right) \tag{4}$$

The first term in the right hand side corresponds to entrants, excluding those that exit immediately while the second term includes incumbents after the realization of new productivities, excluding those that exit.

3.1 Equilibrium

Let $M_t = \int d\mu_t(s)$ denote the total mass of firms. Denote by m_t the mass of entrants at time t. Labor market clearing requires that:

$$\int n(s, p_t)\, d\mu_t(s) + M_t c_f + m_t c_e = N_t. \tag{5}$$

The first term is productive labor demand, the second term overhead and the third labor utilized for entry, e.g. entrepreneurs in startups. The right hand side represents total labor inelastically supplied.

An equilibrium for a given sequence $\{N_t\}$ and given initial measure μ_0 is given by shutdown thresholds $\{s_t^*\}$, mass of entrants $\{m_t\}$, measures of production units $\{\mu_t\}$ and prices $\mathbf{p} = \{p_t\}$ such that:

1. Shutdown thresholds are given by equation (2);
2. No rents for entrants: $v_t^e(\mathbf{p}) \leq 0$ and $v_t^e(\mathbf{p})\, m_t = 0$;
3. Market clearing condition (5) holds.
4. The sequence μ_t is generated recursively by equation (4) given the initial measure μ_0.

Following Hopenhayn (1992b), there exists a unique equilibrium. It can be easily characterized when entry is strictly positive in every period, that is in reality the relevant case. Let p^* be a constant price such that $v_t^e(p^*) = 0$ for all t. Under the above assumptions this price is unique, corresponding to the stationary equilibrium price in Hopenhayn (1992b). Let $s_t^* = s^*$ be the corresponding shutdown threshold. Given the initial distribution μ_0 we derive recursively a sequence m_t^* so that the market clearing condition is satisfied in every period as follows.

Let S_n denote the probability that an entrant survives at least n periods, i.e. that the state $s_{i\tau} \geq s^*$ for ages τ from 0 to n. Let $\tilde{\mu}_n$ denote the cross-sectional probability distribution of productivities for production units in the age n cohort. These can be obtained recursively as follows:

1. Let $S_0 = (1 - G(s^*))$ and $\tilde{\mu}_0(ds) = G(ds)/S_0$, that is the distribution for entrants draws G conditional on $s_0 \geq s^*$.

2. Let $S_n = S_{n-1} \int P\left(s_n \geq s^* | s_{n-1}\right) d\tilde{\mu}_{n-1}(s_{n-1})$, where the term under the integral is the probability that a productive unit in cohort $n-1$ is not shutdown in the next period, and let

$$\tilde{\mu}_n\left(ds\right) = \frac{\int P\left(ds_n | s_{n-1}\right) d\tilde{\mu}_{n-1}(s_{n-1})}{S_n / S_{n-1}}.$$

Let $\tilde{e}_n = \int (n\left(s, p^*\right) + c_f) d\tilde{\mu}_n$, the average employment of a productive unit in the cohort of age n. Total employment of that cohort at time t depends on the original number of entrants in that cohort and the survival rate, namely

$$E_{tn} = m_{t-n} S_n \tilde{e}_n$$

Thus at time t employment from incumbents (i.e. excluding new entrants) is given by $E_t^I = \sum_1^t E_{tn}$. Adding the employment of entrants $m_t\left(S_0 \tilde{e}_0 + c_e\right)$ we get the market clearing condition:

$$N_t = m_t\left(S_0 \tilde{e}_0 + c_e\right) + E_t^I. \tag{6}$$

This determines implicitly m_t, the only unknown in the above equation at time t. Provided that $E_t^I < N_t$, entry will be strictly positive in every period and all equilibrium conditions are satisfied. Assuming N_t is an increasing sequence, a sufficient condition for positive entry every period is that $N_t - E_{t+1}^I > 0$. Note that

$$\begin{aligned} N_t &= m_t c_e + m_t S_0 \tilde{e}_0 + m_{t-1} S_1 \tilde{e}_1 + ... + m_0 S_t \tilde{e}_t \\ E_{t+1}^I &= m_t S_1 \tilde{e}_1 + m_{t-1} S_2 \tilde{e}_2 + ... + m_0 S_{t+1} \tilde{e}_{t+1}, \end{aligned}$$

so E_{t+1}^I is the inner product of the same vector of the mass of entrants with a forward shift in the corresponding terms $S_n \tilde{e}_n$ and excluding entry costs. Thus a sufficient condition for entry to be positive every period is that the term $S_n \tilde{e}_n$ decreases with n. This condition says that, adjusting for differences in entry rates, the total employment of a cohort is decreasing in age. Survival rates are decreasing in n by definition but average size of a cohort, if properly calibrated to the data, is increasing. Thus shutdown rates must be sufficiently high to offset the latter growth. In the model, this is a property that depends on the stochastic process for the shocks s_{it} and the threshold s^*. But given these parameters its easy to verify.[6]

Proposition 1. *Suppose that N_t is a nondecreasing sequence and $S_n \tilde{e}_n$ is non-increasing. Then the unique equilibrium has constant price $p_t = p^*$ and exit thresholds $s_t^* = s^*$.*

[6]Models that assume permanent productivity shocks and exogenous exit trivially satisfy this condition as well as the technology in Mortensen and Pissarides (reference) where productivity shocks are redrawn with some probability from the same distribution as entrants.

Corollary 1. *Under the Assumptions of Proposition 1, exit rates and average firm size, by cohorts are time invariant.*

This Corollary implies that changes in aggregate entry and exit rates as well as average firm size will be driven only by changes in firm demographics, the age distribution of firms and the rate of increase in population.

3.2 The Turnover of Production Units

In this section we examine the determinants of aggregate rates of entry and exit and in particular the role of firm demographics, i.e. the age distribution of production units.

Total exit ξ_t at time t is the sum of exit masses of different age cohorts. Exit of productive units of age n equals the difference in survival rates between $S_{n-1} - S_n$ multiplied by the size of that cohort, that is the entry mass at the time that cohort entered, m_{t-n}. We follow here the convention that the age at which a unit is shut down corresponds to the age at which this unit was last productive. As for the new entrants, while the model allows for immediate exit we will consider that $m_t S_0$ is in practice the measure of entry in this economy and thus exclude $m_t (1 - S_0)$ from total exits. It follows that

$$\xi_t = \sum_{n=1}^{t} m_{t-n} (S_{n-1} - S_n)$$

The number of firms at $t-1$ is given by:

$$M_{t-1} = \sum_{n=1}^{t} m_{t-n} S_{n-1}$$

Letting α_{tn} denote the share of units of age n in the total population of productive units at time t and $h_{n-1} = (S_{n-1} - S_n)/S_{n-1}$ the hazard rate of exit of units of age $n-1$, the aggregate exit rate ξ_t / M_{t-1} can be expressed as the weighted average of different cohort hazard rates of exit

$$\xi_t / M_{t-1} = \sum_{n=1}^{t} \alpha_{t-1,n-1} h_{n-1}.$$

Taking these hazard rates as fixed, this is only a function of the age distribution of productive units, which in turn is determined by past entry rates. The exception of course is when exit rates are the same for all cohorts in which case firm demographics plays no role.

