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Going Entrepreneurial? IPOs and New Firm Creation

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Abstract

Using matched employee-employer US Census data, we examine the effect of a successful initial public offering (IPO) on employee departures to startups. Accounting for the endogeneity of a firm's choice to go public, we find strong evidence that going public induces employees to leave for start-ups. Moreover, we document that the increase in turnover following an IPO is driven by employees departing to start-ups; we find no change in the rate of employee departures for established firms. We present evidence that, following an IPO, many employees who received stock grants experience a positive shock to their wealth which allows them to better tolerate the risks associated with joining a startup or to obtain funding. Our results suggest that the recent declines in IPO activity and new firm creation in the US may be causally linked. The recent decline in IPOs means fewer workers may move to startups, decreasing overall new firm creation in the economy.

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In this paper, we focus on the role of the initial public offering (IPO) market and the firm's choice to go public as a possible driver of new firm creation through the reallocation of skilled employees from the firms going public to startups. The IPO event may serve as a significant positive shock to the wealth of employees who were granted stock options, as well as a positive shock to employees' outside employment opportunities more generally, which can change employees' ability or desire to move to a new firm. Our question of whether a successful IPO allows entrepreneurial human capital to be reallocated to new firms, leading to greater overall startup activity, is similar to the question of whether a larger and more active stock market encourages new business creation though the recycling of informed investor capital from public firms to new ventures, a mechanism elucidated in the model of Michelacci and Suarez (2004). In our paper, we ask whether IPOs free up critical entrepreneurial human capital which can then be re-invested in new startups.

Many employees at high growth startups join these firms after leaving a former employer, a practice of "entrepreneurial spawning" documented in Gompers, Lerner, and Scharfstein (2005). Given the critical role these departures from paid employment can play in new firm creation, it is important to understand the drivers behind these employee decisions, which can shed light more broadly on the incentives and frictions in the economy that may affect total start-up activity. Understanding such incentives and frictions is particularly salient now given the documented decline in the rate of new firm creation in the US (Haltiwanger et al (2014)) combined with a growing body of evidence that young firms disproportionately contribute to job and productivity growth (Haltiwanger et al (2016); Decker et al (2014); Haltiwanger et al (2013)).

We use a sample of high-tech firms, industries in which Gompers, Lerner and Scharfstein (2005) find evidence of significant entrepreneurial spawning. For the sample of high-tech firms which file to go public, we document that, on average, 4.7% of employees leave to join startups over three years. However, for firms that successfully complete their IPO, this rate jumps to 17.5%, when estimated using an instrumental variables strategy, implying that a successful IPO has an economically important effect on one of the key components to new firms: employees.

To establish the causal relation between IPOs and employee departures to startups, we focus on a set of firms which all filed an IPO prospectus and then compare results between those firms which succeeded in going public as compared to those firms which withdrew their IPO filing.

However, this step alone is insufficient to allow for clean inference. The decision to withdraw an IPO is driven by the firm's success during the book building phase, the period immediately following the IPO filing. If, during this time, the firm fails to receive sufficient investor interest at prices acceptable to the issuing firm, the IPO is more likely to be withdrawn. This probability will depend on both the quality of the IPO firm and the overall performance of the market during this period (Busaba, Benveniste and Gao (2001); Benveniste et al (2003); Edelen and Kadlec (2005); Dunbar and Foerster (2008); and Bernstein (2015)).

Thus, to ensure that our results for the sample of successful IPO completions do not reflect endogenous firm quality, we follow an instrumental variable approach, as in Bernstein (2015). We use NASDAQ stock market returns in the 60 day window immediately following the IPO filing to instrument for IPO completion. Lower NASDAQ returns are associated with a significant decrease in the probability of IPO success. While market returns can predict employee turnover due to the correlation between returns and employment opportunities, the instrument uses returns only in a short post-IPO filing window. As such, we are able to control for returns more generally using year fixed effects. There is no direct reason why returns over a short window, after controlling for returns over the year, would impact future entrepreneurship. Moreover, we directly test this assumption by running a placebo test using returns in the 90 day period prior to the IPO filing. We find returns during this window neither predict IPO success nor entrepreneurial spawning.

We consider three non-mutually exclusive mechanisms which may explain why employees are more likely to depart to startups following an IPO. First, following an IPO, many employees who received large stock grants in the past are more wealthy and able to liquidate their new-found wealth. To identify evidence specifically in support of this mechanism, we interact a successful IPO with historic two-year industry stock returns. We argue employees at firms with high past industry returns will, on average, receive a larger wealth shock following the IPO as stock grants previously made to employees in these firms are likely to have relatively higher values. We observe a significant effect on the interaction suggesting this wealth shock may allow employees to better tolerate the risks associated with joining a new start-up, but only in the sample of male employees.

Additionally, we explore whether a certification shock, or greater outside employment opportunities, can explain our results. The labor market may change their perception of employees who have worked at a firm which has successfully completed its IPO. We argue that the additional marginal change to perceived worker quality around a successful IPO is likely to be moderated at

firms which received VC financing earlier (and benefited from an earlier change in perceived worker quality). We find no evidence that IPOs at firms with VC-backing result in fewer employee departures to start-ups.

Alternatively, employees may leave due to a changed culture or less desirable work environment following the IPO. The IPO can change the culture at the firm and employees most likely to match to a start-up should be most likely to then depart. We proxy for IPOs associated with greater culture change when the CEO departs within two years of the IPO filing. We find no evidence that IPOs associated with CEO departures result in greater employee departures to start-ups.

Besides speaking to one of the drivers of entrepreneurship, our results also provide insight into the causes of employee turnover. One such determinant is firm quality. Contrary to the IV results, we document no relation between IPO completion and employees departing for entrepreneurship in an OLS setting. Firms in the OLS sample which successfully complete their IPO are, on average, of higher quality compared to those firms who withdraw their plans. Hence, the difference in these results suggests that firm quality is associated with fewer employee departures to start-ups.[1] We find a similar pattern between the OLS and IV results when exploring turnover to established firms. Turnover to established firms decreases in the OLS setting and this correlation disappears in the IV setting. Again, firm quality likely explains the discrepancy between the OLS and IV findings. However, only turnover to startups increases post-IPO in the IV setting, suggesting that the IPO event has a uniquely salient effect on employees who are entrepreneurial-minded, after controlling for firm quality.

We conclude that rising departures to entrepreneurship post-IPO is not driven by employee expectations of declining wages or declining employment. Instead, we document that total firm employment and wage growth rates increase following an IPO in an OLS regression. However, once we instrument for the IPO, only the employment result remains statistically significant. The fact that wages do not increase post-IPO in the IV setting suggests that pre-IPO firms are not limited in their ability to pay wages due to cash constraints.

[1] In the IV setting, we find more employees depart to startups following a successful IPO. In the OLS setting, we find no statistical difference following a successful IPO. Taken together, these results imply that the endogeneity in the OLS sample regarding IPO completion creates a bias which masks the causal impact of the IPO on departure to startup rates. Better quality firm is associated with fewer departures to startups.

To quantify the potential impact of declining IPOs on US entrepreneurial activity, suggested by our base estimates, we estimate that the decline in high-tech IPOs in the early 2000s can explain approximately 8.2% of the missing employment in high-tech startups over the next decade. Although this is a rough approximation, our calculations indicate that IPOs can have a meaningful impact on startup employment. However, we caveat this calculation as, more recently, firms which would have traditionally filed for an IPO are now instead seeking acquisitions. Acquisitions during our sample period are associated with an increase turnover to startups, albeit at a one quarter of the magnitude as compared to following an IPO. This lower effect may be because acquisitions do not bestow the same wealth shock on employees given the ability of the acquirer to cancel stock options (Babenko, Du and Tserlukevich 2016).

Of course, any positive impact on new firm creation might be partially offset by costs to the growth and productivity of the firm that has gone public and which loses its employees to startups. While we cannot quantify the precise cost of employee departures to the IPO firms, we have reasons to believe these departures can have negative implications. Popular media is rife with stories about employee distractions following IPOs. In a July 25, 2005 article in Fortune, Adam Lashinsky states that "If the IPO was the beginning, it was also the beginning of the end. Netscape's businesspeople and engineers often seemed on different planets as the company wrestled with runaway growth and the vertigo of overnight wealth." Moreover, we do have direct evidence that the employees who depart to startups were valued by their previous employer. Employees who leave for start-ups have average wages that are 10-12% higher, as compared to the average wage of employees who depart for established firms. Furthermore, losing entrepreneurial minded employees may be particularly damaging for firms that are still depending on innovation to meet expectations of exponential growth over the following years. Finally, these departing employees may be taking ideas out of the IPO firm and helping to launch new rivals.

Our paper contributes to the literature of entrepreneurial spawning and entrepreneur resource accumulation by Gompers, Lerner, Scharfstein (2005); Hellmann (2007); SØrensen (2007); Campbell, Ganco, Franco, Agarwal (2012), Babina (2015) by showing the specific impact of a successful IPO on the departure rate of a firm's employees to startups. We also add to the literature looking at changes to firm performance following IPOs, including the impact on innovation in Bernstein (2015), top managers in Kaplan, Sensoy, Stromberg (2009), product market in Chemmanur, He, and Nandy (2009), firm employment in Borisov, Ellul, Sevilir (2015),

and acquisitions in Celikyurt, Sevilir and Shivdasani (2010). To the best of our knowledge, we are also the first to link empirically firm quality and employee turnover. Our results suggest that higher quality firms have lower turnover rates, providing empirical support for recent theories of the firm focused on employees as the key assets (e.g., Rajan and Zingales 1998, Zingales 2001, Carlin and Gervais 2009.

The rest of the paper proceeds as follows. The next section describes the data and the measurement of key variables used in the analysis. The following sections presents the main findings and offer an evaluation of the mechanisms driving them. Finally, we conclude with a discussion of the costs and benefits of IPOs on firms and the economy more broadly. The final section concludes.

1. Measuring Employee Departures to Entrepreneurship

Key to our analysis is being able to measure employee departures from their current firms and tracking their movements. It is also important to measure other variables which may also affect employees' decisions to stay or remain with a firm, such the wage, age, and education of the employees as well as attributes of the firm and condition of financial markets. In the following section, we review the multiple databases used to measure our variables of interest and to create our sample. We provide summary statistics of the firms included in our sample and discuss the calculations of key variables.

1.1. Data Sources

We combine databases from the following sources to form our estimation sample: the US Census Bureau; Thompson Reuter's Securities Data Corporation (SDC) and VentureXpert; and DowJones' VentureSource.

1.1.1. Matched Employer-Employee Data

Our primary database is the Longitudinal Employer-Household Dynamics data (LEHD) maintained by the US Census Bureau. This matched employer-employee database tracks employees and their wages with various employer establishments on a quarterly basis. LEHD data are collected from the unemployment insurance records of states participating in the program.[2]

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

Data start in 1990 for several states and coverage of states increases over time. The data coverage ends in 2008. Our project has access to 25 states: Arkansas, Georgia, Hawaii, Iowa, Idaho, Illinois, Indiana, Louisiana, Maryland, Maine, Montana, North Carolina, New Jersey, New Mexico, Nevada, Oklahoma, Oregon, Rhode Island, South Carolina Tennessee, Utah, Virginia, Vermont, Washington and Wisconsin. While we do not observe data for all states, for any state in the program, we observe all employees at firms with at least one paid employee. For each individual we observe quarterly wages and current place of employment. The LEHD also allows us to observe the age, gender, race, place of birth, and education of each employee.

We supplement the information contained in the LEHD with firm-level information from the Longitudinal Business Database (LBD). The LBD is a panel dataset, also maintained by the Census Bureau, that tracks all US business establishments.[3] An establishment is any separate physical location operated by a firm with at least one paid employee. The LBD contains information on the number of employees working for an establishment and total annual establishment payroll. In addition, the LBD also contains a unique firm-level identifier, *firmid*, which links establishments that are part of the same firm. We observe the LBD for all 50 states and the District of Columbia.

