Who Works for Startups? The Relation between Firm Age, Employee Age, and Growth

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Abstract

We present evidence that young employees are an important ingredient in the creation and growth of firms. Our results suggest that young employees possess attributes or skills, such as willingness to take risk or innovativeness, which make them relatively more valuable in young, high growth, firms. Young firms disproportionately hire young employees, controlling for firm size, industry, geography and time. Young employees in young firms command higher wages than young employees in older firms and earn wages that are relatively more equal to older employees within the same firm. Moreover, young employees disproportionately join young firms that subsequently exhibit higher growth and raise venture capital financing. Finally, we show that an increase in the regional supply of young workers increases the rate of new firm creation. Our results are relevant for investors and executives in young, high growth, firms, as well as policymakers interested in fostering entrepreneurship.

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I. Introduction

Large amounts of capital are invested in young firms, by founders via their personal savings, by professional venture capital and private equity investors, and by the public capital markets at IPO and beyond. A large economics literature starting from as early as Schumpeter (1912) and continuing to the present (e.g., Haltiwanger, Jarmin and Miranda (2010)) argues that young firms are an important part of economic growth through the processes of innovation, creative destruction and job creation. While we know young firms have the potential to grow rapidly, achieve large scale and generate high returns, many fundamental questions remain about what distinguishes young firms that grow rapidly from those that do not.

In this paper, we ask whether there are differences in employee workforces between young and old firms and whether initial employee workforce composition is related to the future growth of young firms. While there have been several studies that examine the people who become CEOs of young high growth firms (e.g., Gompers, Lerner and Scharfstein (2005), Graham, Harvey and Puri (2010) and Kaplan, Klebanov and Sorensen (2010)), there have been few systematic studies that examine the rank and file employees who join young firms. This is despite the fact that labor and human capital are increasingly important components to production, especially in R&D intensive industries where startup activity abounds. Moreover, there is a growing recognition in the finance literature that employees may impact how firms finance themselves and are valued (e.g., Zingales (2000) and Berk, Stanton and Zechner (2010)).

We use data from the U.S. Census Bureau for a large sample of both private and public firms to address several questions about the employees who work for young, high growth, firms. In so doing, we shed light on the employee characteristics demanded by young, high growth, firms and how the relative supply of such workers may conditionally impact the creation, financing and growth of firms.

We first ask whether there is a difference in the age of employees who join young firms relative to older firms. We focus on employee age since a number of employee characteristics that are likely to be important for young high growth firms have also been argued to be correlated with age. A number of studies in the psychology literature have found that younger people tend to be more risk tolerant (e.g., Vroom and Phal (1971) and Hensely (1977)). The economics literature has also argued that younger people may be less risk averse when it comes to portfolio choice (e.g., Bakshi and Chen (1994) and Bodie, Merton and Samuelson (1992)). Greater risk tolerance may make young employees more willing to bear the labor income and

human capital risk of working for a young firm. Moreover, greater risk tolerance may mean that young employees will be more likely to select riskier projects or tasks within the firm once they are hired, leading to higher firm growth. In addition, since younger employees are more likely to have more recently completed their education, they may possess more current technical skills which allow them to have more innovative ideas or be able to better adapt to new environments.[1] Building a workforce with such characteristics may be especially critical to young firms, which are often in growth mode, may be developing new products, and are more likely to fail.

We find that young firms disproportionately employ younger workers. Around 45 percent of employees in firms aged 1 to 5 years are under the age of 35, and 70 percent are under the age of 45. In contrast, in established firms that have been in existence for 20 years or more, fewer than 30 percent of employees are under the age of 35, while over half are over the age of 45. This suggests that young firms have a greater demand for young employees relative to older firms.

If young workers are more likely to look for new jobs, relative to older workers, as suggested by the labor economics literature (e.g., Topel and Ward (1992)), then young workers may be disproportionately hired by young firms that are expanding their workforces simply because they are the ones searching for jobs, whereas older workers may stay with a given firm as it (and they) age. However, when we examine only firms that hire new employees in a given year, we find that younger firms hire younger employees, relative to older firms. Furthermore, we find that the positive relation between firm age and employee age, both for all employees and new hires only, holds when we control in a regression framework for firm size, industry, geography, and time. We also find a similar relation between firm age and employee age in the full sample, dominated by smaller privately held firms, and in a subsample of larger publicly traded firms.

We next ask if younger employees are more highly compensated in young firms. If young firms hire more young employees because young employees possess attributes or skills that are relatively more important for growth, young employees in young firms should receive greater compensation relative to young employees elsewhere. Indeed, we find that young

[1] On the other hand, in a career concerns framework (e.g., Holmstrom (1982)), older workers, with established professional track records may be more willing to join young firms, whereas younger workers may prefer to begin their careers in older, established, firms to acquire industry- or task-specific skills before joining a young firm. Moreover, older workers may possess industry experience or have learned ways to innovate in their past jobs that young firms may find desirable. Thus, ultimately, the question of whether young, high growth, firms hire younger or older workers must be answered empirically.

employees in young firms earn higher wages than young employees in older firms. Moreover, the positive wage spread documented by labor economists between older and younger employees (e.g., Ben-Porath (1967) and Murphy and Welch (1990, 1992)) is narrower within young firms, with young employees earning relatively more equal pay with older employees in the same firm. This suggests that young employees in young firms are also more skilled, or productive, relative to the older employees within the same firms, as compared to the young employees in older firms.

Using additional firm-level data on our subsample of publicly held firms, we examine whether the larger share of young employees in young firms and the higher relative wages of young employees in young firms can be explained by labor income risk, financial constraints or differences in use of equity compensation. We find that firms in which labor income risk is greater, controlling for firm age, employ larger shares of younger employees, consistent with young employees having a greater tolerance for labor income risk. We do not find evidence that the young employees earn higher relative wages at riskier firms, controlling for firm age, however. Rather our wage results are most consistent with greater demand by young firms for young employees with skills, such as innovation skills, that make them relatively more productive and valuable in young firms. We do not find evidence that the large number of young employees in young firms is driven by financial constraints, nor do we find strong evidence that differences in equity compensation drive the higher wages paid to young employees relative to older employees in young firms.

We next ask whether the young firms that exhibit higher growth hire greater shares of young employees ex ante. If young employees are more productive or willing to take risk in young firms, we should expect to see that the young firms exhibit higher potential and actual growth employ larger shares of young workers ex ante. We find that younger workers are more likely to join new firms in an industry when there are positive financial market signals of investment opportunity and growth. This supports the idea that younger workers are more likely to join young firms when they can be more productive, enable faster growth, and capture higher wages. We also find a substantial difference in the subsequent performance of new firms that are started with greater shares of younger employees relative to older employees. In particular, new firms that grow faster and receive venture capital financing are started with younger employees. This supports the argument that the presence of younger employees predicts future growth. A

younger workforce is also associated with different financing outcomes as compared to firms with older employees.

Finally, we ask whether the rate of new firm creation is affected by the supply of young workers. If young employees are important for young firm growth due to their unique skills or attributes, we should expect that when more young employees are available, entrepreneurs find it easier to start and grow companies. Using historical demographic information on the relative ratio of youth in a state as a predictor for the ratio of younger to older workers ten years later, we argue that a causal relationship exists between the supply of young workers and the rate of new firm creation. These results suggest that the supply of young workers, in addition to the supply of financial capital, is an important ingredient in the creation and growth of new firms.

Our study contributes to the literature on what drives new firm creation and growth. A large focus of this literature to date has been on understanding the role of financial market development and structure.[2] A separate literature examines the role of regulations and the legal system.[3] We explore the role of labor markets and how the relative supply of young workers can impact firm creation and growth. Our results are important for understanding when investors, such as VCs or other private equity investors, and CEOs may find it easier or harder to grow new firms as a function of labor market conditions and are relevant for policy makers wishing to foster entrepreneurship.

Our results also contribute to the labor and organizational economics literatures in documenting the strong positive association between employee age and firm age, in documenting the relative wages of young employees in young and old firms, and in documenting how the positive wage spread between older and younger employees narrows in young firms. Previous studies have explored the relation between firm size and wages and between firm age and wages (e.g., Brown and Medoff (1989, 2003)), but none have explored the relation between age of employees, the age of firms and the relative wages paid to employees of different ages across firms of different ages. Moreover, our results can be brought to bear on the theoretical organization economics literature that suggests that firm hierarchies might be flatter in young,

[2] Studies such as Evans and Jovanovic (1989), Holtz-Eakin, Joulfaian and Rosen (1994) and Hurst and Lusardi (2004) focus on the role of personal and family wealth in alleviating financial constraints in new firms. Other studies focus on the roles played by intermediaries, such as venture capitalists (e.g., Lerner (1995), Kaplan and Stromberg (2001) and Puri and Zarutskie (2010)) and banks (e.g., Black and Strahan (2002), Hellmann, Lindsey and Puri (2008)), and angel investors (e.g., Kerr, Lerner and Schoar (2010)). See also Metrick and Yasuda (2010) for a recent overview of the venture capital and private equity literatures.

[3] See, for example, studies by Hause and Du Rietz (1984) and Klapper, Laeven and Rajan (2006)).

entrepreneurial firms (e.g., Rajan and Zingales (2001)). We document some new stylized facts about the relative wages of younger and older employees in firms of differing ages.

The remainder of this paper proceeds as follows. Section II describes the data. Section III examines the relation between firm age and employee age. Section IV explores the relative wages of younger and older employees in young and old firms. Section V examines to what extent labor income risk, financial constraints and equity compensation can explain our finding on employment and wage differences in young firms. Section VI examines the relation between employee age and young firm growth. Section VII concludes.

II. Data

We use four primary data sources in the analysis. We use data from the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program to obtain information on the ages and wages of employees. We use data from the U.S. Census Bureau's Longitudinal Business Database (LBD) to obtain information on the industry, age and geography of the firms for which the employees in the LEHD data work. We use Compustat to obtain additional information on the publicly traded firms in the LBD. Finally, we use data from SDC Thomson's VentureXpert and DowJones VentureSource to obtain information on which firms in the LBD receive venture capital financing.

A. Longitudinal Employer-Household Dynamics Data

LEHD data is collected from the unemployment insurance records of states participating in the program. Data starts in 1992 for several states and coverage of states increases over time. By 2004, twenty-seven states in the U.S. are included in the LEHD data.[4] The LEHD data tracks employees who work for firms in the participating states on whom unemployment insurance taxes are paid.[5]

We use the Quarterly Workforce Indicators (QWI) which aggregates worker-level information in the LEHD to the business establishment level.[6] The QWI data provide

[4] These states are California, Colorado, Delaware, Florida, Iowa, Idaho, Illinois, Indiana, Kentucky, Maine, Maryland, Minnesota, Missouri, Montana, North Carolina, New Jersey, New Mexico, North Dakota, Oklahoma, Oregon, Pennsylvania, Texas, Virginia, Vermont, Washington, Wisconsin, and West Virginia.

[5] See Abowd et al (2006) for a more detailed description of the program and the underlying data sets that it generates.