Consider now entry rates.[7] Let $e_t = N_t / M_t$. It follows that the rate of growth in the

[7] We are defining as $m_t S_0$ as "measured entry". Had we assumed that all entrants must remain at least one period in the market, then $S_0 = 1$ so m_t would then be measured entry.

number of firms

$$\frac{M_t}{M_{t-1}} = \frac{N_t}{N_{t-1}} \frac{e_{t-1}}{e_t}. \tag{7}$$

Now the mass of productive units can be decomposed in incumbents that survived plus entrants. Letting $\overline{S}_t$ denote the average survival rate from $t-1$ to t, it follows that

$$M_t = \overline{S}_t M_{t-1} + m_t S_0$$

Substituting from M_t in (7) gives the following expression for the entry rate:

$$\lambda_t = \frac{m_t S_0}{M_{t-1}} = \frac{N_t}{N_{t-1}} \frac{e_{t-1}}{e_t} - \overline{S}_t \tag{8}$$

In the special case where average employment is constant, this equation reduces to

$$\lambda_t = \frac{N_t - N_{t-1}}{N_{t-1}} + \frac{\xi_t}{M_{t-1}}$$

so the entry rate equals the sum of the population growth rate and the exit rate; as average firm size is constant, the total mass of firms needs to grow at the rate of population growth to clear the market. Entry rate must be enough to replace the exiting units and in addition create this extra employment. This justifies the above formula.

In a balanced growth path where population grows at a constant rate, cohort entry weights decay as a function of age at this rate and average firm size is constant. More precisely, if $N_{t+1}/N_t = \gamma$, then

$$N_t = m_t \sum_{n=0}^{\infty} \gamma^{-n} S_n \tilde{e}_n + m_t c_e$$

the total number of firms

$$M_t = m_t \sum_{n=0}^{\infty} \gamma^{-n} S_n$$

Exit at time t is $m_t \sum_{n=1}^{\infty} \gamma^{-n} (S_{n-1} - S_n)$ so the exit rate is given by

$$\begin{aligned} \xi_t &= \frac{m_t \sum_{n=1}^{\infty} \gamma^{-n} (S_{n-1} - S_n)}{M_{t-1}} \\ &= \frac{m_t \sum_{n=1}^{\infty} \gamma^{-n} (S_{n-1} - S_n)}{\gamma^{-1} M_t} \\ &= \frac{\sum_{n=1}^{\infty} \gamma^{-n} (S_{n-1} - S_n)}{\sum_{n=0}^{\infty} \gamma^{-n} S_n}. \end{aligned}$$

Which is independent of t and so is the entry rate. The same holds in a model where

productivity shocks are fully persistent or randomly redrawn from the same distribution as the one faced by entrants (as in Mortensen and Pissarides), average firm size is constant so the above formula applies. In particular this means that the rate of entry is independent of history and only depends on current population growth. If exit rates are not age dependent, the same will also be true for exit.

More generally, exit rates will depend on the age distribution of firms and thus the history of past entry. As conditional exit rates are decreasing in age, a larger share of young firms will be associated with higher exit rates and consequently higher entry. In addition, changes in average firm size will impact entry rates. A rise in entry rates will increase the share of younger productive units which tend to be smaller. This should lower average firm size, and from equation (8) increase the rate of entry. Thus a rise in population growth will lead to increased entry rates over and above those needed to accommodate the increase in the labor force. This multiplier effect will operate similarly in the opposite direction when facing a decrease in the rate of growth in the labor force. Our main result is stated below.

Theorem 1. *Assume conditional exit rates $(S_{n-1} - S_n)/S_{n-1}$ are decreasing in age, and average firm size $\tilde{e}_n$ is increasing in age. An increase (decrease) in the rate of growth of the labor force will result in an increase (decrease) of entry rates over and beyond the rate of increase (decrease) in the labor force.*

3.3 Temporary Increase in Population Growth

The results described in the previous section can be illustrated in the face of a temporary increase in the growth rate of the labor force. Suppose initially the labor force is stationary. It then grows at a constant rate γ for T periods to then return indefinitely to its initial zero level. The rate of exit is exogenous, so $S_n = (1-\delta)^n$ and average firm size $\tilde{e}_n$ increases with the age of the cohort at rate g, so $\tilde{e}_n = (1+g)^n$ where $0 < g < \delta$. At the original steady state there is a mass M_0 if firms, so $m = \delta M_0$ and average firm size is $e_0 = \delta \tilde{e}_0 / (\delta - g)$. For long T, the rate of entry converges to $\lambda_T = \delta + \gamma$, the relative share of firms of the cohort of age n to $\left(\frac{\delta+\gamma}{1+\gamma}\right)\left(\frac{1-\delta}{1+\gamma}\right)^n$ and average firm size to

$$\left(\frac{\delta+\gamma}{1+\gamma}\right)\sum\left(\frac{(1-\delta)(1+g)}{1+\gamma}\right)^n \tilde{e}_0 = \left(\frac{\delta+\gamma}{1+\gamma-(1-\delta)(1+g)}\right)\tilde{e}_0$$

4 Quantitative Analysis

The quantitative exercise is as follows. We assume the US economy was in a stationary equilibrium before the 1940s. We then feed the time series of the civilian labor force growth rate in the data, starting in 1940, through the model economy. We calibrate the model such that the model-implied time series match the data in 1978. This calibration strategy allows us to capture the effects of the rise and the fall in the labor force on firm demographics, without requiring firm-level data from the 1940s.

Functional forms. The production function of a firm is $f(s,n) = sn^{\alpha}$, where $0 < \alpha < 1$ captures decreasing returns to scale at the firm level. Firm productivity follows an AR(1) process:

$$\log(s_{t+1}) = \mu_s + \rho \log(s_t) + \varepsilon_{t+1}; \qquad \varepsilon_{t+1} \sim \mathcal{N}(0, \sigma_\varepsilon^2) \tag{9}$$

with ρ as the persistence, μ_s as the drift and σ_ε^2 as the variance of shocks. The distribution of startup productivities G is lognormal with mean s_0 and variance $\sigma_\varepsilon^2/(1-\rho^2)$. We allow overhead labor to increase linearly with firm size, $c_f(n) = c_{fa} + c_{fb}n$. This specification captures the intuitive idea that overhead labor increases with the number of production workers in the firm.

Calibration. The model period is set to one year. The time discount factor is $\beta = 0.96$, which implies an annual interest rate of 4%. The worker's share of output, α, is set to the standard value of 0.64. The steady-state labor force growth rate g is set to the standard value of one percent.