We link the LEHD to firm identifiers in the LBD using the employer identification numbers (EIN). Matching between the LBD and the LEHD is an imperfect process because the LBD infrastructure is based on physical establishments while the LEHD infrastructure uses reporting units for a given firm which are defined at the state level and called State Employer Identification Numbers (SEIN). SEINs may or may not match the physical establishments identified in the LBD. As such, we do not track whether an individual stays at the same physical establishment over time, only if the individual remains at the firm.

1.1.2. Data on IPOs and Other Financial Variables

We use Thomson's SDC to identify all IPO filing firms from 1992 through 2006 and whether the IPO was successfully completed or later withdrawn. We start in 1992 and stop in the first quarter of 2006 to match the time series of available data from Census sources and allow for a three-year post- event window to measure post-IPO filing employee mobility. Following the literature, we exclude IPO filings of financial firms (SIC codes between 6000 and 6999), non-US

[3] See Jarmin and Miranda (2002) for more information.

based firms, unit offers, closed-end funds (including REITs), ADRs, limited partnerships, special acquisition vehicles, spin-offs, and issues of non-common shares. Given our interest in understanding the drivers behind the entrepreneurial spawning observed in Gompers, Lerner and Scharfstein (2005), we use a sample of high-tech firms. We define high-tech as firm operating in the biotech or computer industries. A firm is in the "Biotech" industry if its primary SIC code is 2830-2839, 3826, 3841-3851, 5047, 5048, 5122, 6324, 7352, 8000-8099, or 8730-8739 excluding 8732. A firm is in the "Computers" industry if its primary SIC code is 5370-5379, 5044, 5045, 5734, or 7370-7379.

Using these restrictions, we identify 2,034 high-tech firms with IPO filing during our time period. We link our IPO filing sample to the Census data in the year the firm first files for an IPO. Since SDC does not provide EIN for some firms, when possible, we fill in missing EIN information by obtaining the EIN from the underlying SEC filing, typically an S-1 or S-1A. This leaves us with a sample of 1,944 IPO filings with non-missing EINs that we attempt to match to Census data, with 1,436 firms that complete IPOs and 508 with withdrawn IPO filings.[4] We are able to match 1,500 filing firms to the LBD that covers all 50 states and allows to calculate firm age, total firm employment, payroll, and average firm wages.[5] Since employee-level data that allow to identify worker mobility are available for 25 states, the final sample consists of 800 firms that have employees in the covered states.

We use a separate database provided by SDC to identify all M&A of firms in our IPO filing sample. We match across databases using CUSIP of the issuing firms. We find that over the three years following an IPO filing, 21% of the firms in our IPO filing sample are acquired. We define a successful acquisition when the deal is completed and the post-acquisition ownership percentage exceeds 50%.

We identify firms which received venture capital funding using both SDC Thomson (VentureXpert) and DowJones (VentureSource). We employ a crosswalk developed by Puri and Zarutskie (2012), which employs a name and address matching algorithm to link to firms in the

[4] We cannot obtain EINs for all IPOs, since some IPO filings that are reported in SDC as being issued by domestic are actually issued by foreign companies, which we exclude. Because some firms change EIN in the process of becoming public, some issuers never report EIN number in the S-1/S-1A filings. Additionally, a few small issuers do not file an S-1 or S-1A.

[5] The number of observations is rounded to the nearest hundred due to Census disclosure policies.

LBD. Specifically, we identify firms as VC-financed if they can be matched to firms contained in VentureXpert or VentureSource and received VC financing prior to the IPO filing.

1.2. Variable Construction

We start by taking a snapshot of all employees working at a given firm as of the end of the quarter prior to the quarter in which the IPO filing takes place. As discussed earlier, the data in the main sample is limited to workers physically located in the 25 US states participating in the LEHD program. For firms with establishments located across multiple states, we will have data for workers in some states, such as Illinois, but not in other states, such as California.

Using longitudinally consistent individual identifiers available in the LEHD data, we track these employees over time. We then take a second snapshot of these same workers, but three years later, and identify the following groups: 1) employees who remain working for the original firm; 2) employees who are now employed at a different firm and this firm is defined as a startup with an age of three years or less (or established during or after the initial IPO filing year); 3) employees who are now employed at a different firm and this firm is more than three years old; and, 4) employees who are no longer observed in the data. Employees may leave the data either because they leave the work force, they are now employed in an area outside of the LEHD coverage or due to a tracking error in the data.

We use the LBD to measure firm age. Firm age is equal to the age of the oldest establishment that the firm owns in the first year the firm is observed in the LBD (Haltiwanger (2012)). This definition of firm age will not misclassify an establishment that changes ownership through mergers and acquisitions as a firm birth, since a firm is defined as a new firm only when all the establishments at the firm are new establishments and establishment age should remain the same in the LBD regardless of ultimate ownership.[6] *Percent Entrepreneurship (All)* is defined as the fraction of the employees observed at the firm prior to the IPO filing who leave the firm and are employed at a start-up (firm with age less than or equal to 3 years old) in the post-period. *Percent Entrepreneurship (Turnover)* uses the same numerator, employees observed at the firm prior to the IPO filing and who leave the firm and are employed at a start-up (firm with age less

[6] The LBD only covers employer firms and does not include Schedule C self-employed activity. As such, the commencement of Schedule C self-employed activity is unmeasured and is not considered to be entrepreneurship in this sample.

than or equal to 3 years old) in the post-period. However, in this measure, we normalize by the number of employees observed at the firm prior to the IPO filing and who leave the firm in the post period to either become employed at a firm of known age or drop out of the employment sample.[7] The two measures of entrepreneurship are complimentary. *Percent Entrepreneurship (All)* measures the percent of employees who depart a given firm to join start-ups. This measures the net impact of an IPO on worker flow into start-ups. Alternatively, *Percent Entrepreneurship (Turnover)* measures the rate at which employees who depart, leave for new jobs at start-ups.[8]

1.3. Summary Statistics

Table 1 reports summary statistics for our primary sample. In Panel A, we explore firm characteristics. In the first column, we report the mean, the kernel-weighted mean [in brackets] and standard deviation (in parentheses) of firm-level characteristics for the full sample of firms. Since Census disclosure procedures prohibit disclosure of percentile value, we approximate median with a kernel-weighted mean, which is estimated using a 99% weight on observations within the interquartile range and a 1% weight on the remaining observations. In the second column, we limit the sample to firms which withdraw their IPOs. In the third column, we limit the sample to firms which successfully complete their IPOs. In the fourth column, we report the difference between means in columns 2 and 3. Finally, in the fifth column, we denote statistical significance of the difference in means, using robust standard errors.

We find that 73% of the firms in our sample successfully completed their IPO. In the full sample, 67% of the firms are identified as being VC-backed. We report no statistically significant difference in VC-backing between firms which successfully complete their IPOs and firms which subsequently withdraw their IPO filing. Likewise, we find that firms in our sample which complete and withdraw IPOs are similar in terms of total employees, total payroll and firm age.

[7] There is a subset of firms where we are unable to identify firm age due to differences in coverage between the LEHD and the LBD, as well as imperfect match between the two dataset. LEHD includes some self-employment activity as well as some public organizations, while LBD does not. To ensure that employees joining these firms for which we cannot identify age are not driving our findings, we also consider an alternative normalization where we divide by all employees who separate from the IPO filing firm over the 3 year window. The results are similar and are available by request from the authors.

[8] Because the variable *Percent Entrepreneurship (Turnover)* is undefined in cases where we observe zero employee turnover, we drop a small number of firms from our sample where this condition holds. This allows us to have a constant sample across regressions and to avoid violating Census disclosure requirement associated with small differences in samples that potentially can reveal information about firms not present in non-overlapping samples.

However, firms with completed IPOs have slightly lower average ex-ante wages per employee. Wages are reported as annual wages per employee and include all forms of immediately taxable compensation, such as salaries, wages, commissions, and bonuses. Firm-level wages can be measured using data available in the LBD or in the LEHD. Wages estimated using LBD data covers all employees in the firm and is calculated as the sum of total payroll at each of the firm's establishments divided by total employment at each of the firm's establishments. Wages estimated using the LEHD data are estimated only on those workers in states covered by the LEHD and is aggregated to the firm level as the average wages across workers, starting with individual-level data.

We measure NASDAQ market returns around the IPO filing using the following three windows: 60 days after the IPO filing, 90 days prior to the IPO filing, and returns between the initial filing and final resolution (a successful or withdrawn IPO). Average 60 day post-issuance NASDAQ returns at firms which complete their IPO are 3% as compared to -3% for firms which withdraw their IPO. These results are consistent with a number of earlier studies documenting the role of market returns in IPO success (Busaba, Benveniste and Gao (2001); Benveniste et al (2003); Edelen and Kadlec (2005); Dunbar and Foerster (2008); and Bernstein (2015)). We find similar differences when we consider returns to resolution. We also find a small difference in pre-filing returns between the two groups.

Panel B explores employee characteristics, as provided in the Individual Characteristics File (ICF) under the LEHD program. We find that workers at firms which successfully complete their IPO tend to be younger, more likely to be born in the state in which they are currently employed, and have more years of schooling.[9] We find no difference in the fraction of employees who are female, white, foreign-born or in the average employee tenure.[10]

Panel C reports summary statistics for our key outcome measures of entrepreneurship and employee turnover. On average, 4.7% of employees leave an IPO filing firm in the 3 years post-filing to join a start-up. This can be contrasted to the fact that 23.6% of employees leave to join an established firm (4 years of age or more) and 15.4% of employees who leave to join firms for which we are unable to determine firm age. An additional 29.2% of workers exit the LEHD

[9] The Census imputes the education variable for workers with missing education. As such, this estimate may be noisy.

[10] Our measurement of tenure is left-hand censored due to data availability. States enter the LEHD program over time, limiting our observed worker-level history.

sample. This may occur because the worker becomes unemployed, retires, or moves to a state which is not covered by the LEHD program. Only 26.7% of the employees who were present at the firm prior to the IPO filing remain employed at the firm 3 years later.

Comparing between firms with successful and withdrawn IPOs, we see no differences in rates of entrepreneurship. This is true if we normalize our measure by all ex-ante employees, *Percent Entrepreneurship (All)*, or if we normalize by all workers who move to a firm of known age or drop from the LEHD sample, *Percent Entrepreneurship (Turnover)*. We also report results for an alternative measure of employee turnover to startups where we also include workers who leave to join firms on unknown age in the denominator, *Percent Entrepreneurship (Turnover2)* and find similar results.[11] This overall mean rate of departures from high-tech firms of 4.7% is larger than mean departure rates from public firms across all sectors of the economy to startups of 3.8% (Babina 2016).

However, we do see a difference in the percent of workers who stay at the IPO filing firms and the percent of workers who move to established firms. If the IPO is successful, the retention rate increases to 30% of ex-ante workers. For firms with withdrawn firms, less than 18% of ex-ante employees remain three years later. Following a withdrawn IPO, workers are over seven percentage points more likely to join an established firm. These retention rates are considerably lower than 40% found in more mature public firms across all sectors of the economy (Babina 2016).

Exploring the outcomes for employees who depart to startups, Panel D explores wages and wage growth. In this panel, we measure wages using only the set of the firm's employees that are observed in the LEHD data.[12] As reported in Panel A, we find that workers at firms which successfully completed their IPO pay workers slightly lower wages, on average, using the full set of LEHD employees. However firms with successful IPOs see higher future wages and higher future wage growth. On average, workers at firms in our sample experience a nearly 5% wage growth from the IPO filing year to the subsequent year. If the IPO was successful, this rate increases to 8%. For firms with withdrawn IPOs, we observe a decline in wages of over 3%.