[6] A business establishment is part of a firm defined by having a particular geographic location. For example, a law firm with an office in San Francisco and an office in Los Angeles would have two business establishments.

information on the count and total payroll for employees hired and separated each quarter. This information is reported for all employees and by age groups.[7] Age groups are reported in ten year intervals, e.g., age 25 to 34, age 35 to 44, etc. Total payroll includes regular salaries and all bonuses and commissions, as well as stock options and other equity compensation in some states.[8] Firms in the QWI are identified by their state employer identification numbers (SEINs). Information on the physical address, industry and federal tax employer identification number (EIN) of each business establishment is also recorded in the QWI. We annualize the QWI data by summing measures of flows, such as new hires and wages, over each quarter of a given year, and adjust wages to be in constant year 2005 dollars.

B. Longitudinal Business Database

The LBD is a panel data set that tracks all employer U.S. business establishments from 1975 to 2005. The database is formed by linking years of the standard statistical establishment list (SSEL), a register of business establishments, maintained by the Internal Revenue Service of the U.S. Treasury Department. The LBD links the employer business establishments contained in the SSEL over time and assigns each a unique identifier as well as a firm-level identifier that allows researchers to aggregate information to the firm level. The LBD contains information on the physical location, industry, total employment and payroll for each business establishment.[9]

We use the LBD to track the business establishments of firms that are included in the QWI over our sample period 1992-2004. We measure firm age based on when the first business establishment of a firm enters the LBD. We can also observe the years in which an establishment exits the LBD. This allows us to identify firm shut downs. We classify a firm as shutting down, or failing, when all of its establishments exit the LBD, i.e., the firms' employment goes to zero.

We link business establishments in the QWI to the business establishments in the LBD using the Business Register Bridge. These files match business establishments across the two databases using federal EIN, industry, state, and county of the establishments. Matches are

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Likewise, a manufacturing firm with three different plants operating in different locations, e.g., two in Illinois and one in Wisconsin, would have three business establishments.

[7] The LEHD data do not contain employee level information on education because this information is not reported by firms to state unemployment agencies.

[8] See http://www.bls.gov/cew/cewfaq.htm for additional details.

[9] For a more detailed description of the LBD see Jarmin and Miranda (2002).

based on 15 combinations of EIN, industry, state and county.[10] In the current analysis we use matches based on EIN, industry, state and county as well as EIN, state and county. Our combined LEHD-LBD dataset contains 4,374,025 firms tracked over the period 1992 to 2004, for a total of 20,185,572 firm-year observations.

C. Compustat, SDC Thomson and DowJones Data

We link information from Compustat to the Census data using the internal Census Compustat/SSEL crosswalk. This crosswalk assigns firms in the LBD to the firm-level data in Compustat using information on EIN and location of the business establishments. Compustat contains information from publicly traded firms' financial statements.

To link information from SDC Thomson and DowJones on venture capital financings we employ the crosswalk developed by Puri and Zarutskie (2010), which employs a name and address matching algorithm to link venture capital financed firms to firms in the LBD. Specifically, we identify firms in the LBD as VC-financed if they can be matched to firms contained in VentureXpert or VentureSource and received VC financing over our sample period. VentureXpert and VentureSource are proprietary databases maintained and sold by SDC Thomson and DowJones, respectively. We use information on which firms are VC-financed when analyzing the relation between employee age and the characteristics of new firms.

III. The Relation between Firm Age and Employee Age

We now turn to our first question, whether younger firms are more likely to employ younger workers. We first examine this question using information on all employees who work for a firm. In the following section, we examine the relative ages of new hires.

A. All Employees

Table I reports the nonparametric relation between employee age and firm age in the data. Panel A reports the relation for full sample of 4,374,025 privately and publicly held firms.

[10] The combinations are EIN, 4-digit SIC or 6-digit NAICS, state and county; EIN 3-digit SIC or 4-digit NAICS, state and county; EIN 2-digit SIC or 2-digit NAICS, state and county; EIN 1-digit SIC or 1-digit NAICS, state and county; EIN, state and county; EIN 4-digit SIC or 6-digit NAICS and state; EIN 3-digit SIC or 4-digit NAICS and state; EIN 2-digit SIC or 2-digit NAICS and state; EIN 1-digit SIC or 1-digit NAICS and state; EIN and state; EIN and 4-digit SIC or 6-digit NAICS; EIN and 3-digit SIC or 4-digit NAICS; EIN and 2-digit SIC or 2-digit NAICS; EIN and 1-digit SIC or 1-digit NAICS; and EIN only. See Abowd et al (2006) for a more detailed description of the crosswalk files.

Panel B reports the relation for the sample of 9,120 publicly held firms only. The rows of each panel correspond to age categories for employees; the columns correspond to age categories for firms. For the full sample, we measure firm age as time from first entry in the LBD, i.e., the year in which the firm hires its first employee. For the sample of publicly held firms only, we define age as time from initial public offering (IPO). The final column, Column (6), reports the average percentages for firms of all ages.

The QWI groups employees into age categories covering 10 years, beginning at age 14, and then groups employees aged 65 and older into one category. We consider the following employee age categories – younger than 25, between 25 and 34, between 35 and 44, between 45 and 55 and older than 55. We collapse the upper distribution of ages to above 55 for brevity, but find similar results when we consider the categories 55 to 64 and 65 to 99 separately. Each cell reports the average percentage of employees in a given age category for firms in a given age category.

The striking fact that emerges from Table I is that younger firms disproportionately employ younger workers. On average, 42 percent of employees in all firms aged 1 to 5 years old, and 47 percent of employees in publicly held firms aged 1 to 5 years old, are younger than 35, as reported in Column (1). Furthermore, employees under 45 represent more than two thirds of the workforce at these young firms, totaling 70 and 76 percent of employees for the full sample and set of public firms, respectively. The percentage of employees in the younger age categories fall steadily as we move across the columns and firm age increases. Employees aged 35 and younger account for only 27 and 34 percent of employment at these older firms, when considering the set of all firms and publicly traded firms, respectively. For firms older than 20 years in Column (5), around 52 (63) percent of employees are under age 45 across all (publicly-traded) firms.

We note that the sample of all firms in Table I Panel A is dominated by privately held firms. Moreover, the firms in Table I Panel A tend to be younger than the average publicly traded firm in Table I Panel B. This is because many privately held firms are started but eventually fail. To become publicly held a firm must grow to a certain size as well as meet other regulatory criteria for its equity to be publicly traded. Therefore, the sample of publicly traded firms is tilted towards older and larger firms, whereas, the sample of privately held firms is tilted towards younger and smaller firms. However, in both samples the positive relation between employee age and firm age is quite strong.

B. New Hires

While suggestive, the patterns revealed in Table I do not account for a variety of alternative factors that may be correlated with employee age and firm age. In particular, if the nature of most labor markets is such that employees look for new jobs relatively infrequently, the observed relation between average employee age and firm age could be simply due to the timing of labor market searches. Young employees are more likely to be searching for jobs relative to older employees since they may be joining the labor force for the first time or rejoining after gaining additional education or may be shopping employers to garner wage gains (e.g., Topel and Ward (1992)), whereas older employees are less likely to search for new jobs and age with the firms that hired them years before. Since jobs at young firms can be considered only by current job hunters, a relation between job search frequency and age could explain the positive relation between firm age and employee age in the data.

In Table II, we control for differences in job search frequencies across employee age by looking just at the age of new hires. Since, by definition, all new hires have recently completed a job search, any relation between firm age and employee age found in this data cannot be explained by differences in job search frequencies. As in Table I, the rows in Table II correspond to employee age categories and the columns correspond to firm age categories. Table II Panel A reports the average percentage of new hires in a given age category for firms in a given age bracket, for all privately and publicly held firms. Table II Panel B reports the average percentages of new hires in a given age category for publicly held firms only.

In Table II, we see that young workers account for a large share of new hires. Focusing on Column (6), which reports averages for all firm ages, we see that workers under age 25 make up over 27 percent of new hires in all firms and nearly 22 percent of new hires in publicly held firms. Comparing these results to Table 1, where workers under age 25 account for only 13 and 10.5 percent of employees in these firms, shows that young workers are indeed more likely to have recently done a job search, consistent with Topel and Ward (1992). However, the most common age of a new hire is between 25 and 34, with around 28 percent and 33 percent of hiring taking place for employees in this age category for all firms and publicly held firms, respectively. Moreover, workers aged 35 to 44 make up a significant fraction of new hires with 23 percent and 25 percent of new hires coming from this category for all firms and publicly traded firms, respectively. Table II presents a positive relation between age of new hires and

firm age, when we focus on workers aged 25 years and above. Column (1) reports that 29 percent of new hires at firms aged 1 to 5 years are in the 25 to 34 year old category for all firms, and 37 percent for the sample of publicly held firms. Moving across the columns by firm age, we see a steady decline in the percentage of new hires aged 25 to 34. The percentages hit 25 for all firms and 30 percent for publicly held firms when firms are aged 20 years and older, as reported in Column (5). We see a similar pattern for new hires aged 35 to 44, but with a smaller decline in percentage hired as firms age. The percentage of new hires aged 45 to 54 is relatively flat across firm age and increases by firm age for new hires older than 55.

For workers under age 25, there is not a distinct relation between firm age and the percentage of new hires in the full sample. In fact, for the sample of publicly traded firms, older firms unconditionally hire more workers under age 25, relative to younger firms. Thus, for the very youngest employees, when we consider just new hires rather than all current employees in a firm, there does not seem to be a strong positive relation between firm age and employee age. These results may be driven by the fact that these youngest workers may be seeking part-time or temporary employment opportunities which may be more readily available at older firms since these workers are more likely to still be completing their schooling.

C. Controlling for Firm Size, Industry, Geography and Time

We observe a positive relation between employee age and firm age when we only examine new hires, similar to the relation between the age of all employees and firm age. This indicates that the positive relation is not simply due to the fact that some employees may not turnover very frequently and simply age with their jobs. In fact, the data in Table II indicate that the labor market is quite active for employees in all age categories.

We next examine whether the positive employee age-firm age relation documented in Tables I and II is being driven by an omitted variable correlated with both firm age and employee age. If new firms are disproportionately created in industries which employ more young workers, then we might see that such industries have both younger workers and younger firms, but that young workers populate all firms equally in these industries. Likewise, the relation between employee age and firm age could be driven by differences in firm size, given younger firms tend to be smaller. Moreover, if there happen to be more young employees and young firms in a particular state, but young employees equally populate all firms in this state, we again might draw the wrong conclusion about the relation between employee age and firm age.

We, therefore, examine in a regression framework whether the nonparametric relations uncovered in Tables I and II hold after controlling for firm size, industry, and geography.