The parameters c_e, c_{fa}, c_{fb}, μ_s, ρ, σ_ε and s_0 need to be calibrated. The entry cost parameter c_e is set such that $p^* = 1$. As discusssed in Hopenhayn and Rogerson (1993), normalizing the equilibrium price gets around the identification problem that arises because price and the idiosyncratic shock enter the firm's objective function multiplicatively. The remaining parameters are calibrated to match the startup rate in 1978, average startup size in the sample, average firm size in 1978, unconditional 5-year firm exit rates and conditional 5-year firm growth rates.

We target the startup rate in 1978 in order to have a common starting point for the time series of the startup rate in the model and the data. We can then evaluate model performance by comparing how the two series evolve over the subsequent years. Average startup size in the data has changed little over time, so we target its sample average. Average startup size in the model is constant over time. It is determined primarily by the mean of the startup distribution, s_0. The dispersion of the productivity process affects the weight on productivity gridpoints where firms exit, so it primarily targets the 5-year exit rate. As

with the startup rate, the average firm size in 1978 is targeted because we use 1978 as the common starting point for the model. The persistence parameter ρ determines how quickly firms grow, so we use it to target the 5-year growth rate of firms. The operating cost intercept parameter c_{fa} enters into the firm size calculation and plays an important role in determining average firm size. The operating cost slope parameter c_{fb} plays an important role in matching labor productivity dispersion, and so we set it to match the Olley Pakes labor productivity covariance reported in Bartelsman, Haltiwanger and Scarpetta (2013). Table 1 summarizes the parameter values.

Assigned

	Value	Definition	Basis
β	0.96	Discount factor	Annual real interest rate of 4%
α	0.64	Worker's share of output	Standard
g	0.01	Labor force growth rate (SS)	Standard

Calibrated

	Value	Definition	Target	Data	Model
c_e	0.0003	Entry cost	$p^* = 1$	—	—
c_{fa}	4.05	Operating cost intercept	Average firm size in 1978	19.50	19.58
c_{fb}	0.06	Operating cost slope	OP covariance 1993-2001	0.51	0.51
s_0	-3.28	Mean of G	Average startup size	6.05	6.01
μ_s	0.0006	Drift in AR(1)	Startup rate in 1978	14.52%	14.59%
ρ	0.97	Persistence of AR(1)	5-year growth rate	72.00%	74.78%
σ_ε^2	0.046	Variance of shocks	5-year exit rate	51.61 %	57.29%

Table 1

Results. Table 1 shows how well the model matches the calibration targets. The parsimonious model does a good job of matching the targets.

Figure 4 shows how the model generated time series for the startup rate compares to the startup rate in the data. The figure includes the growth rate of the civilian labor force in the data that is fed through the model. The rise and fall of labor force growth is evident in the inverse U-shape observed in the data, with the peak around 1978. The startup rate follows the same inverse-U pattern. We are calibrating the model to 1978 only, so there is no apriori reason why the startup rate in the data for other years should match the model-implied series. As the figure shows, the model does an excellent job of matching key features of the data. The model generates the steady decline in the startup rate observed since the 1980s. The startup rate in the data declined from 14.52% to 7.67%, whereas the

startup rate in the model declined from 14.73% to 7.97%. Therefore the model generates almost all of the decline observed in the data.

The recent literature on the business startup rate focuses on the steady decline observed in the data since 1978. As Figure 4 shows, the decline was preceded by an increase in the startup rate. The data exhibit a steady increase in the startup rate from 1950 to 1978.[8] The model generates the increase in the startup rate observed in the data. The civilian labor force growth rate spiked during World War II. Figure 4 shows that there was a corresponding spike in startup rate in both the model and the data. The ability of the calibrated model to match both the long term trends and short term fluctuations indicates that the central role of changes in the labor force growth rate in the evolution of the startup rate.

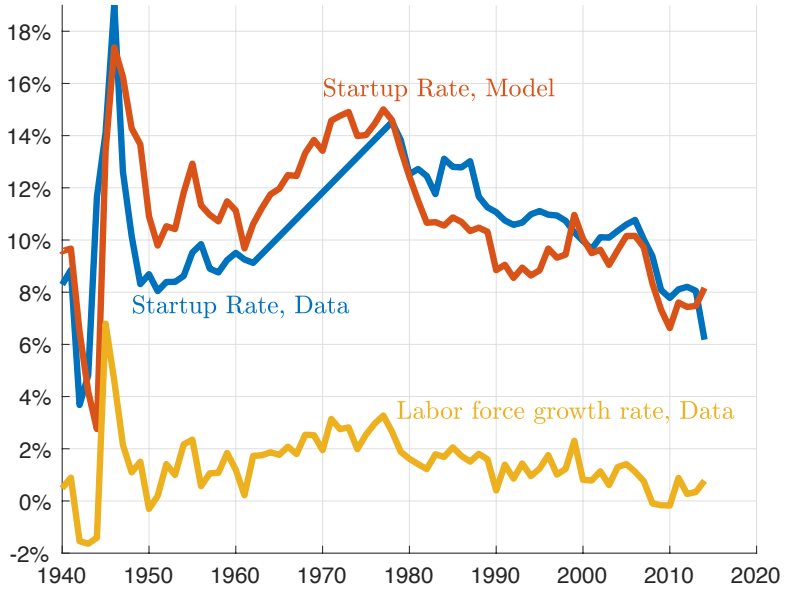
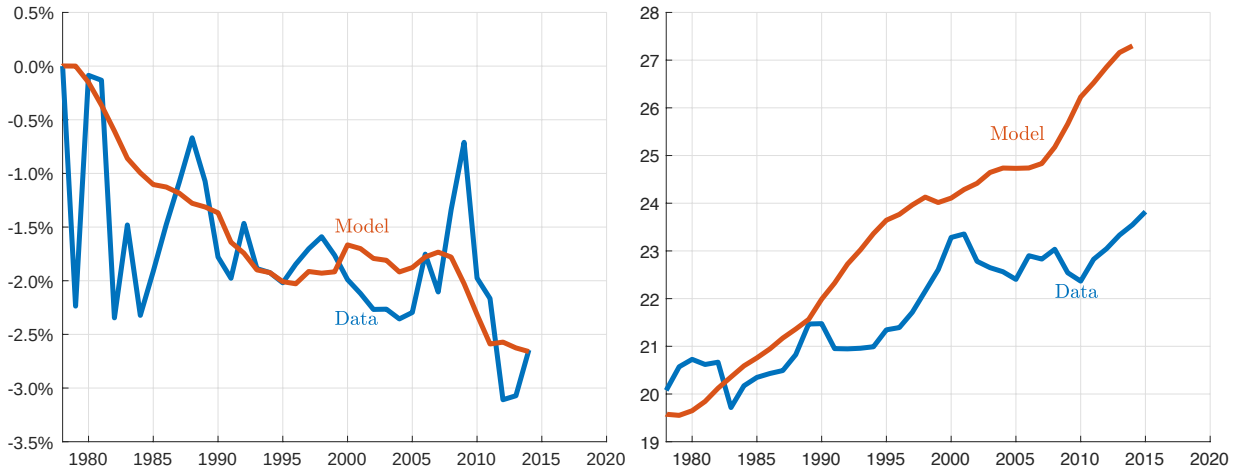


Figure 4

Notes. The entry rate from 1963 to 1977 is linearly interpolated.
Sources. Entry rate 1940-1962: Survey of Current Business. Entry rate 1978-2014: Business Dynamics Statistics. Labor force growth 1940-1946: Lebergott (1964). Labor force growth 1947-2014: Current Population Survey.