[11] Throughout the paper, we also use this variable as a robustness test wherever *Percent Entrepreneurship (Turnover)* is used. Results are similar.

[12] We limit this sample to employees observed in the LEHD to be able to identify differences between employees who remain employed at the IPO filing firm and employees who leave over the three year window.

Our measure of average wage change includes all employees, regardless of whether they remain or depart the original firm. This ensures that there are no differences in the composition of workers in the pre- and post-samples. To assist in the inference, we next look at the subset of LEHD workers which separate from the IPO filing firm within the 3 year window following the filing. We find that workers which subsequently leave the firm have lower ex-ante wages, as compared to the full set of workers. Moreover, we find a similar difference between workers at firms with successful IPOs and firms with withdrawn IPOs. Workers which subsequently leave the firm earn, on average, 7% lower ex-ante wages if employed at a firm with a successful IPO. This difference between firms with successful and unsuccessful IPOs is more pronounced as compared to in the full sample, suggesting that departing employees at least partially drive the results in the full sample.

On average, workers who leave an IPO filing firm realize negative wage growth. However, workers who separate from firms with successful IPOs realize a less negative wage growth as compared to workers who separate from firms with withdrawn IPOs. In unreported results, we also document that of the workers who leave, workers who leave and subsequently join a start-up have the highest ex-ante wages. As compared to workers who leave and join established firms, workers who leave for startups earned between 10 and 12% higher wages ex-ante.

Finally, we document a relatively stable employment, on average, for the full sample. However, this is masking striking differences between firms with successful and unsuccessful IPOs. Firms with successful IPOs experience a 4% employment increase over the following 12 months. Firms which later withdraw their IPO filing instead realize negative 18% employment growth, on average. This is consistent with Borisov, Ellul, and Sevilir (2015).

2. Do IPOs Prompt Employees to Join Startups?

In this section, we report results from regressing the percent of employees who leave a firm to enter into entrepreneurship on a completed IPO. We first report results using an OLS methodology. We follow with results using an instrumental variables 2SLS methodology.

2.1. OLS Regression Results

In Table 2, we explore the relationship between departures to entrepreneurship and a successfully completed IPO using the following specification:

$$Y_i = \alpha + \beta_1 IPO_i + X_i'\delta_i + \mu_t + \vartheta_k + \varepsilon_i \quad (1)$$

where Y_i measures the number of employees who depart and join a start-up within 3 years of the IPO filing normalized by either the number of employees at the firm ex-ante, *Percent Entrepreneurship (All)*, (columns 1-4) or by the number of employees who leave for other career opportunities, *Percent Entrepreneurship (Turnover)*, (columns 5-8). IPO_i is a dummy variable which assumes a value of 1 if the IPO was successfully completed, X_i' is a vector of control variables, μ_t are year fixed effects, ϑ_k are SIC1 industry fixed effects and ε_i is the error term. Observations are measured at the firm level and robust standard errors are reported.

Columns 1 and 5 report an economically small and statistically insignificant coefficient on IPO, indicating no significant relationship between departures to start-ups and IPO completion. Columns 2 and 6 add SIC1 industry fixed effects. Columns 3 and 7 include year times industry fixed effects. The inclusion of additional fixed effects has little impact on the coefficient on IPO. Finally, columns 4 and 8 include firm level controls as well as year and industry fixed effects. We control for firm size (the natural logarithm of the count of total employment in the first quarter of the year of the IPO filing), firm wages (the natural logarithm of the average firm annualized wages), firm average worker age, percent of female workers, average worker education (years of schooling), 90-day NASDAQ return prior to filing, and a dummy variable which identifies IPO filers which are acquired in the three year window post-IPO filing. In this multivariate setting, we now document a negative and significant correlation between firm total employment and IPO completion.

As in the univariate statistics, we continue to observe a negative and statistically significant relation between ex-ante wages and IPO completion. The insignificant coefficient on IPO is little changed with the addition of these further controls which suggests these firm-level variables, including the dummy variable for post-IPO acquisition, do not drive our results. We find no significant relationship between the remaining variables and IPO success, including the firm's average worker age. At first glance, this insignificant coefficient on worker age may seem surprising given Ouimet and Zarutskie (2014) find that younger workers are more likely to work at younger firms. However, since our sample is composed of workers who selected to work at

relatively young firms, such coarse individual characteristics may no longer have significant explanatory power.

These results can be interpreted in two possible ways. A successful IPO completion may have no impact on employee departures to start-ups. Alternatively, a successful IPO completion may indeed impact employee departures to start-ups, however, uncontrolled differences between firms with successful and unsuccessful IPOs also impact employee departures to start-ups, counteracting the effect of the IPO completion. In the following section, we instrument for the IPO completion allowing us to distinguish between these two interpretations.

2.2. IV Regression Results

The success of a firm at bookbuilding, following an IPO filing, will depend on both aggregate market conditions as well as on the firm's expected future growth opportunities. Due to greater promotion opportunities, employees may be less likely to leave a firm with greater future prospects. To allow for clean inference of the impact of an IPO completion on employee departures to start-ups, we instrument for the IPO using NASDAQ returns in the 60 days following the IPO filing, an approach based on Bernstein (2015).

To validate that NASDAQ returns in the 60 day window following an IPO filing predict successful IPO completions, we estimate the following regression:

$$IPO_i = \alpha + \beta_1 NASDAQ\_RET_i + X_i'\delta_i + \mu_t + \vartheta_k + \varepsilon_i \qquad (2)$$

where IPO_i is a dummy variable which assumes a value of 1 if the IPO was successfully completed. $NASDAQ\_RET_i$ is the cumulative value-weighted NASDAQ returns over a 60 day window, starting the day of the IPO filing , X_i' is a vector of control variables, μ_t are year fixed effects, ϑ_k are SIC1 industry fixed effects and ε_i is the error term. Observations are measured at the firm-level and robust standard errors are reported.

Table 3 reports the results. In column 1, we include year fixed effects. Column 2 adds industry fixed effects. Column 3 includes industry times year fixed effects and Column 4 includes additional firm-level controls. In all four regression specifications, there is a strong and positive relationship between 60 day NASDAQ returns and whether or not the IPO was successfully completed. A decline of one standard deviation in NASDAQ returns translates into a decline of

6% in the likelihood of completing the IPO. Moreover, the *F*-statistic ranges from 11-12, exceeding the threshold of $F = 10$ and suggesting that the instrument is strong and unlikely to be biased toward the OLS estimates (Bond, Jaueger, and Baker (1995), Staiger and Stock (1997)).

In order to be a valid instrument, the IV must also meet the exclusion restriction condition. In the case of our specification, we must argue that 60 day NASDAQ returns do not directly impact the rate of employee departures to start-ups except through the IPO completion channel. It is important to stress here that while NASDAQ returns may predict future entrepreneurship directly, by including year fixed effects, we are controlling for this correlation between macroeconomic trends and future entrepreneurship. Our identification rests on the fact that returns during a specific and short window immediately following the IPO filing predicts IPO success. It is unlikely that returns during this short window will directly predict future entrepreneurship except through the channel of reflecting broader macroeconomic trends, trends which are controlled for in our analysis with year fixed effects. However, we further validate this assumption in Section 4.1 by using a placebo test. We show that returns during a similar short window of time, but a window which strictly *precedes* the IPO filing, neither predict IPO completion nor future entrepreneurship, after controlling for year fixed effects.

Having validated our instrument, we now proceed with the second stage of our 2SLS estimate. We run the following baseline regression:

$$Y_i = \alpha + \beta_1 \widehat{IPO}_i + X_i' \delta_i + \mu_t + \vartheta_k + \varepsilon_i \qquad (3)$$

where Y_i measures the number of employees who depart and join a start-up within 3 years of the IPO filing normalized by either the number of employees at the firm ex-ante, *Percent Entrepreneurship (All)*, (columns 1-4) or by the number of employees who leave for other career opportunities, *Percent Entrepreneurship (Turnover)*, (columns 5-8). $\widehat{IPO}_i$ is estimated in the first stage (equation 2), X_i' is a vector of control variables, μ_t are year fixed effects, ϑ_k are SIC1 industry fixed effects and ε_i is the error term. Observations are measured at the firm.

We report results of the causal impact of IPO completion on employee departures to start-ups in Table 4. Columns 1 and 5 report a positive and statistically insignificant coefficient on instrumented IPO completion, indicating a causal relationship between IPO completion and employee departures to start-ups. Columns 2 and 6 add SIC1 industry fixed effects. Columns 3

and 7 include year times industry fixed effects. The inclusion of additional fixed effects has little impact on the coefficient on IPO. Finally, columns 4 and 8 include firm level controls as well as year and industry fixed effects. We find a significant coefficient on IPO, even after controlling for firm characteristics.

In the IV setting, we now observe a negative and significant coefficient on firm employment and average wage. Smaller firms and firms which pay lower average wages see greater departures to startups. These firm characteristics may proxy for differences in firm quality. Given we believe that a successful IPO is also a proxy for firm quality in an OLS setting, it is not surprising that these variables were insignificant in an OLS regression but significant in this IV regression without the presence of a highly collinear variable. We also observe a positive and statistically significant increase in turnover to startups following an acquisition, albeit the magnitude of this effect is approximately one third of the comparable effect following an IPO.

Our estimates show not only a statistically significant and causal relationship between IPO completion and employee departures to startups, but also an economically significant relationship. On average for our sample of firms, 4.7% of employees depart to join startups over three years, relative to total ex-ante employment. For firms that complete their IPO, this jumps by 17.5%, implying that the average rate of worker who exit to join startups quadruples for a marginal firm that completes an IPO filing. We also document that this is not driven by an overall increase in turnover and constant percentages of employees departing for start-ups. On average for our sample of firms, 7.6% of employees depart to join start-ups over three years, relative to total turnover. For firms that complete their IPO, this jumps by 24.3%, a three-fold increase form the mean rate of 7.6%.

These results provide a striking contrast to the results estimated using an OLS methodology in Table 2. After controlling for the endogenous relation between firm quality and IPO success, the relation between IPO success and future entrepreneurship becomes both statistically significant and economically meaningful. The difference in the two results suggests that employees are less likely to depart to start-ups at high quality firms. This correlation between firm quality and future entrepreneurship masks the causal relationship between IPO success and future entrepreneurship in the OLS regressions, which can only be observed in the IV setting.

While we show important economic magnitudes, there are limits to the generalizability of our results. Given that our instrumental variables regression is measured on those firms whose

decision to complete the IPO is conditional on NASDAQ stock market performance during the bookbuilding period, we are cautious about over-generalizing our results. Those firms for which the market demand for the firms' IPO shares is little impacted by overall market trends, presumably the firms with the strongest future growth prospects, may experience different post-IPO trends in turnover and departures to start-ups.

Moreover, we do not find similar results when we consider the sample of IPOs in all industries. The lack of a significant finding for non-tech industries may be related to fewer high-growth startup opportunities in these industries. While there are high number of startup opportunities across all industries, it is a unique phenomenon of the high-tech sector that many of the startups are formed with high growth aspirations. In addition, the wealth shock and certification mechanism may be less likely to apply outside of high-tech where stock options are most common and new startups will be most interested in hiring employees with successful IPO experience.