Table III reports estimates from OLS regressions of the fraction of firm employees in an age category on firm age categories as well as firm size, measured by the lagged logarithm of total employees and industry (4-digit SIC code), state and year fixed effects.[11,12] Panel A of Table III reports the results for the full sample of privately and publicly held firms; Panel B reports the results for the sample of publicly held firms. After controlling for firm size, industry, geography and time, the relation between employee age and firm age is strengthened. The relation is strongest when we consider employees aged 25 and older in Columns (2) to (5), once again likely due to the fact that employees under age 25 are still often completing their schooling. Firms aged 1 to 5 employ 9 percent more workers in the 25 to 34 age category, as compared to firms 20 years or older. This is an economically meaningful increase given that, on average, 23 percent of a firm's workforce is between 25 and 34 years of age, as reported in Table 1. The percentage of employees aged 25 to 34 steadily declines as we move up the firm age categories. The magnitudes are similar for the sample of publicly held firms. The relation between the percentage of employees aged 35 to 44 is relatively flat across firm age, though slightly positive for all firms and slightly negative for publicly held firms. There is a strong increase in the percentage of employees aged 45 to 54 and aged 55 and older as firms age in both samples of firms in Table III. We note that in both sample of firms, larger firms employ slightly more young workers compared to smaller firms.

We also examine whether the relation between firm age and age of new hires is robust to controlling for firm characteristics and year fixed effects. We report estimates from OLS regressions of the fraction of new hires in an age category on firm age categories, firm size and industry, state and year dummies in Table IV. Panel A reports the estimates for the full sample of privately and publicly held firms. Panel B reports the estimates for the sample of publicly held firms only. We find that the positive relation between age of new hires and firm age is robust to these controls, and is once again, strongest when we consider new hires aged 25 and older. Table IV, Panel A, Column (2) shows that the percentage of new hires aged 25 to 34 in

[11] The excluded firm age category is > 20 years old. We map NAICS codes to SIC codes for years 2002 to 2004.

[12] We also estimate logistic regressions in which the dependent variable is the log odds function of the fraction of employees in a given age category. We find our results are very similar to the OLS regressions in which the fractions of employees of a given age are the dependent variables and report these estimates for easier discussion of economic magnitudes.

firms aged 1 to 5 years is 3 percentage points higher than in firms 20 years or older in the full sample of privately and publicly held firms, a 12 percent increase as compared to the mean fraction of new hires in this age category. In Table IV, Panel B, we see that the equivalent figures are 4.4 percentage points and 15 percent in the sample of publicly traded firms. Likewise, in the full sample of firms, in Table IV, Panel A, Column (4), the percentage of new hires aged 45 to 54 in firms aged 1 to 5 is 2.1 percentage points or 14 percent lower than the percentage hired in firms older than 20. The corresponding estimate in the sample of publicly traded firms in Panel B firms is 3.6 percentage points or 23 percent.

Overall, we show that young firms disproportionately hire younger employees, a result that is robust to focusing only on new hires, rather than all current employees, and to controls for firm size, industry, geography and year. This suggests that young firms have a greater demand for young employees, in particular those aged 25 to 34 and who have likely completed their schooling, relative to older firms.

IV. Wage Differences in Young and Old Firms

If young firms hire more young employees because young employees possess attributes or skills that are relatively more important for growth, young employees in young firms should receive greater compensation relative to young employees elsewhere and compensation which is relatively more equal to their older colleagues, as compared to young employees at older firms. On the other hand, if a large reason why younger employees match to younger firms is that younger workers are less skilled and productive relative to older workers and that younger firms are less productive than older firms (e.g., Oi and Idson (1999a, 1999b)), then we should expect to see that the average wages for young employees in young firms is at least no greater than the average wages for young employees in old firms. In the following sections, we examine the relative wages of young employees in young and old firms.

A. Employee Wages

We first compare mean wages by employee age category for existing employees between young and old firms, as reported in Table V. We then explore differences in mean wages by employee age category for new hires between young and old firms, as reported in Table VI. In both cases, we separately report results using the full sample and the subset of public firms.

In Table V, we report estimates from OLS regressions that regress the logarithm of wage per employee across all employees, as well as within employee age categories, on the firm age categories, firm size, industry, geography and year. Panel A of Table V reports estimates for the full sample of privately and publicly held firms. Panel B of Table V reports estimates for the sample of publicly held firms only.

A.1. Employee Wages in Privately and Publicly Held Firms

Focusing first on the estimates for the larger sample of both privately and publicly held firms, we see in Column (1) that the average wage per employee, across all age groups, is lower at young firms. In particular, employees working for firms aged 1 to 5 years earn around 6.8 percent less than employees working at firms aged 20 years or older, and there is a steady increase in wages as firms age. However, when we decompose average wages by employee age, we see that the picture is more complicated. For younger employees, i.e., those under age 45, we see that the average wage per employee is higher in young firms, as reported in Columns (2) to (4) of Table V, Panel A. On average, employees under 25 earn 6 percent more, employees aged 25 to 34 earn 4 percent more and employees aged 35 to 44 earn 2 percent more at firms aged 1 to 5 years relative to similarly aged employees in firms 20 years or older. We see a very different pattern for employees older than 45 in Columns (5) and (6) of Table V, Panel A. Employees aged 45 to 54 are paid almost 10 percent less and employees aged 55 and older are paid 26 percent less in firms aged 1 to 5 years relative to firms older than 20 years. These large negative wage premia for older employees in younger firms contribute to the average effect observed across all employees in Column (1).

Finally, in Columns (7) and (8) of Table V, Panel A, we test whether the differences in wage premia in young firms between young and older employees is also present within the same firms or is primarily being driven by differences in young firms that employ relatively more young versus relatively more older employees. In Column (7) we regress the difference in log wage per employee between employees aged 25 to 34 and employees aged 45 to 54 within the same firm on the characteristics of the firm, including firm age.[13] We see that the wage differential between these two groups of employees is narrower at younger firms, which indicates that employees aged 25 to 34 are paid higher wage premia relative to older employees

[13] In unreported results, we see that younger workers are paid less than older workers, on average, and this holds across all firm age groups.

within the same firms. Column (8) presents regression results for the difference in wage per employee between the 35 to 44 and 45 to 54 age groups. We also see that within the same firm, employees aged 35 to 44 are paid more relative to their older colleagues in young firms, as compared to in old firms.

A.2. Employee Wages in Publicly Held Firms Only

Table V, Panel B, which presents the wage regressions for the sample of publicly held firms, shows similar wage patterns to the sample of both privately and publicly held firms. However, there are some notable differences. In the sample of publicly traded firms, we observe that all employees earn more. Given these firms are larger on average, compared to the full sample in Panel A, this is consistent with the documented firm size-wage effect (e.g., Brown and Medoff (1989)). As before, the average wage increases as employees age, until employees hit age 55 years and above, at which point the average wage per employee begins to decline. Second, the average wage per employee, across all employee ages, is higher in the youngest firm age category. Employees in publicly held firms aged 1 to 5 are paid 6.4 percent more than employees in firms 20 years or older. This is in contrast to our finding using the full set of firms where employees at young firms were paid less, on average. This result largely reflects the higher average wage paid to young employees, aged 25 to 44, in young publicly held firms. Employees aged 25 to 34 are paid 17.5 percent more and employees aged 35 to 44 are paid 21.6 percent more in the youngest firms, relative to employees of the same age in the oldest firms. In addition, employees aged 45 to 54 also command positive wage premia in young publicly held firms, earning 12.6 percent more in the youngest firms, compared to employees of the same age in the oldest firms. Employees aged 55 and older are the only age group to earn a negative wage premium in the youngest firms, earning 6.7 percent less in the youngest firms, as reported in Column (6).

As in the full sample of firms, within a given firm, the wage differential between younger and older employees narrows in young firms, so that younger employees are paid larger positive wage premia relative to older employees in young firms, as reported in Columns (7) and (8).

A.3. Wages of New Hires

We also compare the wages of new hires of younger and older employees across firm ages. In older firms, some of the older employees may have worked in the firm for many years

and, thus, earn a higher wage than older employees in young firms who have not worked with the same firm for the same amount of time. This difference could in part drive the narrower wage differential between younger and older employees in young firms relative to older firms.

Table VI presents estimates from OLS regressions of the logarithm of wage per new hire on firm age categories, firm size, industry, state, and year. Panel A presents estimates for the full sample of firms; Panel B presents estimates for publicly held firms only. Focusing first on the full sample in Panel A, we see that across all employees, new hires in young firms earn 4.7 percent higher wages in firms aged 1 to 5 years, relative to firms 20 years or older. This contrasts with the finding of lower wages for existing employees in firms aged 1 to 5 years, relative to firms 20 years or older. As surmised above, the difference appears to be driven by a set of highly compensated existing older employees at older firms. When we look at the older employee age categories in Columns (5) and (6), we now see a positive wage premia being paid to older employees who join young firms relative to older employees who join older firms, whereas, when we looked at wages across all employees, we saw a negative wage premia for older employees at young firms. Thus, even older employees who join young firms are paid higher wages, on average, than older employees who are hired by older firms. However, it still remains the case that the wage differential paid to older hires relative to younger hires is smaller at young firms, as compared to firms aged 20 or older, as evidenced by the negative coefficients on the firm age 1 to 5 year dummy in the specifications in Columns (7) and (8) of Table VI, Panel A.

In the sample of publicly held firms, we also see that the basic patterns uncovered for all employees is present when we consider new hires only, as reported in Table VI, Panel B. New hires in young firms are generally paid higher wages than new hires in old firms. The age groups that command the highest wage premia in young firms are new hires aged 25 to 34 years, who earn almost 10 percent more in young firms, as compared to firms 20 years or older, and new hires aged 35 to 44 years, who earn 11.6 percent more. We also see that within the same firm, the wage premia paid to younger hires in young firms is larger than the wage premium paid to older employees, as reported in the specifications in Columns (7) and (8), with the wage differential between younger and older employees narrowing by between 5 and 7 percent in the youngest firms.

A.4. Summary of Wage Results

We find that younger employees, especially those aged 25 to 34, earn higher wages at young firms than at older firms. This is consistent with the argument that young employees in young firms possess attributes or skills that make them relatively more productive and valuable relative to young employees in older firms. This finding is inconsistent with the argument that young employees who are less productive work for young firms which are equally less productive compared to older firms. We also find that the positive wage differential between older and younger employees is narrower within young firms. This suggests that young employees in young firms are also more skilled, or productive within the firm, relative to the older employees within the same firms, compared to young employees in older firms. [14]

The wage evidence lends support to the earlier argument that young, especially high growth, firms demand young employees with key attributes such as innovation skills or willingness to take risks. Young firms may need more young employees because these firms are trying to introduce new products or make use of new technologies or because these employees are willing and able to undertake risky projects within those firms.

However, these wage results may also be explained by alternative interpretations related to compensation for labor income risk, financial constraints and equity compensation. In the next section we further explore these alternative interpretations. We also explore alternative explanations of the young firm, younger employees relation.

V. Do Labor Income Risk, Financial Constraints, or Equity Compensation Explain Employment and Wage Differences in Young Firms?

