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Evidence from the Semiconductor Industry

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Is Working for a Start-up Worth It? Evidence from the Semiconductor Industry

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Abstract

This paper examines the long-term earnings implications of workers' decisions to work for early-stage firms. Using quarterly data, 1990-2002, from the California Unemployment Insurance System covering workers in California's semiconductor industry, I compare the career trajectories of charter employees (i.e. employees who leave established firms to join a start-up firm in the start-up's first quarter of record) with a matched sample of comparable workers at each charter employee's pre-start-up employer. Estimating a fixed-effects model using the matched sample, I find that joining an early-stage firm has higher expected value and higher variance than staying at an established firm or than changing jobs to a different established firm. Additionally, I demonstrate that firm death and initial public offerings both have very little effect on the earnings levels and trajectories of charter employees. Finally, I look at the coefficient of relative risk aversion at which workers are indifferent between working at a start-up and staying at their previous employer. I conclude that joining a start-up in California's semiconductor industry is utility maximizing for all workers with a low to moderate level of risk aversion.

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1 Introduction

The semiconductor industry in the 1990s was marked by declining barriers to entry that gave rise to an increase in firm start-up activity. These start-ups are thought to offer a high-reward/high-risk employment relationship to potential employees. On the upside, relative to workers at established firms, workers at start-ups may have steeper earnings profiles as they progress through a small growing firm. Also, early employees may reap greater benefits from an initial public offering (IPO) than workers who join the firm later. On the downside, start-ups may be cash constrained and pay lower initial wages than workers' alternative employment, and workers at start-ups may face a greater risk of involuntary displacement due to firm death. Workers faced with the opportunity to leave an established firm to become a charter employee at a start-up must decide if the potential reward of working for a start-up justifies the potential risk. In this paper, I provide an ex post analysis of the rewards and risks of start-up employment in the semiconductor industry in California.

Specifically, I analyze the earnings profiles of *charter employees*, where charter employees are individuals who leave an established firm to work for a start-up in the start-up's first period of record. I examine the following counterfactuals on charter employees' earnings:

- What would charter employees' career profiles look like had they not left their previous employer to join a start-up?

- What would charter employees' career profiles look like had they changed jobs to an established firm and not to a start-up?

I also examine the impact of firm death and firm initial public offering on the earnings profiles of workers in this industry.

Very little is known about the long-term earnings profiles of entrepreneurs and other early-stage employees[1]. This paper provides a framework for analyzing the earnings profiles of early-stage workers. Additionally, this research provides estimates of the distribution of future earnings for workers who choose to pursue entrepreneurial activities and provides baseline estimates of the coefficient of relative risk aversion of start-up employees. The

[1] There is a small, but growing literature on the labor market outcomes for entrepreneurs and other forms of self-employment. Most existing studies look at the characteristics that lead to self-employment (Blanchflower and Oswald, 1998; Rees and Shah, 1986) including gender differences (Devine, 1994) and racial differences (Fairlie and Meyer, 2000). There are several studies that compare the earnings and hours worked between self-employed and paid workers, but can not construct a strong counterfactual group (Hamilton, 2000; Carrington, McCue, and Pierce, 1996).

research also demonstrates that in California's semiconductor industry, working at a start-up has substantial returns and substantial variance.

Using Unemployment Insurance (UI) data from the state of California I construct quarterly panel data on every worker that worked in the semiconductor industry at any time between 1990 and 2002. I focus on the set of all semiconductor charter employees (workers who leave established semiconductor firms and immediately join a start-up in the new firm's first quarter of record). I construct a reference group for the charter employees by matching each charter employee with a colleague who worked at the same firm at the same time and earned a very similar amount as the charter employee but did not choose to leave to work at a start-up.

Using the matched sample of workers, I extend the methodology of Jacobson, LaLonde, and Sullivan (1993) to examine the effect of firm events on employees' earnings and earnings growth. I use the Jacobson, LaLonde, and Sullivan approach to examine:

- the earnings profiles of all workers who leave established firms to join start-up firms relative to the sample of matched workers who stay at established firms.
- the pre- and post-firm death earnings of charter employees and their matched counterparts.
- the pre- and post-initial public offering earnings of charter employees and their matched counterparts.