In Table 5, we explore variants of our employee departure to start-ups variables. All columns in Table 5 have the same controls and are estimated using the same 2SLS methodology used in Table 4. In Column 1, the dependent variable is the number of new firms associated with workers employed at the IPO filing firm during the quarter prior to the IPO filing who become entrepreneurs in the 3 years following the IPO filing, normalized by the number of workers who leave the firm. This dependent variable allows us to interpret the macroeconomic effects of IPOs. It is possible that employees departing a given IPO filer may depart in a group to a new firm. In which case, the IPO filer may lose a significant number of employees but only one new start-up will be affiliated with the IPO filer. We observe a positive and significant coefficient on IPO indicating that team starts are not driving the results. Employees departing IPO filers leave for a number of different unique start-ups. We document similar results in column 3 where the dependent variable is the number of new start-ups, normalized by employees who leave to join firms of known age or drop from the LEHD sample.

In Column 2, the dependent variable is the fraction of workers at the IPO filing firm who become entrepreneurs in the three years following the IPO filing and are one of the top five paid employees at the start-up, normalized by ex-ante employment at the IPO filing firm. By limiting the sample to workers who are among the top earners of the start-up, we seek to estimate whether the IPO completion specifically impacts the rates of departure for those workers who are among founding teams of start-ups as compared to workers who are joining as rank-and-file workers at

new enterprises. As evidenced by the coefficient on IPO, we find to find a positive and statistically significant relationship between IPO completion and rates of entrepreneurship. We show similar results in Column 4 where we instead normalize by employees who depart to firms of known age or drop from the LEHD sample. These two additional results allow us to generalize our results that IPOs do not only cause departures startups, but also more startups founded by employees from IPO filing employers.

2.3. Understanding the Mechanisms Underlying Employee Departures to Startups

In the following section, we explore different potential drivers of the causal relation between a successful IPO and employee rates of departures to startups. Increasing departures to start-ups may be driven by many non-mutually exclusive mechanisms. In this paper, we consider three such mechanisms: a shock to employee wealth, a change in employee outside opportunity sets, or a change in firm culture.

2.3.1. Wealth Shock

An IPO event can involve a large wealth shock for existing employees. Employees in pre-IPO firms are often granted options in lieu of additional cash compensation. This can be a particularly valuable strategy in firms with large growth options and limited cash, such as pre-IPO firms (Core and Guay, 2001). While most firms don't disclose the total number of stock options which have previously been granted to employees who remain with the firm, we can gauge the magnitude of these holdings by looking at total existing options outstanding. At a typical start-up, these shares are held primarily by current and former employees and early investors. Using a sample of 897 IPOs issued in the late 1990s, Pukthuanthong, Roll and Walker (2007) find that the average IPO issuing firm has existing options outstanding (primarily held by VC firms, founders and employees) equal to 48% of the shares offered in the IPO.

Following an IPO, the existence of a publicly traded market makes it easier for employees to sell their shares. While some firms do allow employees with vested option to sell their options prior to the IPO, for most employees there are limited pre-IPO selling options. This represents a significant shock to the wealth of employees with grants. This new wealth may allow employees to better tolerate the risks associated with joining a new start-up. Start-ups impose high employment risk on their employees, as in Haltiwanger, Jarmin, and Miranda (2012). Moreover,

start-ups, on average, cannot match the wage growth at more established firms. In unreported results, we document that the average wage growth for employees leaving an IPO filer to go to a start-up decreases, relative to wage growth experienced by employees who remain at the IPO filer or move to older firms.

To identify evidence consistent with this mechanism, we interact pre-filing industry stock returns with the IPO dummy variable. Under the assumption that industry returns are correlated with the change in valuation for the pre-IPO firm, then employees compensated with stock options at firms in industries that experienced a run-up prior to their IPO filing will have a larger wealth shock following the IPO event, all else equal. Returns are measured at the 3-digit SIC-level, using the two year window which strictly precedes the IPO filing year. The mean industry stock return in our sample is 14.3%. We modify the first-stage of the regression to include two instrumental variables: the NASDAQ stock market returns in the 60 day window immediately following the IPO filing and the interaction of this variable with pre-filing industry returns.

Table 6, Panel A reports results. Columns 1 uses the full sample. We find a positive but statistically insignificant coefficient on the interaction of IPO and returns. In Column 2, we limit the sample to just male employees at IPO filing firms. The entrepreneurship literature has a history of focusing on male employees since males are much more likely to participate in entrepreneurship (Koellinger, Minniti and Schade, 2013).[13] Using just male employees, we now find a positive and statistically significant coefficient on the interaction term. Male employees at IPO filing firms whose firm successfully completes the IPO are more likely to depart for start-ups the higher the past two-year industry returns have been. In column 3 (4), we use just the top (bottom) ½ of the workers by pre-IPO filing wages in a given firm. As expected, workers with higher wages, who are most likely to receive stock options, have a larger point estimate on the interaction term. However, neither the interaction terms in the high- and low-wage columns is significant, which is likely due to high volatility of industry stock returns and hence low power of the test.

2.3.2. Certification Shock

Decisions to leave a given firm are driven by beliefs about future career prospects at the existing firm as well as outside employment opportunities. Employees working at a firm which

[13] In unreported results, we find that the causal relation between a successful IPO and departure rates to start-ups is driven by male employees in our sample.

successfully completes an IPO may see their value in the marketplace rise. Other start-up firms may see these employees as having the necessary skills to expertly guide a firm through an IPO. This, in turn, may increase the job prospects for these employees at start-ups. Similar arguments have been made in regards to occupational certification in Kleiner and Krueger (2013).[14]

To empirically test this mechanism, we look for cases where the IPO will have a relatively lower certification effect on the firm's employees. We argue that employees of firms which have received VC financing receive a certification effect at the time the financing is announced. We assume that subsequent certification shocks, such as the news of a successful IPO, will have a relatively more moderate incremental impact on employee's career prospects, as compared to the news that a firm successful completed an IPO without VC backing.

We report the results in Panel B using the same four samples as described in Panel A. Across all samples, we find a negative coefficient on the interaction of IPO and VC-backed, consistent with the certification shock mechanism. However, these coefficients are always insignificant, likely reflecting the low power in these tests.

2.3.3. Culture Shock

Start-ups are typically associated with a unique culture. As a firm completes an IPO, this culture may change. Indeed, many high-tech firms filing for an IPO explicitly list as a risk factor for continued strong performance and results a possible adverse change in the firm's corporate culture following the IPO.[15] We posit that if the IPO is also associated with turnover in the CEO, then this suggests greater change in firm culture. Indeed, past studies such as Adams, Almeida and Ferreira (2009) and Wasserman (2013) find that firm performance can deteriorate following founder CEO departures; moreover, a founder CEO departure can signal more broadly managerial structural changes often associated with a changing corporate culture. We report the results in

[14] An occupational certification is provided by either the US government or a third party and indicates that the employee has completed training in a given occupation. Applying for an occupational certification is typically a voluntary action and not required to perform the job tasks related to the occupation, unlike an occupational license. There is a modest but significant effect on jobs for employees with these occupational certifications. See Kleiner and Krueger (2013) for more information.

[15] For example, in Google's S-1 dated April 29, 2004, they explicitly state: "We believe that a critical contributor to our success has been our corporate culture, which we believe fosters innovation, creativity and teamwork. As our organization grows, and we are required to implement more complex organizational management structures, we may find it increasingly difficult to maintain the beneficial aspects of our corporate culture. This could negatively impact our future success. In addition, this offering may create disparities in wealth among Google employees, which may adversely impact relations among employees and our corporate culture in general."

Panel C, again using the same four samples described in Panel A. We interact IPO with a CEO departure indicator and show that the interaction predicted in the second stage has positive coefficients, consistent with the belief that completed IPOs paired with CEO departures lead to higher employee departures to startups. However, the interaction term is always statistically insignificant. Given the difficulty in measuring changes in culture, we are reluctant to dismiss this mechanism. The lack of a finding may be due to low power and a noisy proxy.

3. Do IPOs Prompt Employee Departures More Generally?

In the prior section, we demonstrated that successful IPOs prompt employees to depart the firm for startups. In addition, we presented evidence that a key underlying explanation for these departures is a positive shock to the wealth of the employees who depart. In this section, we consider whether a successful IPO cause employees to depart the firm more broadly, including to established firms. Understanding this is important from the perspective of evaluation the mechanisms explored above, as well as for a consideration of the possible offsetting positive effects of new firm creation stemming from successful IPOs.

3.1.4. General Turnover Results

To understand the incentives for employees to leave following an IPO and join a start-up it is important to consider other changes the IPO will have to the employee's opportunity set. Does the IPO increase the frequency at which employees leave in general? Or leave and join established firms? Or is there an increase in employees who drop from the LEHD sample following a successful IPO suggesting an increase in the number of employees who have voluntarily or involuntarily left labor force? Understanding the answer to these questions will help to understand whether the IPO changes the desirability of remaining at the filing firm in general and whether or not it affects the desirability or availability of other alternative opportunities.

Table 7 reports results exploring changes in other forms of employee turnover. In Columns 1-3, we report results using an OLS methodology. In Columns 4-6, we report results using the IV methodology as described in earlier tables. In Columns 1 and 4, the dependent variable is the percent of employees observed ex-ante that remain employed at the firm in the post period. Column 1 shows a nearly 11 percentage points increase in employees who remain at the IPO filing firm if the IPO is successful. This is an economically meaningful estimate given only 27% of ex

ante employees remain in the post period at the average sample firm. However, once we control for the endogeneity of IPO success, the result becomes insignificant (Column 4). Taken together, these results suggest that overall employee turnover is lower at firms with higher quality. Furthermore, the changes which occur at a firm following an IPO, in net, do not appear to have an overall significant relation on the propensity to remain employed at the firm for the average ex ante employee.

Columns 2 and 5 explore the percent of ex-ante employees who leave to join established firms (firms of 4 years or greater) following the IPO. The OLS regression shows a strong decline of nearly eight percentage points in the probability of leaving the filing firm and joining an established firm. Again, this represents a meaningful change given the sample average rate of joining an established firm of 24%. However, once we control for the endogeneity of the IPO completion, the relation is no longer significant. These results show a consistent story with the percent of employees who remain employed at the filing firm. Better quality firms have greater employee retention and lower departures to other established firms. Moreover, the IPO itself appears to have no net casual impact on departures to established firms.

Columns 3 and 6 explore the percent of workers who leave the LEHD sample following an IPO. Workers may leave the LEHD sample because they become temporarily unemployed, leave the labor force permanently, move to a state which is not covered in our LEHD data or due to tracking errors in the data. Using either the OLS or IV methodology, we find no significant change in employee departures from a firm and out of the LEHD sample.

3.1. Total Employment Results

Next, we explore changes in total employment around the IPO event. Changes in total employment can provide insight into the labor needs of the firm. If employment declines post-IPO, then our results on changes in entrepreneurism may reflect employees who were either forced out of the firm or who anticipated limited career opportunities at their existing firm and hence sought out alternative employment options, such as start-ups. For example, Babina (2015) shows that following periods of firm financial distress, employees are more likely to exit to found new firms. On the other hand, if employment is increasing post-IPO, this could signal a firm with strong career and promotion opportunities. An employee leaving such a firm to join a start-up is making this decision in light of potentially large opportunity costs.

Table 8 reports the results. In Columns 1-3, we report results using an OLS methodology. In Columns 4-6, we report results using the IV methodology as described in earlier tables. In Columns 1 and 4, the dependent variable is ex-ante total firm employment. Column 1 shows that firms with successful IPOs are larger, by employee count, prior to the IPO filing.[16] However, this result loses significance once we instrument for the IPO in Column 4.

Columns 2 and 5 explore one year employment growth following the IPO. The OLS regression shows a one year employment growth rate that is 17 percentage points greater at firms which successfully complete their IPO. The IV regression shows a similar point estimate, however, the result is not statistically significant. Columns 3 and 6 explore three year employment growth following the IPO. Both the OLS and IV regressions show a positive, statistically significant and economically important increase in employment growth following the IPO. If anything, the IV results suggest that after controlling for the endogeneity of IPO completion, future employment growth is even stronger. The capital inflow associated with an IPO may be more critical to future expansion plans for firms of marginal quality where NASDAQ returns will have the greatest influence on IPO completion, the same firms upon which our IV identification rests.