If young firms hire more young workers because young workers are better able to tolerate the risks associated with working at a young firm, then we should observe an even higher fraction of young employees at the riskiest firms. We test this prediction using the subset of public firms and the standard deviation of sales over the past three years as a proxy for labor

[14] Another interpretation of our wage results is that old firms keep wages low for young employees with the promise of higher wages for employees who get promoted within the firm's hierarchy, as in models such as Oyer (2008) and Axelson and Bond (2009). Young firms may be less likely to pursue the same strategy because young firms have a lower chance of survival and may have less established hierarchies than older firms (e.g., Rajan and Zingales (2001)).

income risk.[15] We estimate OLS regressions similar to those in Tables III and IV in which the dependent variable is the fraction of employees who work for a firm in a given age category and in which the independent variables are firm age categories, firm employment size, 4-digit SIC industry fixed effect, state fixed effects, year fixed effects as well as an independent measure of risk to labor income of employees, as measured by standard deviation of sales over the past three years. In Table VII, we report the coefficient, followed by the t-statistic adjusted for firm-level clustering in parentheses, on the standard deviation of firm sales in these regressions. We also report the number of observations in each regression below the t-statistic. Panel A of Table VII reports the coefficient on the standard deviation of firm sales for regressions in which the dependent variable is the fraction of all employees in a firm of a given age; Panel B of Table VII reports the coefficient on the standard deviation of firm sales for regressions in which the dependent variable is the fraction of new hires by a firm of a given age.

Examining the first rows of Panels A and B of Table VII, we see that firms with more volatile sales employ fewer workers under the age of 25 but employ significantly more workers aged 25 to 34 as well as aged 35 to 44. This suggests that younger employees, in particular those aged 25 to 34 who have just recently completed their formal educations, do not shy away from working for firms in which their labor income may be riskier, at least compared to older workers. The positive coefficients on the standard deviation of firm sales for these employee age categories suggest that younger workers may be more risk tolerant, as compared to older workers, e.g., those aged 45 and older, as predicted.

The finding in Table VII that riskier firms employ more young workers suggests an alternative interpretation of our wage results. Perhaps younger employees in firms with more volatile sales are paid higher wages relative to older employees in the same firms to compensate them for additional labor income and career risk. In wage regressions similar to those in Tables V and VI, we regress the log wage per employee on firm age, firm size, industry, state and year dummies as well as the standard deviation of sales of the firm over the past three years. In Table VIII, we report the coefficient and t-statistic for the standard deviation of firm sales as well as the number of observations in each regression. The first two columns of Table VIII report the

[15] The idea behind this measure is that if sales are more volatile wages may be less certain in the future. In addition, higher volatility of sales may mean a greater chance of firm failure or bankruptcy. Baily (1977) argues that a large fraction of layoffs are caused by fluctuations in demand. The theoretical argument in Baily (1977) is supported by Hallock (2009) which finds that "slump in demand" is the most common justification given by firms upon announcing large layoffs. Furthermore, we find that our results hold when we use alternative measures of firm risk, such as stock return sigma as well as idiosyncratic risk.

coefficients on the standard deviation of sales when the dependent variables are the log of wage per employee and log of wage per new hire across all employee ages. We see that when the standard deviation of firm sales is higher the average wage paid per employee and new hire is also higher, suggesting that employees demand higher wages to compensate for labor income risk generally.[16] In particular, a one standard deviation increase in the log standard deviation of sales increases average wages by 27 percent. In unreported regressions broken out by employee age, we also see that employees across all ages earn higher wages when the standard deviation of sales is higher.

The last four columns of Table VIII report the coefficients on standard deviation of firm sales when the dependent variables are the differences in log wages between older employees, i.e., those aged 45 to 54, and younger employees, i.e., those aged 25 to 34 and those aged 35 to 44. We see in Columns (3) and (4) that employees aged 45 to 54 earn even higher wages relative to employees aged 25 to 34 when the standard deviation of firm sales increases; however, 35 to 44 year olds earn slightly more than 45 to 54 year olds when firm risk increases. Thus, there does not seem to be evidence that younger employees are paid higher wages relative to older employees to compensate them for labor income risk at firms with more volatile sales. This evidence also suggests that the higher wages earned by young employees relative to older employees at young firms is not due to younger employees demanding greater compensation because they are less willing to bear labor income risk.

We next examine whether the employment and wage patterns we observe for young firms relative to older firms could be driven by financial constraints. It has been documented that younger firms are more likely to be financially constrained than older firms (e.g., Petersen and Rajan (1994) and Hadlock and Pierce (2010)). Is it the case that younger employees demand higher wage compensation relative to older employees because they demand more insurance against not being paid in the future if the firm cannot raise enough capital, but that younger firms may still hire more young employees because they are relatively cheaper than older employees?

To examine this explanation we include a dummy for whether a firm is financially constrained, as measured by whether a firm has a public bond rating, in the employment regressions estimated in Tables III and IV. Faulkender and Petersen (2006) find that firms with a public bond rating have more access to debt markets and subsequently also have higher leverage

[16] This result is consistent with the intuition in Berk, Stanton and Zechner (2010). The authors argue that employees can gauge a firm's risk and will expect higher compensation at riskier firms.

ratios, which indicates that firms without a public bond rating may be more limited in how much they can borrow. We report the coefficients and t-statistics, adjusted for firm-level clustering, for the financial constraint dummy variable followed by the number of observations in these employment regressions in the second rows of Panels A and B of Table VII. From Table VII, we see that financially constrained firms employ and hire more workers aged 25 and younger, with these employees comprising a 3.8 percentage point greater share of financially constrained firms' workforces and a 4.9 percentage point greater share of financially constrained firms' new hires. Employees aged 25 to 34 comprise a 1 percentage point greater share of financially constrained firms' workforces, but make up less of their share of new hires by 1.6 percentage points. Employees aged 35 and older make up smaller percentages of the employee workforces and new hires of financially constrained firms. However, the coefficients on the share of employees aged 55 and older are statistically insignificant. These coefficients on the financially constrained dummy indicate that financially constrained firms employ and hire more employees at the lowest edge of the age distribution. This suggests that financially constrained firms may rely more on temporary, part time, or less skilled employees in fulfilling their labor needs. This evidence is inconsistent with the explanation that the young firms in our data hire more employees aged 25 to 34 in response to financial constraints.

We further examine the relative wages paid by financially constrained firms by estimating wage regressions similar to those in Tables V and VI, with the inclusion of the financially constrained firm dummy. We report the coefficients, t-statistics and number of observations for each regression in the second row of Table VIII. From columns (1) and (2), we see that financially constrained firms pay wages that are between 27.7 percent and 24.5 percent lower to all employees and new hires, respectively. In fact, across all employee age categories, employees and new hires are paid less in financially constrained firms, but as Columns (3) and (4) indicate, the wage differential between older employees, those aged 45 to 54, younger employees, those aged 25 to 34, is narrower at financially constrained firms. In Columns (5) and (6) we report that there is no statistical difference in the wage differential between employees 45 to 54 and employees 35 to 44 at financially constrained firms, as compared to the rest of the sample. The negative wage premia paid to employees in financially constrained firms is inconsistent with an argument that the positive wage premia paid to employees in young firms, in particular the younger employees, is due to premia demanded for insurance against financial

constraints, as measured by the lack of a credit rating.[17] Rather the evidence presented in Table VIII suggests that financially constrained firms hire less productive or part-time and temporary employees to whom they pay lower wages as compared to unconstrained firms.[18]

Finally, we consider whether differences in equity compensation between younger and older employees in young firms could explain why younger employees earn a higher premium relative to older employees in young firms. While stock options are reported in total wages and salary in the LEHD data, these data may not capture the true value of the equity ownership of employees since the value of stock options may only be reported when they are granted and we cannot separate wages from stock options in the data. If older employees in younger firms have more stock relative to wage compensation, then this may explain the wage differential between younger and older employees in young firms. To test this alternative interpretation, we explore cross sectional variation in wages for firms with a relatively greater or weaker reliance on equity-based compensation. From Execomp, we calculate the fraction of management compensation that is comprised of stock options and include it in the employment and wage regressions estimated earlier in Tables VI and VIII. As we cannot observe the equity compensation of rank and file employees in Compustat firms, we use the fraction of compensation that management receives as equity as a proxy for the pervasiveness of equity compensation throughout the firm.[19] The third row of Table VII reports the coefficients and t-statistics on the equity compensation variable in the employment regressions. We see that firms where equity compensation is more pervasive employ and hire more workers aged 25 to 34 as well as 35 to 44. This is consistent with the employee age results we observe for young firms and is also consistent with younger employees being more willing to work for or being in greater demand by firms that link compensation more closely to firm equity performance.

Turning to the wage regressions in Table VIII, the coefficients in the third row for columns (1) and (2) show that in firms where equity compensation is more pervasive, wages are higher across all employee ages. In particular, a one standard deviation increase in the ratio of stock options to salary of executives in a firm is associated with an 8 percent increase in

[17] We also find similar results when we use alternative measures of financial constraints, including whether firms pay a dividend and the firm-level index developed by Whited and Wu (2006)

[18] In addition, the lower wages paid to older employees relative to younger employees in financially constrained firms suggest that older employees may be more willing to take pay cuts when a firm is financially constrained in order to increase job security in the future since they may have more firm-specific human capital at stake that contributes to their wages at the firm.

employee wages. This suggests that employees in firms with greater equity compensation may be more skilled or productive relative to employees in firms with less equity compensation. Moving to columns (3) and (4) we see that the wage differential between employees aged 45 to 54 are employees aged 25 to 34 widens when equity compensation is more pervasive. The wage differential between employees aged 35 to 44 and employees aged 25 to 34 is uncorrelated with the use of equity compensation, as reported in columns (5) and (6). Thus, the evidence presented in Table VII suggests that differences in equity compensation provided to older rank and file employees does not appear to explain the larger positive wage premia earned by young employees relative to older employees in young firms.

In this section, we examined alternative explanations for the higher density of younger workers at young firm and the higher relative wages paid to younger employees in young firms. We do not find evidence that the higher relative wages for young employees at young firms are driven by younger employees demanding higher wages as compensation for greater labor income risk at young firms. In fact, we find that firms in which labor income risk is greater employ larger shares of younger employees. We do not find evidence that the large number of employees aged 25 to 34 in young firms is driven by financial constraints, nor do we find strong evidence that differences in equity compensation drive the higher wages paid to young employees relative to older employees in young firms. Rather our wage results seem most consistent with greater demand by young firms for young employees with skills, such as innovation skills, that make them relatively more productive and valuable in young firms. Moreover, we have seen evidence in this section consistent with larger shares of younger employees joining young firms because they are more willing to bear the risk of working for young, riskier, firms.

VI. Employee Age and Young Firm Growth

In the previous sections we show that young firms disproportionately hire young employees and that young employees earn relatively higher wages in young firms. We argue that these findings are most consistent with young employees possessing skills or attributes, such as innovation skills or willingness to take risk, that are particularly valuable for young firms. We

[19] Ittner, Lambert and Larcker (2003) show that many variables which predict managerial stock ownership also predict employee stock ownership.

now examine whether variance in reliance on young employees within young firms can explain variance in the performance of young firms. Young employees may be associated with higher firm growth by both matching to firms where they anticipate growth, because they have a greater preference to work for such firms, and by contributing directly to firm performance via their skills and actions within the firm.

A. Employee Age and Young Firm Outcomes

If younger employees in young firms are more skilled or productive, we might expect that the young firms that employ more young workers will exhibit different outcomes relative to young firms that employ fewer young workers. For example, young firms that employ more young workers may exhibit higher growth, relative to other young firms, if younger workers are more productive, risk-taking or innovative, as such firms may more rapidly capture market share. We therefore examine the correlation between the workforce age composition of young firms at their inception and several outcomes of these firms.