The startup rate declined by roughly 6 percentage points from its peak in 1978 to the 2010s. However, the labor force growth rate in the data declined by roughly 2 percentage points over the same time period. By the accounting identity (1), the remaining 4 percentage points must be accounted-for by the aggregate exit rate and by changes in average firm size. Figures 5a and 5b compare the model generated time series to the data. Figure 5a shows that the model does an excellent job of matching the decline in exit rates observed in the data since 1978. Figure 5b shows that average firm size increases in the model similar to the amount in the data, though with a bit of overshooting.

[8] Karahan, Pugsley and Şahin (2018) find that the entry rate for *establishments* increased from 1965 to 1978.



(a) Exit rate (b) Average firm size

Figure 5

Table 2 presents exit rate and average firm size by firm age. Overall the model does an excellent job matching average exit rate by firm age. This is perhaps not very surprising, given that we are calibrating to the 5-year unconditional exit rate. The model slightly undershoots average firm size for younger firms and overshoots for older firms. The undershooting and overshooting is coming from a higher growth rate in the model than in the data. In the data, firm growth exhibits a discontinuity: the growth rate of 0-year old firms is almost twice that of 1-year olds, but the growth rate of 1-year olds is only slightly higher than 2-year olds. This discontinuity is absent in the model, so the model overshoots firm growth rates.

Table 2: Exit rate and average firm size by age in the data and model

Age	**Exit rate**		**Average firm size**	
	Data(%)	Model(%)	Data	Model
0	–	–	6.05	6.01
1	21.85	25.57	7.73	6.81
2	15.86	17.20	8.46	7.63
3	13.43	13.43	9.14	8.51
4	11.68	11.24	9.77	9.47
5	10.48	9.79	10.36	10.51
6-10	8.30	7.58	11.98	13.92
11-15	6.40	5.68	15.08	21.06
16-20	5.56	4.83	18.81	29.04
21-25	4.99	4.36	24.03	37.04

Given that the model does a good job of matching firm exit rates and average firm size

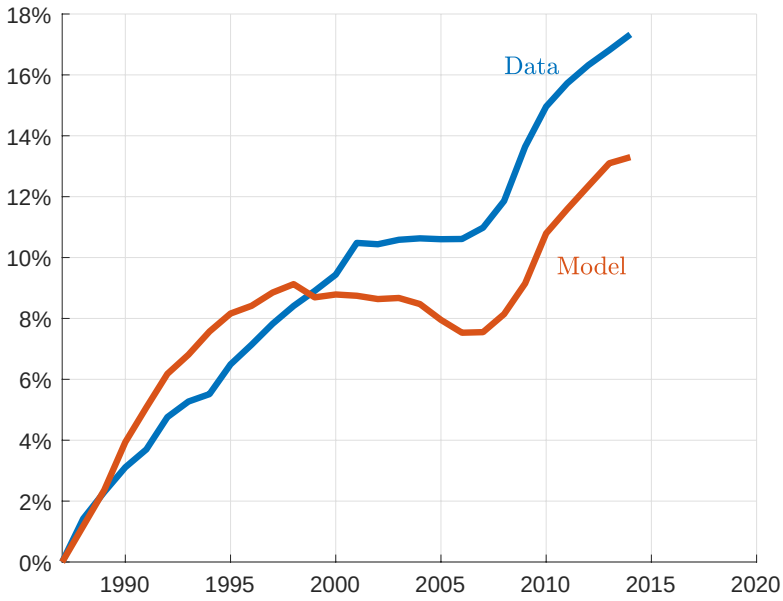


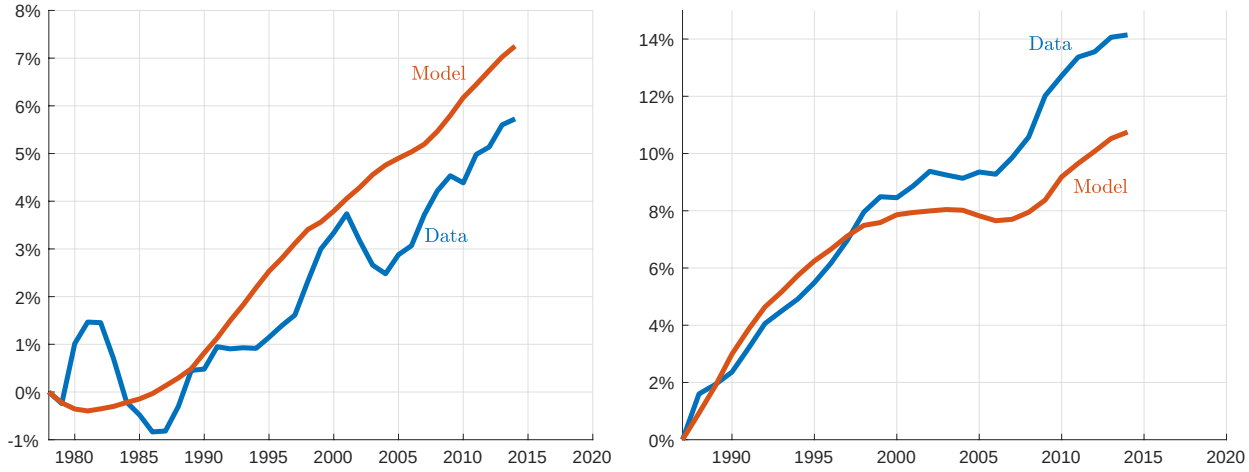
Figure 6: Firm Aging

by age, the ability of the model to match the change in the aggregate time series of these variables depends on how well it matches firm aging. Figure 6 shows the model generates similar aging as that observed in the data. The share of 11+ firms in the data increased by 17 percentage points in the data and by 13 percentage points in the model. The aging of the firms in the model is driven by the change in labor force growth: as the rate of labor force growth declines, the startup rate declines and the firm-age distribution shifts towards older firms.