Combining these results of an average increase in employment with the finding of no decrease in employee turnover suggests that following an IPO event, firms do not, on average, increase forced separations. As such, the workers we observe who leave following the IPO to join a new start-up are more likely pursuing these opportunities out of choice and not because they were forced out of their previous employer.

3.3. Wage Results

In the following section we explore changes in wages around the IPO event. Changes in wages provide the final clue in understanding the opportunity set available to workers who then chose to leave their current employer and join a new start-up.

Table 9 reports the results. In Columns 1-4, we report results using an OLS methodology. In Columns 5-8, we report results using the IV methodology as described in earlier tables. In Columns 1 and 4, the dependent variable is pre-IPO average firm wages, aggregated based on

[16] This result differs from the finding in Table 1 where univariate statistics show no significant difference in ex-ante employment between successful IPO firms and firms which withdraw their IPOs indicating the importance of controlling for other firm characteristics in this regression.

individual wages for all employees covered in the LEHD. Using both methodologies, the coefficient on IPO is statistically insignificant.

Columns 2 and 5 explore thee year wage growth following the IPO. Firm-level average wage growth is estimated by aggregating the wage change for all individuals at the firm, observed in the pre-IPO filing window, and covered in the LEHD data. OLS results show a positive and statistically significant coefficient on IPO while the IV results show an insignificant coefficient. Taken together, these results are consistent with positive assortive matching. The IPO dummy in the OLS regression proxies for firm quality and better employees, employees who receive higher wage growth, match to these better firms. However, there appears to be no causal impact of the IPO event itself on average firm wage growth, potentially suggesting that pre-IPO firms are not limited in their ability to pay wages due to cash constraints.

Wage changes in Columns 2 and 5 are estimated for all employees observed at an IPO filing firm in the quarter before the filing. As such, any changes in wages will not reflect changes in the composition of a firm's workforce. However, this estimate includes wage changes for workers who are no longer employed at the original IPO filing firm. We thus consider two alternative approaches to measuring wage change. In Columns 3 and 6 we estimate wage changes, again using the LEHD data, but using only those employees who left the original IPO filing firm.[17] Comparing the results in Columns 2(5) with results in Columns 3(6) allows us to infer the differential wage path for both stayers and employees who separate from their original employer. In Columns 3 and 6, we observe a statistically and, more importantly, economically insignificant coefficient on IPO. These results suggest that the changes in wages observed in Columns 2 and 5 is driven by employees who remain at the IPO filing firm.

Finally, we consider one additional measure of wage change. In Columns 4 and 8 we measure wage change using LBD data. By using LBD data, we are able to include information on all employees of a firm, not just those employees in states covered by the LEHD program and includes both, pre-IPO workers and new hires after the IPO filing. Second, we aggregate this information from establishment-level data on total payroll and total employment, as such the estimation is specific to employees employed at the IPO filing firm. The drawback of this

[17] A more direct approach would be to look at the subset of employees who stay. However, for some firms in our sample, all employees leave. As such, an estimate using wage changes for just staying employees would involve a small change in the sample composition, leading to a more complicated Census disclosure path.

approach is that we cannot confirm that the employees whose wages are measured in the pre-period are the same employees observed in the post-period. As such, any wage change could be a consequence of changes to the composition of the firm's workforce or to changes in wages for the average employee. The results in Columns 4(8) are similar to those reported in Columns 2(5) suggesting that post-IPO the firm does not make significant changes in the composition of its workforce by pay level.

In sum, the turnover, total employment, and wage results all suggest that a successful IPO has no significant negative impact on employment opportunities and career expectations within the firm. Moreover, the employment results suggest that the IPO potentially improves the prospects for employees. These results are consistent with our interpretation that employees departing for startups are electing to do so because of a specific desire to seek out these jobs, not because of an increase in pressure to leave their existing jobs.

4. Robustness Tests

In this section, we consider two robustness tests. First, we show evidence validating the assumption that the exclusion restriction is met. Second, we show evidence validating the generalizability of our results by showing that the 25 states in our sample do not have unique properties as compared to the entire US.

4.1. Placebo Test

To validate that the exclusion restriction is met, we consider the following placebo test. We look at the relationship between entrepreneurship rates and NASDAQ returns using the 3 month window *prior to* the IPO filing, on the same sample of firms. We argue that returns prior to the IPO filing should have no impact on entrepreneurship rates, after controlling for annual returns using year fixed effects. Indeed, this is confirmed in Table 10.

Column 1 reports the first stage results. There is no significant relationship between returns prior to the IPO filing and IPO success. Columns 2 and 3 report second stage results where the dependent variable is the count of employees who leave the IPO filing firm and join a start-up in the 3 years following the IPO filing. In Column 2, this variable is scaled by all employees pre-IPO at the firm, as measured in the quarter prior to the IPO filing. In Column 3, this variable is scaled by all employees who leave the firm in the post period to either become employed at a firm

of known age or drop out of the employment sample. All Columns include year and industry fixed effects as well as additional firm characteristics as controls. After instrumenting for IPO success with NASDAQ returns prior to the IPO filing, we find no statistical relationship between IPO success and future rates of entrepreneurship. These results give additional validity to our assumption that there is no direct relationship between post-filing IPO returns and entrepreneurship rates, after controlling for annual returns.

4.2. Sample Selection Tests

One analysis is restricted to 25 states due to data limitations in the LEHD. All of our prior analysis was completed on employees at IPO filing firms physically located in these 25 states. Given that we are missing key states in terms of high-tech start-ups, such as California, one may be concerned about the generalizability of our results. To address this possible concern, we make use of the fact that while the LEHD is restricted in its coverage, the LBD is available for all 50 states and the District of Columbia. The LBD can be used to observe wages and employment. As such, we repeat our tests of ex-ante employment and wages as well as employment and wage changes following IPO filing using the LBD. We do this for two samples: the 25 states in the original analysis; and, the entire United States.

In Table 11, we report the results from the OLS regressions. The odd columns have the sample using the 25 original states. The even columns use the full United States. By expanding the sample to the full US, we nearly double the number of unique IPOs. We also include employees of the firms in the original sample but who were employed outside of the original 25 states in the broader sample. However, even with these large increases to coverage, the results are very similar between the two samples. Columns 1-2 (3-4) look at ex-ante employment (wages). Columns 5-6 (7-8) look at changes in employment (wages). In these OLS results, in no case does the sign change direction, nor do we lose significance on the key variable of interest, IPO. Moreover, we find similar patterns using the IV approach. These results suggest that the 25 states in our sample do not exhibit unusual patterns, as compared to the complete United States and speak to the generalizability of our findings.

5. To What Extent May the Slowdown in IPO Activity Contribute to Reduced New Firms Creation?

To quantify the potential impact of declining IPOs on US entrepreneurial activity, suggested by our base estimates, we make the following approximation. If we assume IPOs remained at average levels in the 1990s (approximately 500 per year) as opposed to the lower realized counts in the 2000s (approximately 100 per year), then with 330 employees on average per IPO firm and an increased departure to new start-ups of 17.5% following a successful IPO, an additional 23,100 employees would join entrepreneurial firms each year.[18] Measuring entrepreneurial employment in technology start-ups is noisy due to the crude measures of industry used in the public access QWI data of employment in firms aged 0-1.[19] We sum employment in professional, scientific and technical services (NAICS 54), information (NAICS 51) and manufacturing (NAICS 31-33) and then divide by two to get a number of unique employees at startups each year.[20] We start by measuring employment in 2000, a year of high IPOs as well as high startup activity. Using available data, we find 529 thousand people according to our measure in 2000.[21] This declines to 280 thousand in 2014, a decline in employment of 249 thousand. The decline in employment increases to 281 thousand after adjusting for the impact of the missing states. Using this calculation, the decline in IPOs can explain approximately 8.2% of the missing employment in high-tech startups.

This is a rough approximation, however, the calculation indicates that IPOs can have a meaningful impact on startup employment. These calculations are supported by the fact that the recent decline in start-up activity in the US followed a sharp decline in rates of new IPOs in the early 2000s. However, we add the important caveat that while IPOs have declined throughout the early 2000s, acquisitions of relatively young high growth firms have increased. Acquisitions of IPO filing firms in our sample do have a significant impact on departures to entrepreneurships but of a magnitude approximately one third that of the IPO effect. This diminished effect may be due to the fact that acquisitions do not bestow the same wealth shock on employees given the ability of the acquirer to cancel stock options (Babenko, Du and Tserlukevich 2016). However if there is

[18] This increase measures the difference in departure rates to startups following IPOs as compared to alternative "exits" such as acquisitions given firms with withdrawn IPOs in our sample are common acquisition targets.
[19] Data is available from http://lehd.ces.census.gov/pub/.
[20] The QWI public use data sum employment over firms of two years. This will possibly count the same employee at a start-up on two subsequent years. To avoid double-counting employees, we divide this number in ½.
[21] Due to limitations in coverage, data on Alabama, Arizona, Arkansas, Kentucky, Maine, Michigan, Mississippi, New Hampshire, Wyoming and DC are unavailable in 2000 (but available in 2014).

a sufficient increase in the overall number of acquisitions of these firms, this could counter the effect of any decrease in IPOs on employee departures to startups.

Moreover, any positive impact on new firm creation might be partially offset by costs to the growth and productivity of the firm that has gone public and which loses its employees to startups. While we cannot quantify the precise cost of employee departures to the IPO firms, we have reasons to believe these departures can have negative implications. Popular media is rife with stories about employee distractions following IPOs. In a July 25, 2005 article in Fortune, Adam Lashinsky states that "If the IPO was the beginning, it was also the beginning of the end. Netscape's businesspeople and engineers often seemed on different planets as the company wrestled with runaway growth and the vertigo of overnight wealth."

Employees who depart to startups appear to have been highly valued by their previous employer. Employees who leave for start-ups have average wages that are 10-12% higher, as compared to the average wage of employees who depart for established firms. Losing entrepreneurial minded employees may be particularly damaging for firms that are still depending on innovation to meet expectations of exponential growth over the following years. However, the IPO may also signal a transition to a firm more focused on implementation and scaling, as compared to pure innovation. As such, the firm may have reduced needs for entrepreneurial minded employees.

Finally, these departing employees may be taking ideas out of the IPO firm and helping to launch new rivals. In support of this idea, we estimate that in our sample, among employees who move to startups, 49% move to startups in the same SIC-2 industry as their former IPO filing employer. This estimate is significantly larger than other available estimates. For example, Babina (2015) shows that in publicly traded firms this number is around 17%, potentially suggesting large competitive effects of employee departures from IPO filing firms to startups.

6. Conclusion

In this paper, we focus on the role of the IPO market and the firm's choice to go public as a possible driver of new firm creation. In particular, we ask whether employees are more likely to depart a firm to join a startup after their current firm goes public. We find that employees are significantly more likely to leave for startups when their firm goes public, but only after instrumenting for whether the firm completes the IPO process.

We suggest three non-mutually exclusive mechanisms which can explain this pattern. First, following an IPO, many employees who received large stock grants in the past are able to cash out. This shock to employee wealth may allow employees to better tolerate the risks associated with joining a new start-up. Alternatively, employees may anticipate a cultural shock or leave in response to greater outside job prospects due to a certification effect following the IPO. Consistent with the first mechanism, we find IPO completion is a more significant predictor of male employee departures to start-ups at firms which had previously realized strong industry returns (where employee stock options have presumably risen more in value).

Our results are unique to workers leaving for start-ups. We find no change in employee departures to established firms following the IPO, after controlling for firm quality. We also document no changes to wages following the IPO, after controlling for firm quality. However, we do observe an increase in employment post-IPO suggesting some of the capital raised is then used to expand the scale of the firm.