We focus on three outcomes – whether a firm receives venture capital (VC) financing, whether the firm fails within five years of being, and the growth in employment over five years for surviving firms. VC financing has been shown to be correlated with rapid firm growth, innovation in the product market, and higher likelihood of a firm going public and getting acquired (e.g., Hellman and Puri (2000), Gompers and Lerner (2001), and Puri and Zarutskie (2010)). If younger workers join young firms that are more likely to be innovative and grow more quickly, we should expect that young firms that receive VC financing employ greater shares of younger workers ex ante. We also examine firm failure and employment growth. If young employees disproportionately join young, high growth, firms, we should see that the firms that exhibit higher growth, and possibly higher failure rates, employ larger shares of young workers ex ante.[20] Exploring firm survival and employee growth rates can lead to additional insight as compared to just examining VC financing given the small number of firms which eventually receive VC funding. Table VIII reports coefficients and t-statistics for a VC financing dummy, the five year failure rate and the five year employment growth rate in regressions of the fraction of employees in a certain age group employed by firms at their inception, or first year in the LBD, on the outcome variable. Included in the regressions as

controls are also the initial number of employees of the firm, and the firm's industry, geography and year the firm was started. [21] Panel A of Table IX reports results estimated on new firms in all industries; Panel B of Table IX reports results estimated only on "high tech" new firms, i.e., those in the Computer, Telecom and Electronics industries, which are often viewed to be the fastest growing sectors over our sample period of 1992 to 2004.

We first focus on whether new firms that receive VC financing exhibit different patterns in the age composition of their initial employee workforces. The first rows of Panels A and B in Table IX reports that VC financing is associated with firms that employ more young workers, in particular those aged 25 to 34 as well as aged 35 to 44. In the sample of all new firms, we see that firms that subsequently receive VC financing initially employ shares of workers aged 25 to 34 that are 7 percentage points higher, on average, than firms that do not subsequently receive VC. Firms that subsequently receive VC initially employ shares of workers aged 35 to 44 that are 4.5 percentage points higher, on average, than firms that do not subsequently receive VC. These figures are 4.5 percentage points for both age categories in VC-financed high tech new firms, as reported in Panel B.

We find similar results when we examine the coefficients on the dummy for whether a new firm fails in the first five years and on the five year employment growth rate of new firms that do survive in Table IX. We see that the fraction of initial employee workforces made up by employees aged 25 to 34 between firms that fail within five years and those firms that survive is relatively similar. Employees aged 25 to 34 make up about 1 percentage point more of the employee base at firms that fail within five years; employees aged 35 to 44 make up around 2 percentage points fewer of the employees at firms that fail within five years. We also see that younger employees aged 25 to 34 are associated with new firms that experience faster growth. A one standard deviation in the 5 year employment growth rate of new firms is associated with an increase in the percentage of the new firm's initial employee base comprised of workers aged

[20] It is not obvious, however, that firm failure should be higher for young firms that employ more young workers, since these firms may be of a higher general quality all around, or be more likely to attract capital from external investors, relative to the young firms that hire older workers.

[21] An alternative regression specification would be to predict the outcome of the firm, e.g., receives VC, fails, 5 year growth rate, as a function of the fraction of initial employees in each of the age categories. Such regressions result in the same conclusions about the correlations between initial employee workforce age composition and subsequent firm outcomes. Because we are measuring correlations between ex ante employee workforce age composition and subsequent firm outcomes in either set of regressions (i.e., we cannot argue that ex ante workforce composition causes subsequent firm outcomes, but we also cannot rule it out), we choose to report regression results using ex ante workforce age composition as the dependent variables to better illustrate how subsequent young firm outcomes are associated with the fraction of the firm's initial employees in each of the age categories.

25 to 34 by around 3 percentage points for all industries and 4.5 percentage points in high tech industries. These characteristics of new firms are in line with those documented to be correlated with high growth, innovative, young firms, such as those also likely to receive VC financing.

The evidence on new firm outcomes suggests that younger workers, in particular those aged 25 to 34, match to more successful, higher growth new firms within a given firm size, industry and geography. This evidence is consistent with the interpretation that young employees in young firms have the skills or attributes demanded by young firms that are likely to grow more rapidly in the early part of the firm lifecycle.

B. When Do Young Workers Join Young Firms?

In the previous section, we show a greater presence of young employees predicts future firm growth in the cross-section. In this section, we look across time to see whether young employees are more likely to join young firms in industries with greater investment opportunities and high expected growth rates. If young firms demand young employees because they possess skills or attributes that are particularly valuable for firm growth, these skills should be even more valuable when opportunities to invest are high and young firms have higher potential growth.

In Table X Panel A, we present regression estimates of the fraction of workers aged 25 to 34 who join new firms in an industry-year as a function of several measures of investment opportunity in the industry-year. Our measures of investment opportunity are taken from the equity markets. We use the lagged log number of IPOs, lagged log of Tobin's Q, and lagged log market capitalization of publicly traded firms in a given industry-year.[22,23] If young workers join young firms when there are more opportunities to invest, innovate and grow, we should expect

[22] See Gompers et al (2008) for a discussion of measures of investment opportunity.

[23] We employ nine broad measure of firm industry often used to characterize startups in databases such as VentureXpert and VentureSource. We map these categories to 4-digit SIC codes as follows. A firm is in the "Computer" industry if its primary SIC code is 3570-5379, 5044, 5045, 5734, or 7370-7379. A firm is in the "Biotech/Medical" industry if its primary SIC code is 2830-2839, 3826, 3841-3851, 5047, 5048, 5122, 6324, 7352, 800-8099, or 8730-8739 excluding 8732. A firm is in the "Electronics" industry if its primary SIC code is 3600-3629, 3643, 3644, 3670-3699, 3825, 5065, or 5063. A firm is in the "Telecom" industry if its primary SIC code is 3660-3669 or 4810-4899. A firm is in the "Consumer Goods" industry if its primary SIC code is 2310-2325, 2329, 2331-2342, 2360-2389, 2392, 2510-2519, 2844, 3140-3149, 3630-3639, 3931, 3942, 3944, 3946, 5023, 5064, 5091, 5092, 5094, 5136, 5137, 5139, 5140-5149, 5180, 5181, 5182, 5192, 5194, 5199, 5411, 5421, 5431, 5441, 5451, 5499, 5531, 5610-5699, 5710-5731, 5735, 5736, 5812, 5183, 5910-5963, 5992, 5993, 5994, or 5999. A firm is in the "Finance" industry if its primary SIC code is 6020-6062, 6090-6099, 6111-6289, 6311, 6321, 6331, 6351, 6361, 6411, 6510-6553, 6712,6722, 6726, or 6790-6799. A firm is in the "Business Services" industry if its primary SIC code is 7310-7349 or 8710-8748. A firm is in the "Industrial Goods" industry if its primary SIC code is 1311, 1381, 1382, 1389 or in a manufacturing SIC code, 2010-3999, not already used to define the previous seven industries. A firm is in the "Other" industry if its primary SIC code is not used to define any of the previous eight industries.

that more young workers join young firms in an industry when there are positive signals for investment and growth.

Column (1) of Table X, Panel A reports the coefficient on the IPO signal variable, Column (2) reports the coefficient on the log of Tobin's Q, and Column (3) reports the coefficient on the log of market capitalization. We find that the fraction of workers younger than 35 employed by new firms in an industry year increases when there have been positive signals of investment opportunity in recent years. A one standard deviation increase in past IPO activity increases the percentage of young workers that join new firms by half a percentage point. A one standard deviation in Tobin's Q increases the percentage of young workers joining the industry by around a quarter of a percentage point. Finally, a one standard deviation in total equity capitalization in an industry increases the percentage of young workers who join new firms by one percentage point. Thus, according to all three measures of investment opportunity, young workers disproportionately join new firms when there are positive signals of investment and growth opportunity in an industry. This evidence further supports the argument that young firms demand young employees because they possess technical or risk-taking skills. Such skills or attributes should be more valuable to young firms when there are greater opportunities to invest and grow.

C. Does the Supply of Young Workers Affect New Firm Creation?

In the previous sections we showed that young firms disproportionately employ young workers and that young employees earn relatively higher wages in young firms, consistent with young employees possessing skills or attributes that are particularly valuable for young firms. If young employees are a critical component for new firms, we should also expect to find that exogenous changes to the supply of young workers will affect new firm creation. In this section we test this prediction.

We use the historic ratio of adolescents and young adults in the population as a proxy for the number of young workers in an area 10 years later. Specifically, we calculate the ratio of the population in a state between 15 and 24 years of age, as compared to the population between 15 and 54 years of age, using data provided by the US Census. We find the historic ratio, lagged 10 years, is a strong predictor of age groups in the same state, after controlling for state fixed

effects.[24] We argue this lagged ratio not only reflects the supply of young workers in a given state, but most importantly, is not likely to be driven by current job opportunities, at least when used in a regression after controlling for time invariant differences across states.

The typical approach would be to use this variable as an instrument in a 2SLS estimation. However, the Census does not provide state-level age distribution data from 1991 onwards. Thus, in order to maximize the sample years used in the estimation, we instead use the lagged age ratio directly as a proxy for the supply of young workers in a given state which is not likely to be driven by current job opportunities.

Panel B of Table X presents the OLS regressions which predict new firm creation in a state as a function of the fraction of the population aged 15 to 24, lagged by 10 years. The sample in this regression is limited to 1980 to 2000. Column (1) excludes state and year fixed effects; Column (2) includes state and year fixed effects. Focusing on Column (2), we see that the historic fraction of the population aged 15 to 24 positively predicts new firm creation rates. In particular, a one standard deviation increase in the fraction of the historic population aged 15 to 24 increases the new firm creation rate by around 2 percentage points. This is an economically meaningful change, moving the percentage of new firms from 4 to 6 percent. Thus, there appears to also be a causal relationship between supply of young workers and new firm creation.

The evidence presented in this section further supports the argument that young workers are a necessary ingredient for the creation and growth of new firms, due to their unique skills or willingness to work for new ventures, and buttresses our previous results that young, high growth, firms disproportionately hire younger employees and pay them higher relative wages.

VII. Conclusion

Young firms are widely agreed to be an important part of economic growth, yet many questions remain about what distinguishes young firms that grow rapidly from those that do not. In particular, we know very little about the employees that join young, high growth firms, despite the fact that labor is a key input in many high growth startups and despite a growing recognition that labor is an important factor in the financing and valuation of firms. Previous studies on the

[24] In an unreported regression, we find that the fraction of people aged 15 to 24 from 10 years prior is a significant predictor of people aged 25 to 34, with a coefficient of 0.8, using the available sample years of 1970 to 1990. We include state and year fixed effects in this regression.

drivers of firm creation and growth have largely focused on the role of firm founders and CEOs, entry regulations, and access to financial capital.

This paper is the first to our knowledge to provide large scale evidence on the characteristics of the rank and file employees who join young, high growth, firms using matched employer-employee microdata from the U.S. Census Bureau. In so doing, we shed light on the employee characteristics demanded by young, high growth firms and how the relative supply of such employees may conditionally impact the creation and growth of firms.