4.1 Non-targeted moments

Concentration. We documented in Section 2 that firm aging is an important driver of the recent increase in firm concentration observed in the US. Because the calibrated model replicates the pattern of firm aging in the data, we ask whether the model can also generate an increase in firm concentration. We use two different measures of firm concentration. *Concentration by size* is the share of employment in firms with 250+ employees. *Concentration by age* is the share of employment in firms aged 11+. Because age and size are correlated, we expect the two measures to exhibit similar patterns. Figures 7a and 7b show the cumulative change in concentration by size and age in the model and the data. The data on concentration by age starts in 1987 because we cannot identify firms aged 11+ in the data before that year. As the figures show, the model does an excellent job of matching the increase in concentration by both size and age.

We decompose the cumulative change in concentration in the model into age-size cat-



(a) Concentration by size

(b) Concentration by age

Figure 7: Firm concentration by size and age in the model and the data

Notes. Concentration by size is share of employment by firms size 250+. Concentration by age is share of employment by firms age 11+.

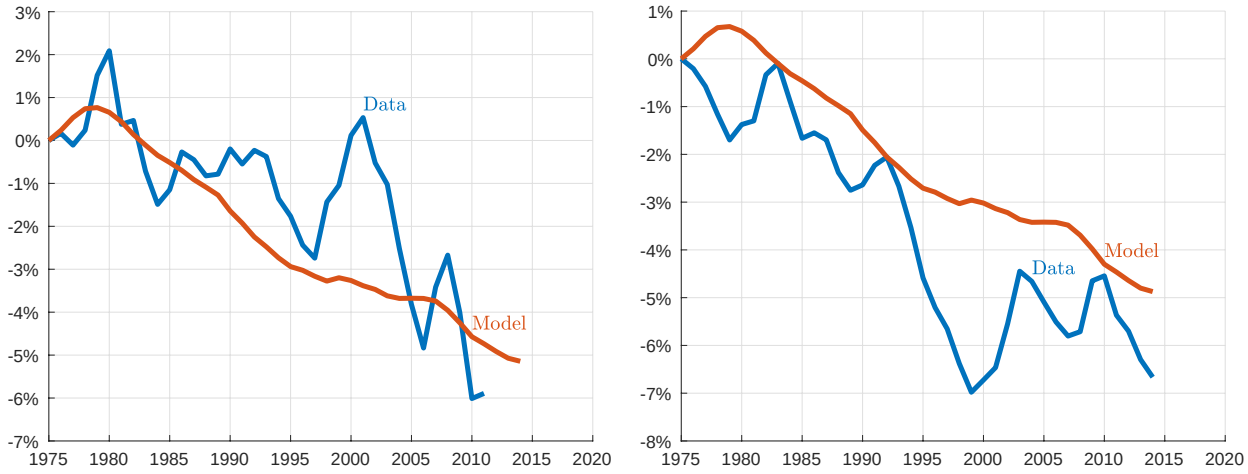
egories. Table 3 compares the model to the data. The model matches a key feature of the data: concentration is primarily about firm age. Young firms have a lower employment share in both the model and the data, regardless of size. Similarly, mature firms have a higher employment share regardless of size. The model does an excellent job of matching the magnitudes of the decline in the employment share by age-size categories.

Table 3: Change in share of employment by age-size categories from 1987 to 2014

Category	Data (pp.)	Model (pp.)
Young		
Small	-11.06	-10.46
Large	-3.09	-0.29
Mature		
Small	4.51	3.33
Large	9.63	7.41

Notes. Small firms have less than 250 employees. Large firms have 250+ employees. Young firms have age less than 11 years. Mature firms have age 11+.

Aggregate labor share. A recent literature documents that the aggregate labor in the US has declined since the 1980s; see e.g. Karabarbounis and Neiman (2014). Autor, Dorn, Katz, Patterson and Van Reenen (2017) use Census data to document that firm-level labor shares are negatively related to firm size. Our model generates this negative relationship because of overhead labor.



(a) Labor Share (b) Nonproduction Workers to Employment

Figure 8

Sources. (a) Karababounis and Neiman (2014); (b) BLS Current Employment Statistics

A firm's labor share can be broken down into the share of value added paid to production workers and to overhead labor. In equilibrium, the share paid to production workers is equal to α for all firms. Therefore, all differences in firm level labor shares are due to the share paid to overhead labor. If we multiply and divide the share of overhead labor by the wage bill of production workers, wn_i, the firm-level labor share depends on the ratio of overhead labor to production employment. We have

$$\text{Firm } i\text{'s labor share} = \alpha + \frac{wc_{fi}}{py_i} = \alpha\left(1 + \frac{c_{fi}}{n_i}\right) \tag{10}$$

The ratio of overhead labor to production employment declines with firm size in the calibrated model. By (10), it follows that firm-level labor shares decline with firm size. Firm age and firm size are positively correlated in the model. Therefore, an aging firm distribution increases the weight of larger firms, those with lower labor shares, leading to a decline in the aggregate labor share.

Figure 8a plots the cumulative change in the aggregate labor share in the model and the data. The aggregate labor share in the model is measured as the sum of firm-level labor shares, weighted by the value-added weight of the firm. Quantitatively, the model does an excellent job of matching the decline in the aggregate labor share. The labor share in the data declines by 6 percentage points, while that in the model declines by 5 percentage points.

The aggregate labor share satisfies a relationship similar to (10). We can rewrite that relationship to express the aggregate labor share as a function of the ratio of overhead to

total employment. We have

$$\text{Aggregate labor share} = \alpha \left(\frac{1}{1 - \frac{\text{Overhead}}{\text{Total employment}}} \right)$$

Because α does not change over time, the decline in the aggregate labor share in the model is entirely due to a decline in the overhead to total employment ratio. To the extent that our mechanism is driving the labor share decline observed in the data, we should observe a similar decline in the overhead to employment ratio in the data. Consistent with our mechanism, Figure 8b shows that the ratio of nonproduction workers to total employment in the data has declined by about 6 pp. The labor share in the data also declined by 6 pp, indicating that the majority of the labor share decline is because of a decline in the ratio of nonproduction workers to total employment.

4.2 Exploring the Mechanism: Counterfactuals

Firm demographics and the initial rise of labor force growth each have important quantitative roles in producing the benchmark results. Firm demographics generates a feedback effect. If older firms exit at a lower rate, the aging generated by an initial drop in the startup rate will lead to lower exit, which decreases the startup rate further. The initial rise in labor force growth generates an increase in entry, which is followed by an expansion of the pool of incumbents. As labor force growth slows down, incumbent growth exceeds labor force growth, leaving less room for new firms. We explore the quantitative effect of each of these amplifying forces by shutting each individually and recalibrating the model.