Our results also suggest that higher quality firms have lower turnover rates, providing empirical support for recent theories of the firm focused on employees as the key assets (e.g., Rajan and Zingales 1998, Zingales 2001, Carlin and Gervais 2009). These empirical results raise questions as to what extent firm financing and other organizational choices depend on quality of firms and their workforce. For example, in a world, where talent pool becomes increasingly global and where workers with required skills can more easily found by firms, internal labor markets might be less valuable to employees and hence benefits to diversification might be diminished.

Finally, our results suggest that the recent decline in IPOs means fewer workers move to startups, decreasing overall new firm creation in the economy. We estimate that the decline in IPOs can explain more than eight percent of the decline in startup activity in the late 2000s. This has important implications for the future growth, dynamism and productivity of the US economy.

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Appendix Table 1. Variable Definitions.

All continuous variables are winsorized at 1/99% percentiles.

FIRM VARIABLES

IPO – An indicator variable which equals one if a firm completes an initial public offering

VC Backed – An indicator variable which assumes the value of 1 if the firm received VC investment prior to the IPO filing, as identified in either VentureXpert or VentureSource using a name and address matching algorithm.

Firm Employment - Total firm employment calculated as the sum of employment of all firm's establishments in the LBD.

Firm Payroll - Total firm payroll calculated as the sum of payroll of all firm's establishments in the LBD (in thousands).

Average Wages (LBD) - Average firm wage calculated as the ratio of Firm Payroll to Firm Employment, measured the year before the IPO filing (in thousands).

Average Wages (LEHD) - Average annualized quarterly wages of the firm's workers available in the LEHD, measured one quarter before the IPO filing (in thousands).

Average Wages of Departing Employees (LEHD) - Average annualized quarterly wages of the firm's workers who subsequently separate from the IPO filing firm over the 3 year window, measured one quarter before the IPO filing (in thousands).

Average Future Wages (LEHD) - Average annualized wages of the firm's workers in the LEHD one quarter before the event quarter, where earnings are total real earnings earned over 3 years following the IPO filing quarter.

Average Future Wages of Departing Employees (LEHD) - Average annualized wages of the firm's workers in the LEHD one quarter before the event quarter and who subsequently separate from the IPO filing firm over the 3 year window, where earnings are total real earnings earned over 3 years following the IPO filing quarter.

Average Wage Growth (LEHD) - Average wage growth for all workers at the firm one quarter before the event quarter as compared to the average wages over the following 3 years.

Average Wage Growth of Departing Employees (LEHD) - Average wage growth for all workers at the firm one quarter before the event quarter as compared to the average wages over the following 3 years, using only those employees who subsequently separate from the IPO filing firm over the 3 year window

Firm Age - Firm age calculated as the age of the oldest establishment owned by the firm using the LBD.

Acquired – An indicator variable which assumes a value of 1 if the firm is acquired over 3 years following the filing.

STOCK RETURNS VARIABLES

Return 60D After – Cumulative NASDAQ stock returns over the 60 days following an initial IPO filing.

Return 90D Before – Cumulative NASDAQ stock returns over the 90 days prior to an initial IPO filing.

Return to Resolution - Cumulative NASDAQ stock return from the date of the initial IPO filing to IPO completion or withdrawal. If completion or withdrawal status is missing, completion period is set to 270 days.

WORKER VARIABLES

Average Worker Age – Firm-level average employee age estimated using all the firm's employees available in the LEHD.

Percent Female - Percent of the firm's workforce that is female, estimated using all of the firm's employees available in the LEHD.

Percent White - Percent of the firm's workforce that is white, estimated using all of the firm's employees available in the LEHD.

Percent Foreign-Born - Percent of the firm's workforce that was born outside of the US, estimated using all of the firm's employees available in the LEHD.

Percent Born in State - Percent of the firm's workforce that was born within the current state of employment, estimated using all of the firm's employees available in the LEHD.

Average Education - Firm-level average number of years of workers' education, estimated using all of the firm's employees available in the LEHD. This variable is partially imputed in the LEHD data.

Average Tenure - Firm-level average number of years of worker's tenure at the current employing unit, estimated using all of the firm's employees available in the LEHD.

ENTREPRENEURSHIP VARIABLES

Percent Entrepreneurship (All) - The fraction of firm workers who become entrepreneurs in 3 years (join firms of age 3 years or less) after we identify them at a given firm and normalized by the beginning of period employment - measured one quarter before the event quarter.

Percent Entrepreneurship (Turnover) - The fraction of firm workers who become entrepreneurs in 3 years (join firms of age 3 years or less) after we identify them at a given firm and normalized by the number of workers who move to a firm with a known age or drop out from the employment sample.

Percent Entrepreneurship (Turnover2) - The fraction of firm workers who become entrepreneurs in 3 years (join firms of age 3 years or less) after we identify them at a given firm and normalized by the number of workers who separate from the firm after IPO filing.

Number New Firms (All) – The number of new firms associated with workers from the IPO filing firm who become entrepreneurs in the 3 years after the IPO filing, normalized by the beginning of period employment.

Number New Firms (Turnover) – The number of new firms associated with workers from the IPO filing firm who become entrepreneurs in the 3 years after the IPO filing, normalized by the number of workers who move to a firm with a known age or drop out from the employment sample.

Percent Entrepreneurship Top5 (All) - The fraction of a firm workers who become entrepreneurs in 3 years (join firms of age 3 years or less) and are also one of the top 5 earners in the new firm normalized by the beginning of period employment - measured one quarter before the event quarter.

Percent Entrepreneurship Top5 (Turnover) - The fraction of a firm workers who become entrepreneurs in 3 years (join firms of age 3 years or less) and are one of the top 5 earners in the new firm normalized by the number of workers who move to a firm with a known age or drop out from the employment sample.

TURNOVER VARIABLES

Percent Stay – The fraction of firm workers who in 3 years since the event quarter stay with the firm normalized by the beginning of period employment, which is measured one quarter before the event quarter.

Percent Move to Older Firm - The fraction of firm workers who in 3 years since the event quarter move to a firm with age more than 3 years normalized by the beginning of period employment, which is measured one quarter before the event quarter.

Percent Move to Firm of Unknown Age - The fraction of firm workers who in 3 years since the event quarter move to a firm with undefined age normalized by the beginning of period employment, which is measured one quarter before the event quarter.

Percent Move to Unemployed - fraction of firm workers who in 3 years since the event quarter drop out from the employment sample normalized by the beginning of period employment measured one quarter before the event quarter.

Table 1. Summary Statistics. Panel A. Column 1 reports the mean, kernel-weighted mean [in brackets] and standard deviation (in parentheses) of firm-level characteristics for firms that filled an IPO. The kernel-weighted mean is estimated to approximate a median and is calculated placing a 99% weight on observations within the interquartile range and a 1% weight on the remaining observations. Column 2 reports the values for the sample of firms which withdrew their IPO filing. Column 3 reports the mean for the sample of firms which completed their IPO filing. Column 4 reports the difference between Columns 2 and 3. Column 5 reports the p-value for the samples' difference in means t-test. All variables are described in Appendix Table 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. Statistical significance is calculated using robust standard errors. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	All Firms	IPO Withdrawn	IPO Successful	Difference	P-value of Difference
VC Backed	0.668	0.679	0.663	-0.016	0.596
	(0.471)	(0.468)	(0.473)		
Firm Employment	331.42	332.38	331.06	-1.322	0.965
	[145.69]	[138.96]	[149.32]		
	(618.11)	(652.42)	(605.30)		
Firm Payroll	19,815.57	20,458.01	19,573.65	-884.36	0.341
	[12,539.22]	[12,533.36]	[12,593.86]		
	(23,656.74)	(25,565.45)	(22,916.44)		
Average Wages (LBD)	89.79	94.00	88.21	-5.80**	0.037
	[84.40]	[89.41]	[82.40]		
	(42.05)	(41.23)	(42.28)		
Average Wages (LEHD)	107.649	110.941	106.409	-4.532*	0.081
	[104.320]	[108.400]	[103.066]		
	(45.848)	(46.372)	(45.630)		
Firm Age	8.08	7.58	8.26	0.68*	0.072
	[6.75]	[6.30]	[6.83]		
	(6.40)	(6.28)	(6.44)		
Return 60D After	0.01	-0.04	0.03	0.070***	0.000
	[0.02]	[-0.03]	[0.03]		
	(0.12)	(0.14)	(0.10)		
Return 90D Before	0.08	0.07	0.08	0.01*	0.089
	[0.07]	[0.06]	[0.07]		
	(0.14)	(0.17)	(0.13)		
Return to Resolution	0.03	-0.03	0.05	0.07***	0.009
	[0.03]	[-0.11]	[0.04]		
	(0.14)	(0.19)	(0.12)		

Table 1. Summary Statistics. Panel B. Column 1 reports the mean, kernel-weighted mean [in brackets] and standard deviation (in parentheses) of worker-level characteristics averaged at the firm-level for firms that filled an IPO. The kernel-weighted mean is estimated to approximate a median and is calculated placing a 99% weight on observations within the interquartile range and a 1% weight on the remaining observations. Column 2 reports the values for the sample of firms which withdrew their IPO filing. Column 3 reports the mean for the sample of firms which completed their IPO filing. Column 4 reports the difference between Columns 2 and 3. Column 5 reports the p-value for the samples' difference in means t-test. All variables are described in Appendix Table 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. Statistical significance is calculated using robust standard errors. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	All Firms	IPO Withdrawn	IPO Successful	Difference	P-value of Difference
Average Worker Age	37.378	37.835	37.205	-0.629**	0.028
	[37.165]	[37.434]	[36.986]		
	(4.564)	(4.650)	(4.523)		
Percent Female	0.308	0.316	0.305	-0.012	0.540
	[0.282]	[0.292]	[0.281]		
	(0.249)	(0.247)	(0.250)		
Percent White	0.844	0.849	0.841	-0.008	0.171
	[0.914]	[0.916]	[0.913]		
	(0.170)	(0.161)	(0.173)		
Percent Foreign-born	0.079	0.086	0.076	-0.010	0.192
	[0.056]	[0.063]	[0.055]		
	(0.141)	(0.148)	(0.139)		
Percent Born in State	0.314	0.301	0.319	0.018*	0.084
	[0.289]	[0.273]	[0.296]		
	(0.231)	(0.228)	(0.232)		
Average Education	14.716	14.604	14.759	0.155***	0.009
	[14.700]	[14.625]	[14.733]		
	(0.995)	(0.970)	(1.002)		
Average Tenure	1.260	1.220	1.275	0.056	0.436
	[1.117]	[1.061]	[1.145]		
	(0.780)	(0.808)	(0.769)		

Table 1. Summary Statistics. Panel C. Column 1 reports the mean, kernel-weighted mean [in brackets] and standard deviation (in parentheses) of variables measuring employee entrepreneurship propensity and different types of worker turnover over three year period following an IPO filing. The turnover variables are estimated at the firm–level. The kernel-weighted mean is estimated to approximate a median and is calculated placing a 99% weight on observations within the interquartile range and a 1% weight on the remaining observations. Column 2 reports the values for the sample of firms which withdrew their IPO filing. Column 3 reports the mean for the sample of firms which completed their IPO filing. Column 4 reports the difference between Columns 2 and 3. Column 5 reports the p-value for the samples' difference in means t-test. All variables are described in Appendix Table 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. Statistical significance is calculated using robust standard errors. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