We present evidence that young employees possess skills or attributes, for example greater willingness to take risk or innovative abilities, which make them relatively more valuable in young, high growth firms. We first show that young firms disproportionately hire younger workers. On average, 45 percent of employees working for firms aged 1 to 5 years are under the age of 35 and over 70 percent are under the age of 45; whereas in established firms twenty years or older, nearly half of the employees are older than 45 and fewer than a third of employees are under the age of 35. We find this positive relation between employee age and firm age holds in large publicly held firms as well as at smaller privately held firms and when we examine only the age distribution of new hires.

We next examine whether young employees receive greater compensation in young firms relative to other young employees in older firms and relative to older employees in the same young firms. If young firms hire more young employees because young employees possess attributes or skills that are relatively more important for growth, then young employees in young firms should receive greater relative compensation. Indeed, we find that young employees in young firms earn higher wages than young employees in older firms. Moreover, young employees in young firms earn wages that are relatively more equal to the wages earned by older employees within the same firm.

We examine whether the greater share of young employees at young firms and the higher relative wages of young employees in young firms can be explained by labor income risk, financial constraints or differences in use of equity compensation. We find that firms in which labor income risk is greater, controlling for firm age, employ larger shares of younger employees, consistent with young employees having a greater tolerance for labor income risk. We do not find evidence that the young employees earn higher relative wages at riskier firms, controlling for firm age, however. Rather our wage results are most consistent with greater demand by young firms for young employees with skills, such as innovation skills, that make

them relatively more productive and valuable in young firms. We do not find evidence that the large number of young employees in young firms is driven by financial constraints, nor do we find strong evidence that differences in equity compensation drive the higher wages paid to young employees relative to older employees in young firms.

We further show that the subsequent performance of young firms is strongly linked to the composition of their initial employee workforces. Young firms that are started with greater shares of younger relative to older workers subsequently grow faster and receive venture capital financing more often. In addition, we find that younger workers are more likely to join new firms in an industry when there are positive financial market signals of investment opportunity and growth, which suggests that young firms have an even greater demand for young employees when signals of investment opportunity are high and when young employees' skills or attributes will be most valuable in the firm.

Finally, we find evidence that the supply of young workers affects the rate of new firm creation, with fewer new firms being created when there are fewer available young workers in a region. Using historical demographic information on the relative ratio of youth in a state as a predictor for the ratio of younger to older workers ten years later, we argue that a causal relationship exists between the supply of young workers and the rate of new firm creation.

Overall, our analysis indicates that young employees are an important ingredient in the creation and growth of young firms. Our results hold relevance for investors and CEOs in young firms as well as policy makers wishing to foster entrepreneurship. Our findings also point to future research questions. How might the need to attract and compensate young employees, or employees who share similar attributes, influence the financing choices of young firms or otherwise interact with financial constraints? Finally, what do shifting workforce demographics mean for new firm creation rates and their subsequent dynamics?

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Table I. The Relation between Firm Age and Employee Age

The data are taken from the union of the LEHD and LBD databases between years 1992 to 2004. The table reports the average percentage of employees in an age category in firms across six firm age categories. The final column reports the average percentage of workers in an age category for all firms in the data sample. Panel A reports perecentages for all firms, i.e., both privately and publicly held firms. Age is defined as number of years a firm is in the LBD. Panel B reports percentages for publicly held firms only. Age is defined as the number of years from a firm's initial public offering.

	Firm Age					
	Ages 1-5	**Ages 6-10**	**Ages 11-15**	**Ages 16-20**	**Ages >20**	**All Ages**
Panel A - Employees of Privately and Publicly Held Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
# of firm-years	5,707,524	4,721,282	3,270,204	2,784,016	3,702,546	20,185,572
# of firms	2,557,082	1,609,913	1,066,899	912,421	741,075	4,374,025
% of employees aged						
< 25 years	15.9%	13.9%	12.5%	11.2%	9.4%	13.0%
25-34 years	26.9%	24.2%	22.2%	21.0%	17.5%	23.0%
35-44 years	28.0%	28.1%	26.9%	25.3%	24.7%	26.9%
45-54 years	18.1%	20.3%	22.4%	23.0%	23.8%	21.0%
>55 years	11.0%	13.5%	16.0%	19.6%	24.6%	16.1%
Panel B - Employees of Publicly Held Firms Only						
	(1)	(2)	(3)	(4)	(5)	(6)
# of firm-years	3,457	7,104	7,904	11,143	17,215	46,823
# of firms	1,969	2,949	3,032	3,371	3,422	9,120
% of employees aged						
< 25 years	12.0%	11.2%	10.8%	10.3%	9.8%	10.5%
25-34 years	35.4%	33.8%	31.3%	28.8%	23.8%	28.7%
35-44 years	29.4%	30.1%	30.2%	29.9%	29.5%	29.8%
45-54 years	16.4%	17.3%	18.6%	20.0%	23.8%	20.5%
>55 years	6.8%	7.6%	9.2%	10.9%	13.1%	10.6%

Table II. The Relation between Firm Age and Age of New Hires

The data are taken from the union of the LEHD and LBD databases between years 1992 to 2004. The table reports the average percentage of new hires in an age category in firms across six firm age categories. The final column reports the average percentage of new hires in an age category for all firms in the data sample. Panel A reports perecentages for all firms, i.e., both privately and publicly held firms. Age is defined as number of years a firm is in the LBD. Panel B reports percentages for publicly held firms only. Age is defined as the number of years from a firm's initial public offering.

	Firm Age					
	Ages 1-5	**Ages 6-10**	**Ages 11-15**	**Ages 16-20**	**Ages >20**	**All Ages**
Panel A - New Hires of Privately and Publicly Held Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
# of firm-years	5,106,216	2,900,703	1,987,184	1,685,182	2,309,702	13,988,987
# of firms	2,540,870	1,110,922	730,009	637,275	540,366	4,104,611
% of new hires aged						
< 25 years	25.3%	29.3%	29.2%	28.7%	27.2%	27.4%
25-34 years	28.7%	28.1%	27.3%	27.3%	25.3%	27.6%
35-44 years	24.1%	22.2%	22.1%	21.9%	22.4%	22.9%
45-54 years	14.1%	12.9%	13.4%	13.6%	14.9%	13.8%
>55 years	7.9%	7.5%	8.0%	8.6%	10.1%	8.3%
Panel B - New Hires of Publicly Held Firms Only						
	(1)	(2)	(3)	(4)	(5)	(6)
# of firm-years	3,442	6,860	7,545	10,771	16,911	45,529
# of firms	1,976	2,862	2,932	3,277	3,388	9,007
% of new hires aged						
< 25 years	18.7%	20.0%	21.1%	22.9%	23.1%	21.9%
25-34 years	37.4%	36.0%	34.9%	33.8%	30.0%	33.2%
35-44 years	26.0%	26.0%	25.4%	24.6%	24.9%	25.2%
45-54 years	13.3%	13.3%	13.6%	13.4%	15.5%	14.2%
>55 years	4.5%	4.7%	5.0%	5.2%	6.4%	5.5%

Table III. The Relation between Firm Age and Employee Age - Regression Analysis

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the fraction of employees in an age cateogry as the dependent variable. The independent variables are firm age categorical variables and the lagged log number of employees at a firm. Included in each specification are 4-digit SIC code fixed effects, state fixed effects and year fixed effects. The unit of observation is a firm-year. Panel A reports perecentages for all firms, i.e., both privately and publicly held firms. Age is defined as number of years a firm is in the LBD. Panel B reports percentages for publicly held firms only. Age is defined as the number of years from a firm's initial public offering. T-statistics adjusted for clustering by firm are reported in parentheses. *** indicates statistical significance at the 1% level.

Panel A - Employees of Privately and Publicly Held Firms

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Fraction of employees aged < 25	Fraction of employees aged 25-34	Fraction of employees aged 35-44	Fraction of employees aged 45-54	Fraction of employees aged >55
Firm Age 1-5 years	0.067 ***	0.089 ***	0.039 ***	-0.052 ***	-0.143 ***
	(249.56)	(266.98)	(104.30)	(-141.43)	(-344.96)
Firm Age 6-10 years	0.048 ***	0.062 ***	0.037 ***	-0.031 ***	-0.116 ***
	(194.27)	(201.82)	(103.41)	(-86.93)	(-290.75)
Firm Age 11-15 Years	0.033 ***	0.041 ***	0.023 ***	-0.009 ***	-0.088 ***
	(131.46)	(129.14)	(64.40)	(-25.60)	(-214.35)
Firm Age 16-20 Years	0.017 ***	0.020 ***	0.008 ***	0.004 ***	-0.050 ***
	(79.37)	(70.23)	(25.38)	(11.55)	(-135.48)
Lagged Log(Firm Employees)	0.014 ***	0.022 ***	0.004 ***	-0.014 ***	-0.026 ***
	(165.05)	(222.91)	(33.51)	(-121.47)	(-220.87)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
N	15,058,835	15,058,835	15,058,835	15,058,835	15,058,835
R^2	0.093	0.054	0.015	0.031	0.093

Panel B - Employees of Publicly Held Firms Only

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Fraction of employees aged < 25	Fraction of employees aged 25-34	Fraction of employees aged 35-44	Fraction of employees aged 45-54	Fraction of employees aged >55
Firm Age 1-5 years	0.063 ***	0.098 ***	-0.020 ***	-0.072 ***	-0.069 ***
	(11.21)	(19.37)	(-4.45)	(-18.33)	(-20.51)
Firm Age 6-10 years	0.048 ***	0.082 ***	-0.008 ***	-0.065 ***	-0.057 ***
	(11.66)	(25.14)	(-2.69)	(-23.82)	(-22.28)
Firm Age 11-15 Years	0.035 ***	0.056 ***	-0.002	-0.047 ***	-0.042 ***
	(9.18)	(19.26)	(-0.70)	(-18.78)	(-18.35)
Firm Age 16-20 Years	0.014 ***	0.028 ***	0.005 ***	-0.025 ***	-0.022 ***
	(5.70)	(13.29)	(2.47)	(-12.70)	(-12.95)
Lagged Log(Firm Employees)	0.012 ***	0.003 ***	-0.004 ***	-0.005 ***	-0.006 ***
	(15.29)	(4.90)	(-6.19)	(-7.41)	(-10.00)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
N	37,359	37,359	37,359	37,359	37,359
R^2	0.081	0.205	0.075	0.145	0.178

Table IV. The Relation between Firm Age and Age of New Hires - Regression Analysis

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the fraction of new hires in an age cateogry as the dependent variable. The independent variables are firm age categorical variables and the lagged log number of employees at a firm. Included in each specification are 4-digit SIC code fixed effects, state fixed effects and year fixed effects. The unit of observation is a firm-year. Panel A reports perecentages for all firms, i.e., both privately and publicly held firms. Age is defined as number of years a firm is in the LBD. Panel B reports percentages for publicly held firms only. Age is defined as the number of years from a firm's initial public offering. T-statistics adjusted for clustering by firm are reported in parentheses. *** indicates statistical significance at the 1% level.