In the first counterfactual, we shut down firm demographics by shutting down the i.i.d. shock process. This is done by setting $\mu_s = 0$, $\rho = 1$ and $\sigma_\varepsilon = 0$. The resulting transition matrix is the identity matrix, $F = \mathbf{I}$, implying that the productivity of a firm equals its productivity drawn at birth. Firms do not grow or shrink in this economy, and therefore do not exhibit differences in average firm size or exit rates across age groups.[9] In the second counterfactual, we shut down the rise in labor force growth that preceded the decline. We do this by assuming the economy is at a stationary equilibrium in 1977, effectively assuming a constant labor force growth and startup rate pre-1978.

Figure 9 plots the startup rate counterfactuals along the benchmark and data. Shutting down the pre-1978 rise in labor force growth reduces the 6 percent entry rate decline to a 4

[9] We generate exit in this economy by assuming that all firms exit at a constant rate δ. We calibrate δ and mean of startup productivity distribution s_0 to match the startup rate and the average firm size in 1978. All other parameters, except c_e, equal their benchmark values. As in the benchmark, the entry cost c_e is set such that $p^* = 1$. The calibrated parameter values are $\delta = 12.02\%$, $s_0 = -3.63$ and $c_e = 0$.

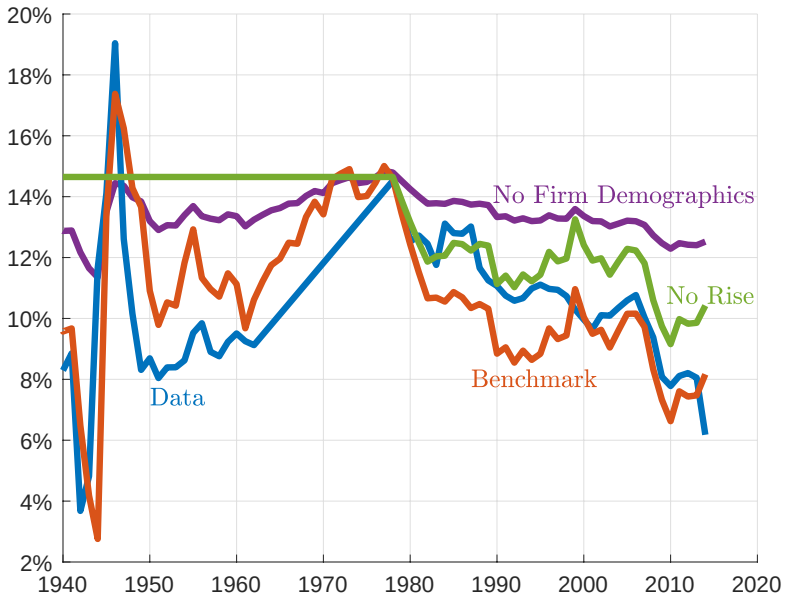


Figure 9: Entry Rate Counterfactuals

percent decline. Therefore the pre-1978 rise of labor force growth amplifies the decline of the startup rate by about 50 percent. Shutting down firm demographics reduces the entry rate decline to only 2 percentage points.

5 Discussion

In this section we discuss the sources of labor force growth and the decline of manufacturing employment.

5.1 Sources of Labor Force Growth

What explains the rise and fall of labor force growth? To answer this question, we decompose labor force growth into each of its components. We start from the BLS' definition of labor force,

$$\text{Labor Force}_t = \text{Civilian Noninstitutional Population Age 16 And Over}_t \times \text{ Participation Rate}_t.$$

It follows that labor force growth rate is the sum of the growth rate of each component,

$$\text{LF Growth Rate}_t = \text{CNP16 Growth Rate}_t + \text{PR Growth Rate}_t.$$

We can further decompose CNP16 growth rate at time t into the birth rate at time $t-16$

and a residual term $Other_t$

$$\text{CNP16 Growth Rate}_t = \text{Birth Rate}_{t-16} + \text{Other}_t,$$

where the *Other* term includes death rates, net migration rates, and rates of entry and exit into institutional status. Figure 10 plots labor force growth rate for each decade, dividing the bars into the percentage contribution of birth rates, growth rate of participation rates, and other. The decomposition shows that birth rates sixteen years prior account for the bulk of changes in labor force growth, accounting for an average of 64 percent of the labor force growth rate across decades.

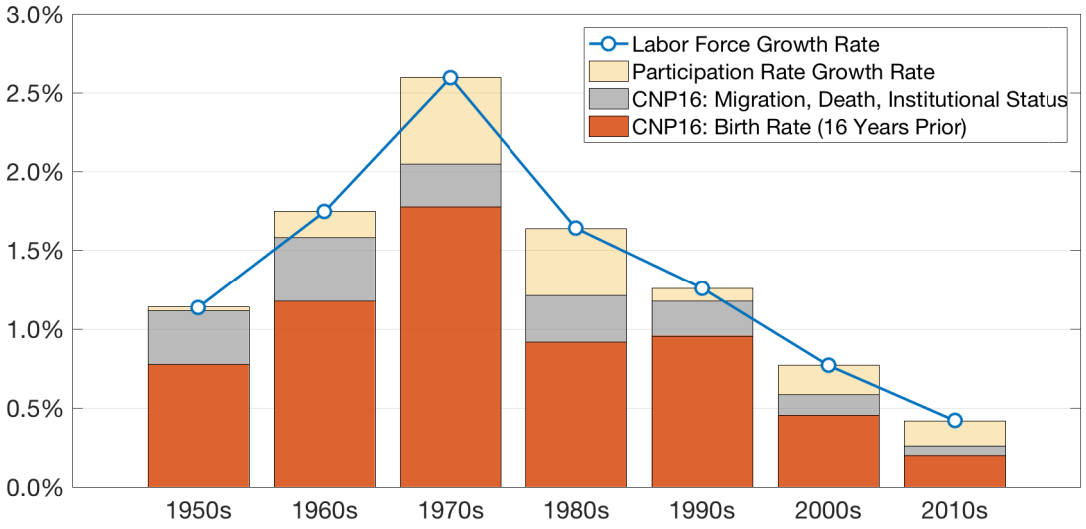


Figure 10: Decomposition of Labor Force Growth

The actual contribution of the birth rate to labor force growth is likely higher than 64 percent because the birth rate also has an effect on participation rates. For example, an important fraction of the decline of participation rates since the year 2000 is due to the baby boomer generation reaching the age of 55 and over, whose age group has low participation rates.

5.2 Manufacturing

Manufacturing has experienced overall negative employment growth since the 1980s. This raises the possibility that an exodus of workers from manufacturing into non-manufacturing reverses the trend of declining employment growth of non-manufacturing sectors. Figure 11 shows that this is not the case. Non-manufacturing employment growth follows a similar rise and fall pattern as total employment growth.