		IPO			P-value of
	All Firms	Withdrawn	IPO Successful	Difference	Difference
Percent Entrepreneurship (All)	0.047	0.051	0.045	-0.006	0.624
	[0.030]	[0.037]	[0.029]		
	(0.110)	(0.118)	(0.106)		
Percent Entrepreneurship (Turnover)	0.076	0.074	0.077	0.003	0.793
	[0.064]	[0.066]	[0.064]		
	(0.141)	(0.133)	(0.144)		
Percent Entrepreneurship (Turnover2)	0.063	0.060	0.064	0.004	0.776
	[0.051]	[0.053]	[0.052]		
	(0.127)	(0.121)	(0.129)		
Percent Stay	0.267	0.179	0.301	0.121***	0.000
	[0.282]	[0.200]	[0.313]		
	(0.251)	(0.222)	(0.253)		
Percent Move to Older Firm	0.236	0.292	0.215	-0.077***	0.000
	[0.207]	[0.264]	[0.184]		
	(0.222)	(0.250)	(0.207)		
Percent Move to Firm of Unknown Age	0.154	0.163	0.150	-0.012	0.259
	[0.107]	[0.129]	[0.101]		
	(0.170)	(0.164)	(0.173)		
Percent Move to Unemployed	0.292	0.311	0.285	-0.026	0.120
	[0.247]	[0.267]	[0.241]		
	(0.232)	(0.247)	(0.226)		

Table 1. Summary Statistics. Panel D. Column 1 reports the mean, kernel-weighted mean [in brackets] and standard deviation (in parentheses) of variables measuring worker ex ante wages (one quarter prior to the IPO filing) and ex post wages/wage growth (average over three years after an IPO filing), as well as firm employment growth post IPO filing (average over three years). All variables are estimated at the firm–level. The kernel-weighted mean is estimated to approximate a median and is calculated placing a 99% weight on observations within the interquartile range and a 1% weight on the remaining observations. Column 2 reports the values for the sample of firms which withdrew their IPO filing. Column 3 reports the mean for the sample of firms which completed their IPO filing. Column 4 reports the difference between Columns 2 and 3. Column 5 reports the p-value for the samples' difference in means t-test. All variables are described in Appendix Table 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. Statistical significance is calculated using robust standard errors. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	All firms	IPO Withdrawn	IPO Successful	Difference	P-value of Difference
Average Wages (LEHD)	107.649	110.941	106.409	-4.532*	0.081
	[104.320]	[108.400]	[103.066]		
	(45.848)	(46.372)	(45.630)		
Average Wages of Departing Employees (LEHD)	100.935	106.023	99.019	-7.004**	0.037
	[97.639]	[102.965]	[95.939]		
	(46.272)	(47.030)	(45.880)		
Average Future Wages	116.771	107.378	120.308	12.930***	0.000
	[110.014]	[102.058]	[113.526]		
	(56.231)	(52.247)	(57.307)		
Average Future Wages of Departing Employees	99.277	96.307	100.395	4.088	0.123
	[92.124]	[91.583]	[92.706]		
	(52.714)	(49.632)	(53.829)		
Average Wage Growth	0.049	-0.034	0.080	0.114***	0.000
	[0.056]	[-0.024]	[0.087]		
	(0.366)	(0.368)	(0.360)		
Average Wage Growth of Departing Employees	-0.125	-0.158	-0.113	0.045*	0.083
	[-0.092]	[-0.147]	[-0.072]		
	(0.495)	(0.478)	(0.501)		
Employment Growth	-0.02	-0.18	0.04	0.22***	0.000
	[0.01]	[-0.13]	[0.05]		
	(0.36)	(0.36)	(0.34)		

Table 2. OLS Regressions. This table reports results of OLS regressions of the percent of future entrepreneurs on whether or not the firm completed an IPO. The dependent variable is the count of employees who leave the IPO filing firm and join a start-up in the 3 years following the IPO filing. In Columns 1-4, this variable is scaled by all employees at the IPO filing firm, as measured in the quarter prior to the IPO filing. In Columns 5-8, this variable is scaled by all employees who leave the firm during this 3 year window to join firms of known age or exit the employment sample. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	Percent Entrepreneurship (All)				Percent Entrepreneurship (Turnover)			
IPO	-0.003	-0.002	0.004	0.002	0.006	0.007	0.012	0.010
	(0.011)	(0.011)	(0.013)	(0.010)	(0.013)	(0.013)	(0.014)	(0.012)
Firm Employment				-0.015***				-0.013**
				(0.005)				(0.006)
Average Wage				-0.046***				-0.045**
				(0.018)				(0.019)
Average Worker Age				-0.001				-0.002
				(0.001)				(0.001)
Percent Female				-0.022				-0.004
				(0.026)				(0.034)
Average Education				0.008				0.010
				(0.006)				(0.007)
Acquired				0.017				0.016
				(0.011)				(0.013)
Return 90D Before				0.005				0.013
				(0.039)				(0.046)
Year FE	Yes	Yes	-	Yes	Yes	Yes	-	Yes
Industry FE	No	Yes	-	Yes	No	Yes	-	Yes
Industry FE x Year FE	No	No	Yes	No	No	No	Yes	No
Observations	800	800	800	800	800	800	800	800
R-Squared	-0.001	-0.003	-0.025	0.020	-0.001	-0.001	-0.027	0.010

Table 3. IV Regressions First-Stage. This table reports results of IV regressions (first-stage). The dependent variable is whether or not the firm completed an IPO. The instrumental variable is the NASDAQ return in the 60 day window following the IPO filing. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable		IPO		
Return 60D After	0.508***	0.518***	0.546***	0.502***
	(0.152)	(0.152)	(0.152)	(0.152)
Firm Employment				0.032**
				(0.015)
Average Wage				0.055
				(0.044)
Average Worker Age				-0.005
				(0.004)
Percent Female				-0.081
				(0.065)
Average Education				0.027*
				(0.015)
Acquired				-0.136***
				(0.040)
Return 90D Before				0.140
				(0.129)
Year FE	Yes	Yes	-	Yes
Industry FE	No	Yes	-	Yes
Industry FE x Year FE	No	No	Yes	No
Observations	800	800	800	800
Adjusted R-Squared	0.149	0.147	0.178	0.170
F-test	11.169	11.628	12.833	10.938
p-value	0.001	0.001	0.000	0.001

Table 4. IV Regressions Second-Stage. This table reports second stage results of IV regressions of the percent of future entrepreneurs on whether or not the firm completed an IPO. The dependent variable is the count of employees who leave the IPO filing firm and join a start-up in the 3 years following the IPO filing. In Columns 1-4, this variable is scaled by all employees at the IPO filing firm, as measured in the quarter prior to the IPO filing. In Columns 5-8, this variable is scaled by all employees who leave the firm during this 3 year window to join firms of known age or exit the employment sample. IPO completion is instrumented by NASDAQ returns in the 60 day window following the IPO filing. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	Percent Entrepreneurship (All)				Percent Entrepreneurship (Turnover)			
IPO	0.155*	0.161*	0.168*	0.175*	0.215*	0.221*	0.228**	0.243**
	(0.090)	(0.090)	(0.086)	(0.093)	(0.114)	(0.114)	(0.106)	(0.120)
Firm Employment				-0.021***				-0.022**
				(0.007)				(0.009)
Average Wage				-0.056***				-0.058***
				(0.021)				(0.022)
Average Worker Age				-0.000				-0.000
				(0.001)				(0.002)
Percent Female				-0.006				0.019
				(0.026)				(0.036)
Average Education				0.004				0.003
				(0.006)				(0.007)
Acquired				0.040**				0.048*
				(0.020)				(0.025)
Return 90D Before				-0.014				-0.013
				(0.049)				(0.059)
Year FE	Yes	Yes	-	Yes	Yes	Yes	-	Yes
Industry FE	No	Yes	-	Yes	No	Yes	-	Yes
Industry FE x Year FE	No	No	Yes	No	No	No	Yes	No
Observations	800	800	800	800	800	800	800	800

Table 5. IV Regressions Second-Stage -- Alternative Measures of Entrepreneurship. This table reports second stage results of IV regressions of measures of entrepreneurship on whether or not the firm completed an IPO. In Column 1, the dependent variable is the number of new firms associated with workers employed at the IPO filing firm during the quarter prior to the IPO filing who joined those new firms three years after the IPO filing, normalized by pre-filing employment. In Column 2, the dependent variable is the fraction of workers at the IPO filing firm who join startup three years following the IPO filing and are one of the top five paid employees at the start-up, normalized by pre-filing employment. In Column 3, the dependent variable is the number of new firms associated with workers employed at the IPO filing firm during the quarter prior to the IPO filing who joined those new firms three years after the IPO filing, normalized by the number of employees who leave and join firms of known age or drop from the LEHD sample. In Column 4, the dependent variable is the fraction of workers at the IPO filing firm who join startup three years following the IPO filing and are one of the top five paid employees at the start-up, normalized by the number of employees who leave and join firms of known age or drop from the LEHD sample. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006 and which are matched to both LBD and LEHD. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable	Number New Firms (All)	Percent Entrepreneurship Top5 (All)	Number New Firms (Turnover)	Percent Entrepreneurship Top5 (Turnover)
IPO	0.171*	0.118*	0.235**	0.235**
	(0.089)	(0.068)	(0.114)	(0.114)
Firm Employment	-0.020***	-0.014**	-0.021**	-0.021**
	(0.007)	(0.006)	(0.009)	(0.009)
Average Wage	-0.052**	-0.039**	-0.054**	-0.054**
	(0.020)	(0.018)	(0.022)	(0.022)
Average Worker Age	0.000	0.002	0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Percent Female	-0.008	-0.000	0.012	0.012
	(0.025)	(0.020)	(0.035)	(0.035)
Average Education	0.004	0.002	0.004	0.004
	(0.006)	(0.005)	(0.007)	(0.007)
Acquired	0.035*	0.024	0.042*	0.042*
	(0.019)	(0.015)	(0.024)	(0.024)
Return 90D Before	-0.022	-0.015	-0.017	-0.017
	(0.047)	(0.029)	(0.056)	(0.056)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	800	800	800	800

Table 6. Testing for Underlying Mechanisms behind Employee Departures to Startups. This table reports second-stage results of IV regressions of the percent of future entrepreneurs on whether or not the firm completed an IPO. Column 1 includes all employees. Column 2 includes only male employees. Column 3 includes only employees in the top ½ of the firm's pre-IPO filing quarter wage distribution. Column 4 includes only employees in the bottom ½ of the firm's pre-IPO filing quarter wage distribution. Panel A looks at the wealth shock mechanism. Panel B looks at the certification shock mechanism. Panel C looks at the culture shock mechanism. The dependent variable is the count of employees who leave the IPO filing firm and join a start-up three years following the IPO filing, scaled by all ex-ante employees at the firm. IPO completion is instrumented by the returns on NASDAQ in the 60 day window following the IPO filing. Ind Returns is measured as the industry stock returns over the two years preceding the IPO filing. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	1 All Employees	2 Male Employees	3 High Earners	4 Low Earners
Panel A				
IPO	0.131	0.153	0.131	0.126
	(0.082)	(0.093)	(0.084)	(0.109)
Ind Returns	-0.070	-0.184	-0.168	-0.034
	(0.111)	(0.145)	(0.144)	(0.120)
IPO * Ind Returns	0.178	0.359*	0.337	0.116
	(0.165)	(0.217)	(0.214)	(0.181)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	800	800	800	800
Panel B				
IPO	0.228	0.248*	0.208*	0.238
	(0.140)	(0.145)	(0.120)	(0.196)
VC-backed	0.045	0.029	0.014	0.061
	(0.080)	(0.083)	(0.070)	(0.111)
IPO * VC-backed	-0.086	-0.058	-0.037	-0.113
	(0.112)	(0.117)	(0.099)	(0.156)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	800	800	800	800
Panel C				
IPO	0.174	0.214	0.184*	0.169
	(0.142)	(0.168)	(0.104)	(0.211)
CEO departure	-0.319	-0.407	-0.079	-0.568
	(0.614)	(0.739)	(0.365)	(0.945)
IPO * CEO	0.469	0.574	0.127	0.821
departure	(0.842)	(1.011)	(0.498)	(1.297)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	800	800	800	800