Panel A - New Hires of Privately and Publicly Held Firms

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Fraction of new hires aged < 25	Fraction of new hires aged 25-34	Fraction of new hires aged 35-44	Fraction of new hires aged 45-54	Fraction of new hires aged >55
Firm Age 1-5 years	0.024 ***	0.031 ***	-2.214E-04	-0.021 ***	-0.034 ***
	(50.72)	(81.26)	(-0.62)	(-69.58)	(-125.42)
Firm Age 6-10 years	0.025 ***	0.021 ***	-0.001 ***	-0.017 ***	-0.028 ***
	(55.34)	(59.63)	(-4.32)	(-60.62)	(-107.82)
Firm Age 11-15 Years	0.022 ***	0.013 ***	-0.003 ***	-0.012 ***	-0.021 ***
	(47.47)	(34.00)	(-7.64)	(-38.96)	(-76.91)
Firm Age 16-20 Years	0.014 ***	0.005 ***	-0.003 ***	-0.006 ***	-0.011 ***
	(32.58)	(14.58)	(-7.31)	(-18.58)	(-43.23)
Lagged Log(Firm Employees)	0.004 ***	0.012 ***	-0.001 ***	-0.005 ***	-0.011 ***
	(32.59)	(122.33)	(-8.71)	(-66.24)	(-148.95)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
N	9,363,445	9,363,445	9,363,445	9,363,445	9,363,445
R^2	0.064	0.022	0.013	0.017	0.030

Panel B - New Hires of Publicly Held Firms Only

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Fraction of new hires aged < 25	Fraction of new hires aged 25-34	Fraction of new hires aged 35-44	Fraction of new hires aged 45-54	Fraction of new hires aged >55
Firm Age 1-5 years	0.025 ***	0.044 ***	-0.015 ***	-0.036 ***	-0.018 ***
	(3.51)	(8.32)	(-3.23)	(-10.09)	(-8.79)
Firm Age 6-10 years	0.020 ***	0.030 ***	-0.008 ***	-0.026 ***	-0.017 ***
	(3.87)	(8.81)	(-2.63)	(-9.91)	(-10.30)
Firm Age 11-15 Years	0.016 ***	0.024 ***	-0.008 ***	-0.018 ***	-0.014 ***
	(3.20)	(7.37)	(-2.74)	(-7.40)	(-9.29)
Firm Age 16-20 Years	0.005	0.014 ***	-0.001	-0.010 ***	-0.007 ***
	(1.34)	(5.58)	(-0.60)	(-5.30)	(-5.41)
Lagged Log(Firm Employees)	0.018 ***	-0.002 ***	-0.007 ***	-0.006 ***	-0.003 ***
	(16.21)	(-2.95)	(-11.21)	(-11.13)	(-8.72)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
N	36,384	36,384	36,384	36,384	36,384
R^2	0.087	0.090	0.041	0.057	0.059

Table V. Do Wages of Young Employees Differ by Firm Age?

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the log wage (in year 2005 dollars) per worker in a given age category as the dependent variable. The independent variables are firm age categorical variables and the lagged log number of employees at a firm. Included in each specification are 4-digit SIC code fixed effects, state fixed effects and year fixed effects. The unit of observation is a firm-year. Panel A reports results using the full sample of all privately and publicly held firms. Panel B reports results for the sample of publicly held firms only. T-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A - Wages of All Employees of Privately and Publicly Held Firms

	(1) Log(wage/employee) all employees	(2) Log(wage/employee) aged < 25	(3) Log(wage/employee) aged 25-34	(4) Log(wage/employee) aged 35-44	(5) Log(wage/employee) aged 45-54	(6) Log(wage/employee) aged >55	(7) Log(wage/employee) diff between 45-54 and 25-34 age categories	(8) Log(wage/employee) diff between 45-54 and 35-44 age categories
Firm Age 1-5 years	-0.068 ***	0.062 ***	0.040 ***	0.024 ***	-0.099 ***	-0.260 ***	-0.156 ***	-0.124 ***
	(-58.56)	(32.86)	(29.55)	(16.97)	(-61.87)	(-133.41)	(-90.51)	(-74.93)
Firm Age 6-10 years	-0.059 ***	0.025 ***	0.007 ***	0.020 ***	-0.071 ***	-0.236 ***	-0.095 ***	-0.090 ***
	(-53.01)	(14.01)	(5.22)	(14.82)	(-47.12)	(-128.70)	(-60.00)	(-58.94)
Firm Age 11-15 years	-0.031 ***	0.008 ***	-0.004 ***	0.011 ***	-0.008 ***	-0.166 ***	-0.020 ***	-0.023 ***
	(-27.69)	(4.49)	(-2.71)	(8.14)	(-5.02)	(-88.89)	(-12.28)	(-14.73)
Firm Age 16-20 years	0.001	-0.001	0.001	-0.006 ***	0.038 ***	-0.063 ***	0.025 ***	0.034 ***
	(0.61)	(-0.63)	(0.90)	(-4.86)	(27.46)	(-38.71)	(16.41)	(23.31)
Lagged Log(Firm Employment)	0.168 ***	0.212 ***	0.188 ***	0.210 ***	0.209 ***	0.213 ***	0.016 ***	-0.012 ***
	(442.31)	(381.83)	(447.67)	(462.45)	(408.43)	(351.19)	(34.45)	(-27.87)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	15,058,835	6,498,157	8,961,775	9,970,437	8,988,197	7,487,130	5,872,541	6,447,768
R^2	0.2957	0.1382	0.2297	0.243	0.2477	0.2425	0.0258	0.01

Panel B - Wages of All Employees of Publicly Held Firms Only

	(1) Log(wage/employee) all employees	(2) Log(wage/employee) aged < 25	(3) Log(wage/employee) aged 25-34	(4) Log(wage/employee) aged 35-44	(5) Log(wage/employee) aged 45-54	(6) Log(wage/employee) aged >55	(7) Log(wage/employee) diff between 45-54 and 25-34 age categories	(8) Log(wage/employee) diff between 45-54 and 35-44 age categories
Firm Age 1-5 years	0.064 ***	0.024	0.175 ***	0.216 ***	0.126 ***	-0.067 **	-0.049 ***	-0.083 ***
	(2.34)	(0.70)	(7.33)	(8.20)	(4.47)	(-2.02)	(-2.95)	(-5.87)
Firm Age 6-10 years	0.014	-0.032	0.077 ***	0.133 ***	0.080 ***	-0.048 **	0.003	-0.046 ***
	(0.77)	(-1.56)	(4.94)	(7.45)	(4.16)	(-2.13)	(0.28)	(-5.31)
Firm Age 11-15 years	-0.017	-0.051 ***	0.022	0.068 ***	0.033 *	-0.028	0.013	-0.031 ***
	(-0.97)	(-2.62)	(1.53)	(4.26)	(1.88)	(-1.34)	(1.26)	(-3.94)
Firm Age 16-20 years	-0.003	0.009	0.021 **	0.036 ***	0.014	0.008	-0.002	-0.020 ***
	(-0.26)	(0.56)	(2.02)	(3.18)	(1.09)	(0.58)	(-0.26)	(-3.40)
Lagged Log(Firm Employment)	-0.058 ***	-0.028 ***	-0.025 ***	-0.034 ***	-0.043 ***	-0.046 ***	-0.018 ***	-0.009 ***
	(-15.21)	(-5.97)	(-7.62)	(-9.65)	(-11.39)	(-10.31)	(-9.07)	(-5.44)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	37,359	34,020	36,402	36,781	36,526	35,141	35,860	36,164
R^2	0.2064	0.0921	0.2078	0.2169	0.2114	0.1762	0.0818	0.0473

Table VI. Do Wages of Young New Hires Differ by Firm Age?

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the log wage (in year 2005 dollars) per new hire in a given age category as the dependent variable. The independent variables are firm age categorical variables and the lagged log number of employees at a firm. Included in each specification are 4-digit SIC code fixed effects, state fixed effects and year fixed effects. The unit of observation is a firm-year. Panel A reports results using the full sample of all privately and publicly held firms. Panel B reports results for the sample of publicly held firms only. T-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A - New Hires of Privately and Publicly Held Firms

	(1) Log(wage/new hire) all employees	(2) Log(wage/new hire) aged < 25	(3) Log(wage/new hire) aged 25-34	(4) Log(wage/new hire) aged 35-44	(5) Log(wage/new hire) aged 45-54	(6) Log(wage/new hire) aged >55	(7) Log(wage/new hire) diff between 45-54 and 25-34 age categories	(8) Log(wage/new hire) diff between 45-54 and 35-44 age categories
Firm Age 1-5 years	0.047 ***	0.045 ***	0.036 ***	0.056 ***	0.042 ***	0.039 ***	-0.008 ***	-0.023 ***
	(39.56)	(25.47)	(24.77)	(34.35)	(22.12)	(16.21)	(-4.48)	(-12.35)
Firm Age 6-10 years	0.004 ***	0.008 ***	-0.003 ***	0.008 ***	-0.005 ***	-0.008 ***	-0.012 ***	-0.017 ***
	(3.84)	(4.47)	(-2.38)	(4.91)	(22.12)	(-3.55)	(-7.11)	(-10.14)
Firm Age 11-15 years	-0.010 ***	-0.005 ***	-0.013 ***	-0.008 ***	-0.014 ***	-0.016 ***	-0.008 ***	-0.013 ***
	(-8.06)	(-3.02)	(-9.14)	(-4.97)	(-7.62)	(-6.76)	(-4.89)	(-7.72)
Firm Age 16-20 years	-0.009 ***	-0.008 ***	-0.010 ***	-0.006 ***	-0.011 ***	-0.012 ***	-0.007 ***	-0.009 ***
	(-8.56)	(-4.83)	(-7.39)	(-4.46)	(-6.09)	(-5.13)	(-3.85)	(-4.79)
Lagged Log(Firm Employment)	0.156 ***	0.148 ***	0.133 ***	0.150 ***	0.148 ***	0.144 ***	0.017 ***	0.003 ***
	(407.92)	(296.11)	(305.27)	(307.83)	(262.19)	(209.35)	(37.05)	(7.04)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9,363,445	5,195,144	5,257,685	4,705,199	3,426,949	2,321,050	2,213,252	2,145,019
R^2	0.2348	0.1167	0.2218	0.2284	0.2172	0.1932	0.0097	0.0023