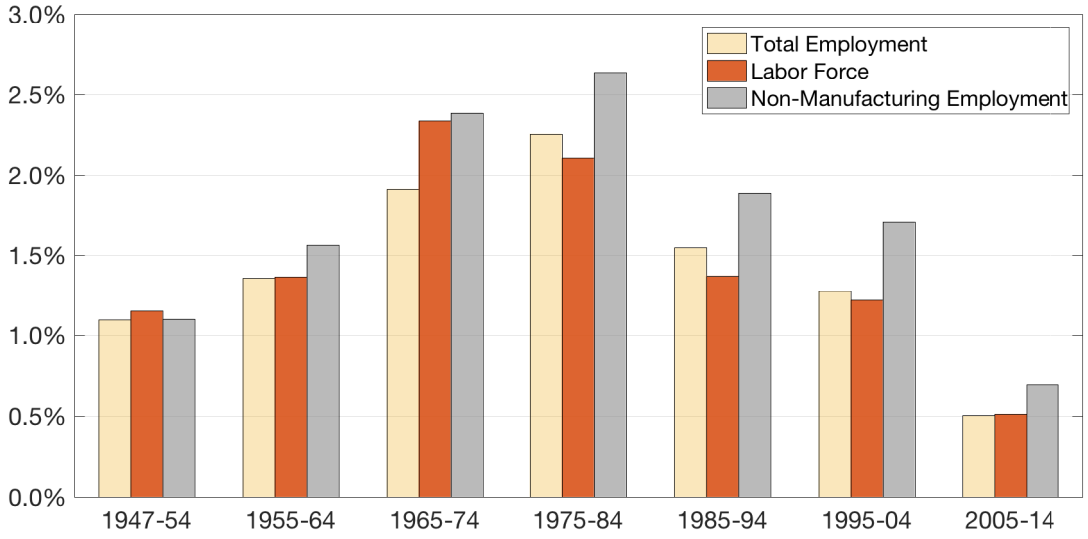


Figure 11: Growth Rates

Sources. Current Population Survey and Current Employment Statistics.
Notes. Manufacturing employment data starts in 1947. Decade cutoffs are chosen so that full business cycles fall within the decade bin, effectively capturing the trend component in employment growth.

The decline of manufacturing employment does not have a large effect on non-manufacturing employment growth partly because the flow of workers out of manufacturing is small compared to the flows of workers entering the labor force. From 1977 to 2014, manufacturing employment shrank by 7.12 million workers while the labor force grew by 56.91 million and total employment grew by 54.29 million workers.

6 Conclusion

Recent decades have witnessed an increase of concentration, a decline in firm entry rates, and a decline of the aggregate labor share. We show that the interplay of population and firm demographics can account for much of these trends. We study the transitional dynamics of feeding observed labor force growth rates through a standard general equilibrium firm dynamics model. We emphasize the role of firm demographics as well as the role of the rise of labor force from the 1940s to 1970s in amplifying susbsequent changes in aggregate trends. Overall, our paper provides a unified quantitative explanation for a set of apparently disparate trends.

Appendix A Data Appendix

Civilian Labor Force Growth Rate 1940-2014. We obtain civilian labor force data from the Bureau of Labor Statistics (BLS) Current Population Survey for the years 1947 to 2014, and from Lebergott (1964) from 1940 to 1946. The civilian labor force definition in BLS includes population 16 years of age and over while in Lebergott the definition includes population 14 years of age and over. We can use Lebergott's series from 1947 to 1960 to compare the difference in growth rates using either definition. Figure 12 shows that the labor force growth rates of ages 14+ and 16+ are nearly identical.

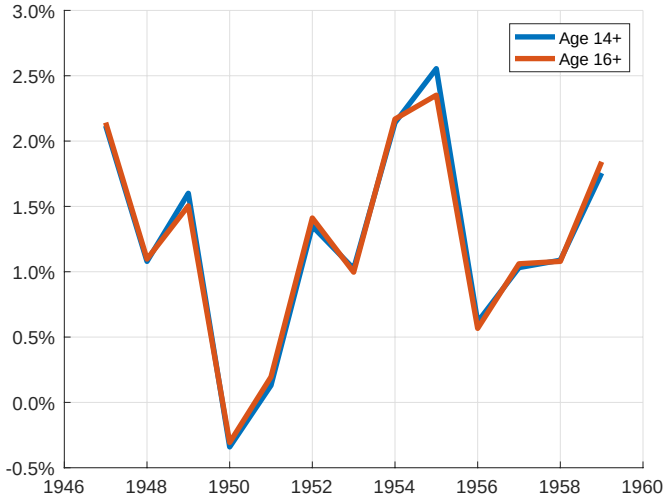


Figure 12: US Civilian Labor Force Growth Rate

Firm-level data 1978-2014. Data to calculate firm-level data comes from the U.S. Census Bureau's Business Dynamics Statistics (BDS). The BDS dataset has near universal coverage of private sector firms with paid employees. BDS data starts in 1977, but best practice suggests dropping 1977 and 1978 due to suspected measurement error (e.g. Moscarini and Postel-Vinay, 2012). We drop 1977, but keep 1978, as calibrating to 1978 or 1979 does not affect our quantitative results (the model matches the startup rate in both 1978 and 1979 almost exactly).

Firm Entry Rates 1940-1962. The firm entry rate from 1940 to 1962 is obtained from the now-discountinued U.S. Department of Commerce's Survey of Current Business. The entry rate is 'New Businesses' divided by 'Operating Businesses'. The 1963 edition was the last one to report a 'Business Population and Turnover' section. From 1963, the Survey of Current Business reported instead 'Business Incorporations', which only include stock corporations. All nonfarm businesses are included, regardless of size.

Ratio of Nonproduction Workers to Employment. Nonproduction workers is total employment in the private sector minus the employment of production and nonsupervisory workers in the private sector. Data on production workers comes from the BLS Current Employment Statistics (Establishment Survey). Data on total employment is from the BLS Current Population Survey.

Birth Rates. The 1930 to 2000 birth rate series is from the CDC National Center for Health Statistics.

Manufacturing Employment. The 1947 to 2014 series on manufacturing employment is from the BLS Current Employment Statistics (Establishment Survey).