Table 7. Turnover Results. This table reports results of OLS regressions (Columns 1-3) and second stage IV regressions (Columns 4-6) of measures of employee turnover on whether or not the firm completed an IPO. In Columns 1 and 4, the dependent variable is the number of workers at the IPO filing firm who remain at the firm as of 3 years following the IPO filing, normalized by pre-filing employment at the IPO filing firm. In Columns 2 and 5, the dependent variable is the number of workers at the IPO filing firm who move to an established firm in the three years following the IPO filing, normalized by pre-filing employment at the IPO filing firm. An established firm is a firm with age more than three years. In Columns 3 and 6, the dependent variable is the number of workers at the IPO filing firm who drop out of the employment sample three years following the IPO filing, normalized by pre-filing employment at the IPO filing firm. In Columns 4-6, IPO completion is instrumented by the returns on NASDAQ in the 60 day window following the IPO filing. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Percent Stay	Percent Move to Older Firm	Percent Move to Unemployed	Percent Stay	Percent Move to Older Firm	Percent Move to Unemployed
IPO	0.106***	-0.076***	-0.009	0.135	0.065	-0.248
	(0.020)	(0.020)	(0.014)	(0.139)	(0.176)	(0.164)
Firm Employment	0.029***	-0.008	0.015***	0.028***	-0.013	-0.010
	(0.008)	(0.007)	(0.005)	(0.010)	(0.009)	(0.010)
Average Wage	0.082***	-0.051**	0.016	0.080***	-0.059**	0.018
	(0.024)	(0.024)	(0.017)	(0.025)	(0.024)	(0.027)
Average Worker Age	-0.004*	0.002	0.001	-0.003	0.002	0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.003)
Percent Female	0.052	0.061	-0.027	0.055	0.075	-0.084
	(0.042)	(0.051)	(0.030)	(0.043)	(0.054)	(0.057)
Average Education	-0.004	-0.012	0.007	-0.005	-0.016	0.007
	(0.009)	(0.012)	(0.007)	(0.010)	(0.014)	(0.013)
Acquired	-0.128***	0.038*	0.063***	-0.123***	0.057*	-0.020
	(0.019)	(0.020)	(0.017)	(0.026)	(0.030)	(0.031)
Return 90D Before	-0.032	-0.007	0.020	-0.035	-0.023	0.041
	(0.059)	(0.057)	(0.045)	(0.059)	(0.061)	(0.074)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	800	800	800	800	800	800
Adjusted R-squared	0.181	0.051	0.060			

Table 8. Employment Results. This table reports results of OLS regressions (Columns 1-3) and second stage IV regressions (Columns 4-6) of measures of firm employment on whether or not the firm completed an IPO. The dependent variable in Columns 1 and 4 is pre-filing firm employment. The dependent variable in Columns 2 and 5 is post-filing firm 1 year employment growth. The dependent variable in Columns 3 and 6 is post-filing firm average three year employment growth. In Columns 4-6, IPO completion is instrumented by the returns on NASDAQ in the 60 day window following the IPO filing. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Firm Employment	Employment Growth (1 Year)	Employment Growth (3 Year)	Firm Employment	Employment Growth (1 Year)	Employment Growth (3 Year)
IPO	0.208**	0.173***	0.166***	0.728	0.254	0.367*
	(0.089)	(0.040)	(0.027)	(0.620)	(0.337)	(0.202)
Firm Employment		-0.064***	-0.036***		-0.067***	-0.043***
		(0.022)	(0.012)		(0.024)	(0.014)
Average Wage	-1.441***	0.343***	0.125***	-1.445***	0.338***	0.113***
	(0.110)	(0.055)	(0.036)	(0.109)	(0.058)	(0.037)
Average Worker Age	-0.004	-0.013***	-0.007**	-0.001	-0.012**	-0.006*
	(0.010)	(0.005)	(0.003)	(0.011)	(0.005)	(0.003)
Percent Female	0.318*	0.088	-0.032	0.363*	0.096	-0.013
	(0.184)	(0.073)	(0.045)	(0.191)	(0.079)	(0.051)
Average Education	0.115***	-0.020	-0.005	0.099**	-0.023	-0.011
	(0.039)	(0.018)	(0.011)	(0.043)	(0.019)	(0.012)
Acquired	0.104	0.038	-0.011	0.174	0.049	0.017
	(0.092)	(0.046)	(0.030)	(0.123)	(0.068)	(0.041)
Return 90D Before	0.251	-0.146	-0.138	0.188	-0.155	-0.160*
	(0.249)	(0.133)	(0.085)	(0.268)	(0.133)	(0.089)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	800	800	800	800	800	800
Adjusted R-squared	0.305	0.246	0.180			

Table 9. Wage Results. This table reports results of OLS regressions (Columns 1-4) and second stage IV regressions (Columns 5-8) of measures of wages on whether or not the firm completed an IPO. The dependent variable in Columns 1 and 5 is the natural logarithm of ex ante average firm wages, aggregated based on individual wages for all employees covered in the LEHD. The dependent variable in Columns 2 and 6 measures ex post firm 3 year average wage growth using LEHD data. The dependent variable in Columns 3 and 7 measures ex post firm 3 year average wage growth using LEHD data for those workers who leave within 3 years following IPO filing. The dependent variable in Columns 4 and 8 measures ex post firm 3 year average wage growth using LBD data for all employees, pre-IPO filing workers and workers hired after the IPO filing. In Columns 4-6, IPO completion is instrumented by the returns on NASDAQ in the 60 day window following the IPO filing. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	Average Wages (LEHD)	Average Wage Growth (LEHD)	Average Wage Growth of Departing Employees (LEHD)	Average Wage Growth (LBD)	Average Wages (LEHD)	Average Wage Growth (LEHD)	Average Wage Growth of Departing Employees (LEHD)	Average Wage Growth (LBD)
IPO	0.031	0.083**	0.005	0.067***	0.044	-0.071	-0.011	-0.066
	(0.040)	(0.032)	(0.042)	(0.021)	(0.305)	(0.256)	(0.327)	(0.165)
Firm Employment	-0.091***	0.011	0.003	0.007	-0.091***	0.016	0.004	0.012
	(0.016)	(0.012)	(0.018)	(0.008)	(0.017)	(0.015)	(0.020)	(0.010)
Average wage		0.004	-0.077	-0.112***		0.012	-0.076	-0.104***
		(0.041)	(0.056)	(0.027)		(0.043)	(0.057)	(0.030)
Average Worker Age	0.029***	-0.008**	-0.008	0.001	0.029***	-0.009**	-0.008	-0.000
	(0.005)	(0.004)	(0.005)	(0.002)	(0.005)	(0.004)	(0.005)	(0.002)
Percent Female	-0.684***	0.087	0.086	-0.012	-0.682***	0.072	0.084	-0.025
	(0.094)	(0.075)	(0.098)	(0.035)	(0.098)	(0.077)	(0.101)	(0.038)
Average Education	0.145***	-0.001	0.004	0.013	0.144***	0.003	0.004	0.016*
	(0.021)	(0.017)	(0.022)	(0.008)	(0.023)	(0.019)	(0.024)	(0.009)
Acquired	0.013	0.030	0.077*	-0.080***	0.015	0.008	0.075	-0.098***
	(0.040)	(0.032)	(0.042)	(0.024)	(0.057)	(0.048)	(0.062)	(0.033)
Return 90D Before	0.161	-0.001	0.027	0.018	0.160	0.016	0.029	0.033
	(0.128)	(0.105)	(0.143)	(0.065)	(0.133)	(0.111)	(0.148)	(0.067)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	800	800	800	800	800	800	800	800
Adjusted R-squared	0.398	0.046	0.039	0.193				

Table 10. IV Regressions -- Placebo Test Results. This table reports first- and second-stage results of IV regressions of the percent of future entrepreneurs on whether or not the firm completed an IPO and other controls. Column 1 reports first-stage results. Columns 2 and 3 report second-stage results. IPO completion is instrumented by the returns on NASDAQ in the 90 day window prior to the IPO filing. The dependent variable in Column 1 is whether or not the firm completed an IPO. The dependent variable in the remaining columns is the count of employees who leave the IPO filing firm and join a start-up in the 3 years following the IPO filing. In Column 2, this variable is scaled by all employees at the IPO filing firm, as measured in the quarter prior to the IPO filing. In Column 3, this variable is scaled by all employees who leave the firm during this 3 year window. All control variables are defined in Appendix 1. The sample includes high-tech firms which filed for an IPO from 1992 through the first quarter of 2006. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	1st Stage	2nd Stage	
	(1)	(2)	(3)
Dependent Variable	IPO	Percent Entrepreneurship (All)	Percent Entrepreneurship (Turnover)
Return 90D Before	0.111		
	(0.130)		
IPO		0.048	0.126
		(0.355)	(0.436)
Firm Employment	0.035**	-0.016	-0.017
	(0.015)	(0.013)	(0.017)
Average Wage	0.058	-0.049*	-0.051
	(0.044)	(0.026)	(0.032)
Average Worker Age	-0.006	-0.001	-0.001
	(0.004)	(0.002)	(0.003)
Percent Female	-0.097	-0.018	0.007
	(0.065)	(0.041)	(0.056)
Average Education	0.027*	0.007	0.007
	(0.015)	(0.011)	(0.013)
Acquired	-0.138***	0.023	0.032
	(0.041)	(0.051)	(0.063)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	800	800	800
Adjusted R-squared	0.157		
F-test	0.733		
p-value	0.392		

Table 11. LBD Regressions Across Different Samples. This table reports results from OLS regressions. The dependent variable in columns 1 and 2 is pre-IPO filing employment. The dependent variable in columns 3 and 4 is 3-year post-IPO filing employment growth. The dependent variable in columns 5 and 6 is pre-IPO filing wages. The dependent variable in columns 7 and 8 is 3-year post-IPO filing wage growth. The sample in columns 1, 3, 5, and 7 includes all establishments associated with high-tech firms which filed for an IPO from 1992 through the first quarter of 2006 in the original 25 states covered in the main tests in the paper and described in the data section. The sample in columns 2, 4, 6 and 8 includes all establishments associated with high-tech firms which filed for an IPO from 1992 through the first quarter of 2006 in the original 50 states and the District of Columbia. The number of observations is rounded to the nearest hundred due to Census disclosure policies. Robust standard errors are reported in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	Firm Employment (LBD)		Employment Growth (3 Year, LBD)		Average Wages (LBD)		Wage Growth (3 Year, LBD)	
IPO	0.150	0.113	0.169***	0.130***	0.039	0.040	0.068***	0.066***
	(0.107)	(0.084)	(0.027)	(0.021)	(0.038)	(0.028)	(0.021)	(0.015)
Return 90D Before	0.101	0.068	-0.109	-0.070	0.115	0.095	0.015	-0.008
	(0.294)	(0.245)	(0.083)	(0.067)	(0.111)	(0.093)	(0.065)	(0.046)
Firm Employment			-0.037***	-0.021**			0.008	0.014***
			(0.012)	(0.008)			(0.008)	(0.005)
Average Wage			0.118***	0.172***			-0.100***	-0.118***
			(0.035)	(0.025)			(0.027)	(0.016)
Acquired			-0.008	-0.001			0.015	-0.047***
			(0.030)	(0.025)			(0.065)	(0.018)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	800	1500	800	1500	800	1500	800	1500
Adjusted R-squared	0.059	0.085	0.174	0.135	0.356	0.308	0.193	0.186