Panel B - New Hires of Publicly Held Firms Only

	(1) Log(wage/new hire) all employees	(2) Log(wage/new hire) aged < 25	(3) Log(wage/new hire) aged 25-34	(4) Log(wage/new hire) aged 35-44	(5) Log(wage/new hire) aged 45-54	(6) Log(wage/new hire) aged >55	(7) Log(wage/new hire) diff between 45-54 and 25-34 age categories	(8) Log(wage/new hire) diff between 45-54 and 35-44 age categories
Firm Age 1-5 years	0.044 *	0.050 ***	0.099 ***	0.116 ***	0.029	-0.067 **	-0.050 ***	-0.073 ***
	(1.83)	(2.21)	(4.94)	(4.81)	(1.11)	(-1.98)	(-3.40)	(-5.31)
Firm Age 6-10 years	0.025	0.022	0.050 ***	0.071 ***	0.018	-0.075 ***	-0.026 ***	-0.042 ***
	(1.38)	(1.33)	(3.36)	(3.95)	(0.89)	(-3.13)	(-2.57)	(-4.53)
Firm Age 11-15 years	0.009 ***	-0.004	0.030 **	0.054 ***	-0.004	-0.044 *	-0.026 ***	-0.039 ***
	(0.50)	(-0.23)	(2.17)	(3.19)	(-0.19)	(-1.94)	(-2.76)	(-4.54)
Firm Age 16-20 years	0.024 **	0.021 *	0.030 ***	0.033 ***	0.021	-0.008	-0.003	-0.010
	(2.08)	(1.87)	(3.06)	(2.83)	(1.60)	(-0.48)	(-0.39)	(-1.38)
Lagged Log(Firm Employment)	-0.032 ***	-0.012 ***	-0.012 ***	-0.013 ***	-0.015 ***	-0.015 ***	-0.001	-0.002
	(-8.03)	(-3.31)	(-3.74)	(-3.41)	(-3.51)	(-2.81)	(-0.50)	(-1.29)
4-digit SIC Industry fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	36,384	33,052	34,863	34,679	33,161	28,655	32,426	32,373
R^2	0.1473	0.081	0.1466	0.1422	0.1216	0.0981	0.0293	0.0183

Table VII. Age of Employees by Firm Risk, Financial Constraints and Equity Compensation for Publicly Traded Firms

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the fraction of employees in an age cateogry as the dependent variable on the sample of publicly held firms for which additional data from Compustat are available. Each regression includes a new variable, either the log of the standard deviation of firm sales over the past three years (a measure of firm risk), the average percentage of total compensation received as equity by the top managers in the firm, or a dummy equal to one if the firm does not have a public bond rating (a measure of financial constraints). Included in each regression are firm age categories and the log of lagged total employees at the firm as well as 4-digit SIC code fixed effects, state fixed effects and year fixed effects. Reported are the OLS coefficient, the t-statistic adjusted for cluster at the firm level in parentheses, and the number of observations in the regression. *** and **,indicate statistical significance at the 1% and 5% levels, respectively.

Panel A - All Employees

	(1) Fraction of employees aged < 25	(2) Fraction of employees aged 25-34	(3) Fraction of employees aged 35-44	(4) Fraction of employees aged 45-54	(5) Fraction of employees aged >55
Risk (Std Sales)	-0.008 ***	0.006 ***	0.006 ***	0.002 **	-0.005 ***
	(-9.52)	(7.15)	(8.88)	(2.27)	(-7.95)
	33,170	33,170	33,170	33,170	33,170
Financially Constrained Dummy	0.038 ***	0.010 ***	-0.019 ***	-0.026 ***	-0.003
	(11.74)	(3.95)	(-9.24)	(-11.40)	(-1.45)
	37,076	37,076	37,076	37,076	37,076
% Equity Comp	-0.019 ***	0.039 ***	0.024 ***	-0.016 ***	-0.028 ***
	(-2.63)	(6.20)	(4.81)	(-3.08)	(-7.22)
	13,380	13,380	13,380	13,380	13,380

Panel B - New Hires Only

	(1) Fraction of new hires aged < 25	(2) Fraction of new hires aged 25-34	(3) Fraction of new hires aged 35-44	(4) Fraction of new hires aged 45-54	(5) Fraction of new hires aged >55
Risk (Std Sales)	-0.016 ***	0.009 ***	0.006 ***	0.002 ***	-0.001 ***
	(-13.86)	(11.37)	(9.21)	(2.74)	(-2.86)
	32,414	32,414	32,414	32,414	32,414
Financially Constrained Dummy	0.049 ***	-0.016 ***	-0.019 ***	-0.014	-0.001
	(11.74)	(-6.29)	(-8.32)	(-7.34) ***	(-0.82)
	36,114	36,114	36,114	36,114	36,114
% Equity Comp	-0.059 ***	0.037 ***	0.037 ***	-0.004	-0.011 ***
	(-6.04)	(5.75)	(6.50)	(-0.87)	(-4.31)
	13,269	13,269	13,269	13,269	13,269

Table VIII. Wages Differences by Firm Risk, Financial Constraints and Equity Compensation

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the log wage (in year 2005 dollars) per employee or new hire in a given age category on the sample of publicly held firms for which additional data from Compustat are available. Each regression includes a new variable, either the log of the standard deviation of firm sales over the past three years (a measure of firm risk), the average percentage of total compensation received as equity by the top managers in the firm, or a dummy equal to one if the firm does not have a public bond rating (a measure of financial constraints). Included in each regression are firm age categories and the log of lagged total employees at the firm as well as 4-digit SIC code fixed effects, state fixed effects and year fixed effects. Reported are the OLS coefficient, the t-statistic adjusted for cluster at the firm level in parentheses, and the number of observations in the regression. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	(1) Log(wage/employee) all employees	(2) Log(wage/new hire) all employees	(3) Log(wage/employee) diff between 45-54 and 25-34 age categories	(4) Log(wage/new hire) diff between 45-54 and 25-34 age categories	(5) Log(wage/employee) diff between 45-54 and 35-44 age categories	(6) Log(wage/new hire) diff between 45-54 and 35-44 age categories
Risk (Std Sales)	0.117 ***	0.093 ***	0.004 *	0.008 ***	-0.004 ***	-0.005 ***
	(29.49)	(23.95)	(1.65)	(3.42)	(-1.96)	(-2.43)
	33,170	32,414	31,961	29,076	32,203	29,041
Financially Constrained Dummy	-0.277 ***	-0.245 ***	-0.026 ***	-0.043 ***	0.000	-0.002
	(-18.58)	(-16.41)	(-3.54)	(-5.85)	(0.08)	(-0.43)
	37,076	36,114	35,595	32,199	35,898	32,146
% Equity Comp	0.333 ***	0.357 ***	0.080 ***	0.040 **	0.003	-0.025
	(8.16)	(8.95)	(3.87)	(2.11)	(0.18)	(-1.55)
	13,380	13,269	13,225	12,672	13,258	12,679

Table IX. Employee Age and New Firm Outcomes

The data are taken from the union of the LEHD and LBD data sets between years 1992 to 2004. OLS regressions are estimated using the fraction of employees in a given age category that worked for a new firm in the first year of its existence as the dependent variables. Each regression includes a variable that measures the outcome of the new firm, a dummy for whether the firm received VC financing, a dummy for whether the firm failed in its first five years, and the firm's five-year employment growth rate from inception (taken as the log difference in employment in years 2 and 5). Included in each regression are firm age categories and the log of lagged total employees at the firm as well as 4-digit SIC code fixed effects, state fixed effects and year fixed effects. Reported are the OLS coefficient, the t-statistic adjusted for cluster at the firm level in parentheses, and the number of observations in the regression. Panel A reports regressions results for firms in all industries. Panel B reports regression results for firms in high tech industries - Computer, Electronics and Telecom. A firm is in the "Computer" industry if its primary SIC code is 3570-5379, 5044, 5045, 5734, or 7370-7379. A firm is in the "Electronics" industry if its primary SIC code is 3600-3629, 3643, 3644, 3670-3699, 3825, 5065, or 5063. A firm is in the "Telecom" industry if its primary SIC code is 3660-3669 or 4810-4899. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A - Employees of new firms in all industries

	(1) Fraction of employees aged < 25 in firm's first year	(2) Fraction of employees aged 25-34 in firm's first year	(3) Fraction of employees aged 35-44 in firm's first year	(4) Fraction of employees aged 45-54 in firm's first year	(5) Fraction of employees aged >55 in firm's first year
VC	-0.081 ***	0.069 ***	0.048 ***	-0.005	-0.031 ***
	(-29.26)	(16.47)	(11.77)	(-1.46)	(-16.58)
	1,432,162	1,432,162	1,432,162	1,432,162	1,432,162
Fail within 5 years	0.026 ***	0.010 ***	-0.021 ***	-0.015 ***	-0.001
	(38.44)	(12.45)	(-25.37)	(-21.77)	(-1.42)
	826,891	826,891	826,891	826,891	826,891
5 yr employment growth	0.004 ***	0.032 ***	-0.003 ***	-0.016 ***	-0.016 ***
	(6.04)	(36.49)	(-3.64)	(-23.84)	(-32.25)
	283,213	283,213	283,213	283,213	283,213

Panel B - Employees of new firms in high tech industries

	(1) Fraction of employees aged < 25 in firm's first year	(2) Fraction of employees aged 25-34 in firm's first year	(3) Fraction of employees aged 35-44 in firm's first year	(4) Fraction of employees aged 45-54 in firm's first year	(5) Fraction of employees aged >55 in firm's first year
VC	-0.057 ***	0.045 ***	0.044 ***	-0.011 ***	-0.021 ***
	(-15.19)	(7.00)	(7.24)	(-2.34)	(-8.55)
	168,181	168,181	168,181	168,181	168,181
Fail within 5 years	0.016 ***	0.008 ***	-0.024 ***	-0.005 ***	0.006 ***
	(9.01)	(3.12)	(-9.20)	(-2.56)	(3.81)
	92,715	92,715	92,715	92,715	92,715
5 yr employment growth	0.007 ***	0.045 ***	-0.018 ***	-0.020 ***	-0.014 ***
	(4.24)	(17.97)	(-7.20)	(-10.53)	(-11.22)
	34,131	34,131	34,131	34,131	34,131

Table X. Employee Age and New Firm Creation

In Panel A, the fraction of workers aged 25 to 34 years old who join new firms in one of nine industry categories - Computers, Electronics, Telecom, Biotech and Medical, Consumer Goods, Business Services, Industrial Goods, Finance, and Other - in a given year are regressed on three measures of investment opportunity in the industry - the log of the lagged number of IPOs in the industry, the lagged logarithm of market weighted tobin's Q of publicly traded firms in the industry and the lagged total logarithm of equity market capitalization of publicly traded firms in the industry. In Panel B, the ratio of new firms to all firms in a state is regressed on the ratio of the population aged 15 to 24 years to the population aged 5 to 54 years lagged by ten years. Coefficients are reported followed by robust t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A - Response of Young Workers to Investment Signals

	(1) Fraction of employees aged 25-34 years old in new firms	(2) Fraction of employees aged 25-34 years old in new firms	(3) Fraction of employees aged 25-34 years old in new firms
Log(IPOs)	0.003***		
	(3.59)		
Tobin's Q		0.002*	
		(1.87)	
Market Capitalization			0.005**
			(2.15)
Industry fixed effects?	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes
N	108	108	108
R^2	0.870	0.861	0.862

Panel B - New Firm Creation Rates

	(1) Ratio of new firms to total firms in the state	(2) Ratio of new firms to total firms in the state
Ratio of state population aged 15 to 24 years to 10 year lag of state population aged 10 to 54 years	0.200*** (8.56)	0.175*** (2.57)
State fixed effects?	No	Yes
Year fixed effects?	No	Yes
N	969	969
R^2	0.029	0.650