Appendix B Firm Age Regressions

Table 4: Regression of concentration (employment share of firms sized 250+) on year

Variable	Specification	
	(1)	(2)
Year	0.003***	-0.000
	(0.001)	(0.000)
AGE:		
Age 0		0.666
		(0.439)
Age 1		0.730*
		(0.439)
Age 2		0.740*
		(0.440)
Age 3		0.756*
		(0.440)
Age 4		0.772*
		(0.440)
Age 5		0.786*
		(0.440)
Age 6 to 10		0.839*
		(0.440)
Age 11 to 15		0.928**
		(0.441)
Age 16 to 20		1.017**
		(0.441)
Age 21 to 25		1.115**
		(0.442)
R^2	0.080	0.976
Observations	301	301

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 5: Regression of log average firm size on year

Variable	Specification			
	(1)	(2)	(3)	(4)
Year	0.006***	-0.005***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.000)	(0.000)
AGE:				
Age 0		1.839***	1.435***	1.441***
		(0.023)	(0.015)	(0.026)
Age 1		2.080***	1.676***	1.717***
		(0.023)	(0.015)	(0.026)
Age 2		2.171***	1.767***	1.806***
		(0.023)	(0.015)	(0.026)
Age 3		2.247***	1.843***	1.868***
		(0.024)	(0.015)	(0.026)
Age 4		2.319***	1.915***	1.941***
		(0.024)	(0.015)	(0.026)
Age 5		2.378***	1.974***	2.002***
		(0.024)	(0.015)	(0.027)
Age 6 to 10		2.526***	2.122***	2.159***
		(0.027)	(0.016)	(0.029)
Age 11 to 15		2.748***	2.344***	2.323***
		(0.029)	(0.017)	(0.032)
Age 16 to 20		2.977***	2.573***	2.472***
		(0.032)	(0.018)	(0.035)
Age 21 to 25		3.251***	2.847***	2.579***
		(0.035)	(0.019)	(0.039)
SECTOR CONTROLS	No	No	Yes	Yes
SECTOR×AGE CONTROLS	No	No	No	Yes
R^2	0.015	0.978	0.995	0.996
Observations	2,682	2,682	2,682	2,682

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 6: Regression of exit rate on year

Variable	Specification			
	(1)	(2)	(3)	(4)
Year	-0.151***	-0.011*	-0.011**	-0.011**
	(0.012)	(0.006)	(0.005)	(0.005)
AGE:				
Age 1		21.780***	19.381***	19.036***
		(0.178)	(0.188)	(0.342)
Age 2		16.143***	13.744***	12.702***
		(0.178)	(0.188)	(0.342)
Age 3		13.673***	11.274***	10.765***
		(0.181)	(0.190)	(0.347)
Age 4		12.029***	9.629***	9.380***
		(0.185)	(0.192)	(0.352)
Age 5		10.753***	8.354***	8.331***
		(0.189)	(0.194)	(0.358)
Age 6 to 10		8.647***	6.247***	6.695***
		(0.208)	(0.206)	(0.390)
Age 11 to 15		6.711***	4.312***	5.160***
		(0.225)	(0.218)	(0.421)
Age 16 to 20		5.901***	3.501***	4.582***
		(0.246)	(0.232)	(0.461)
Age 21 to 25		5.416***	3.017***	4.420***
		(0.271)	(0.250)	(0.514)
SECTOR CONTROLS	No	No	Yes	Yes
SECTOR×AGE CONTROLS	No	No	No	Yes
R^2	0.065	0.962	0.976	0.978
Observations	2,358	2,358	2,358	2,358

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

References

Autor, D., D. Dorn, L. F. Katz, C. Patterson and J. Van Reenen, "The Fall of the Labor Share and the Rise of Superstar Firms," Working Paper 23396, National Bureau of Economic Research, May 2017. 4, 20

Barkai, S., "Declining Labor and Capital Shares," Working paper, 2017. 5

Bartelsman, E., J. Haltiwanger and S. Scarpetta, "Cross-Country Differences in Productivity: The Role of Allocation and Selection," *American Economic Review* 103 (February 2013), 305–34. 16

Chatterjee, S. and B. Eyigungor, "Declining Interest Rates and Firm Dynamics: Falling Startups and Rising Concentration," Working paper, August 2018. 5

Elsby, M., B. Hobijn and A. Sahin, "The Decline of the U.S. Labor Share," *Brookings Papers on Economic Activity* 44 (2013), 1–63. 5

Engbom, N., "Firm and Worker Dynamics in an Aging Labor Market," Working paper, November 2017. 5

Grullon, G., Y. Larkin and R. Michaely, "Are U.S. Industries Becoming More Concentrated?," Working paper, August 2017. 5

Hartman-Glaser, B., H. Lustig and M. Z. Xiaolan, "Capital Share Dynamics When Firms Insure Workers," NBER Working Papers 22651, National Bureau of Economic Research, Inc, September 2016. 5

Hopenhayn, H. and R. Rogerson, "Job Turnover and Policy Evaluation: A General Equilibrium Analysis," *Journal of Political Economy* 101 (October 1993), 915–38. 15

Hopenhayn, H. A., "Entry, Exit, and Firm Dynamics in Long Run Equilibria," *Econometrica* 60 (1992a), 1127–1150. 5

———, "Exit, selection, and the value of firms," *Journal of Economic Dynamics and Control* 16 (1992b), 621–653. 9, 10

Jiang, H. and F. Sohail, "Skill Biased Entrepreneurial Decline," Working paper, September 2017. 5

Karabarbounis, L. and B. Neiman, "The Global Decline of the Labor Share," *The Quarterly Journal of Economics* 129 (2014), 61–103. 5, 20

Karahan, F., B. Pugsley and A. Şahin, "Demographic Origins of the Startup Deficit," Working paper, May 2018. 5, 17

Koh, D., R. Santaeulalia-Llopis and Y. Zheng, "Labor share decline and intellectual property products capital," Economics Working Papers ECO2015/05, European University Institute, 2015. 5

Kopecky, J., "An Aging Dynamo: demographic change and the decline of entrepreneurial activity in the United States," Working paper, 2017. 5

Lebergott, S., *Manpower in Economic Growth: The American Record Since 1800* (McGraw-Hill Book Company, 1964). 26

Liang, J., H. Wang and E. P. Lazear, "Demographics and Entrepreneurship," *Journal of Political Economy* 126 (2018), 140–196. 5

Liu, E., A. Mian and A. Sufi, "Low Interest Rates, Market Power, and Productivity Growth," Working paper, March 2018. 5

Loecker, J. D. and J. Eeckhout, "The Rise of Market Power and the Macroeconomic Implications," Working Paper 23687, National Bureau of Economic Research, August 2017. 5

Moscarini, G. and F. Postel-Vinay, "The Contribution of Large and Small Employers to Job Creation in Times of High and Low Unemployment," *American Economic Review* 102 (May 2012), 2509–39. 26

Neira, J. and R. Singhania, "The Role of Corporate Taxes in the Decline of the Startup Rate," MPRA Paper 81662, University Library of Munich, Germany, September 2017. 5

Piketty, T. and G. Zucman, "Capital is Back: Wealth-Income Ratios in Rich Countries 1700Ð2010 *," *The Quarterly Journal of Economics* 129 (2014), 1255–1310. 5

Pugsley, B. and A. Şahin, "Grown-up Business Cycles," *The Review of Financial Studies* (2018). 5

Salgado, S., "Technical Change and Entrepreneurship," Working paper, February 2018. 5

U.S. Census Bureau, "Business Dynamics Statistics," (2018), https://www.census.gov/ces/dataproducts/bds/data_firm.html (accessed April 1, 2018). 26