The first point examines the counterfactual "What would charter employees earn had they not left their established firm to work for a start-up?" The second and third points examine the firm outcomes that traditionally make start-ups high-reward/high-risk.

Building on the methodology of Jacobson, LaLonde, and Sullivan, I construct dummies for each year pre- and post- job change for each worker and estimate a model including fixed effects and time varying characteristics. This specification is a generalization of difference-in-differencing that accounts for the impact of permanent observed and unobserved characteristics and time-varying observed characteristics. Even if workers' permanent characteristics are related to their job change status, this methodology yields unbiased results[2]. Additionally, this model does not impose a strong functional form on earnings profiles.

[2]See Jacobson, LaLonde, and Sullivan (1993) for further details. The Jacobson, LaLonde, and Sullivan methodology has also been implemented in Kletzer and Fairlie (2003), Stevens (1997) and Schoeni and Dardia (1996).

I find that workers who leave established firms to work for start-ups suffer an initial earnings dip but quickly recover and after four quarters are earning more than their matched counterparts. After three years, charter employees have earned approximately $4,500 more than the counterfactual group who remained at the established firm. I also find that firm death and IPO play very little role on the cash earnings of workers in this industry and time period.

These results may be driven by the endogeneity of job change: workers only change jobs if they expect to do better on their new job. As a robustness check, I examine the earnings profiles of charter employees after a job change to a start-up with the earnings profiles of charter employees after other job changes. Because I have longitudinal data on charter employees from 1990-2002, I capture all job changes for charter employees, and analyze whether job changes to start-ups are significantly different from other job changes. I find that workers in the charter sample earn substantially more after changing jobs to start-ups than after changing jobs to established firms. Over their first three years on a new job, charter employees earn approximately $30,000 more after changing to a start-up than after changing jobs to an established firm.

As an additional robustness check, I examine whether charter employees are systematically different than the matched sample with respect to job changes. If workers in the charter sample earn more than their matched counterparts for every job change, then the effect of changing jobs to a start-up will be biased upwards. I compare the earnings profiles of charter employees after job change to an established firm to the earnings profiles of their matched counterparts after job change to an established firm. I find that both charter employees and their matched counterparts have very similar outcomes after changing jobs to an established company.

The robustness checks demonstrate two key points: within the sample of charter employees, job change to a start-up is significantly different than job change to an established firm; and between the two samples of workers, there is little difference after job change to an established firm. This implies that the large returns to working at a start-up are driven by either characteristics of the start-up job or characteristics of the match between start-up job and individual characteristics of charter employees.

There is substantial return for workers at start-ups, but there is very little risk. After three years, over 75% of charter employees have greater total earnings than their matched counterparts. Although approximately 27% of start-ups fail in the first three years, workers at failed start-ups are not penalized in the labor market. Similarly, 1.5% of start-ups go public within three years, but initial public offering has little effect on the earnings profiles of charter employees.

While few charter employees earn less than their matched counterparts, there is substantial variance in future earnings for workers at start-ups. Even though potential charter employees may safely assume that they will be better off joining a start-up than staying at their original firm, the variance of outcomes for charter employees is much larger than for their matched sample, so there may be uncertainty as to how much better off they will be.

I find that because of the variance in outcomes, it makes economic sense for workers with low to moderate levels of relative risk aversion to join start-ups in California's semiconductor industry. At the mean and median, the earnings profiles of charter employees dominate those of similar workers who stay at the same established firm as well as those who change jobs into established firms, however the variance in outcomes for charter employees is large.

The remainder of this paper proceeds as follows. In Section 2, I present an overview of the semiconductor industry. I describe the industry and discuss the underlying industry trends that may affect the results of the research. Section 3 contains an overview of the data from the California UI System and a discussion of relevant measurement issues. In Section 4, I present the analytical framework for looking at the long-term career implications of workers' decisions. I present estimates of the impact of the decision to leave an established firm and work for a start-up in Subsections 4.1-4.4. Concluding remarks are in Section 5.

2 Overview of the Semiconductor Industry

The late 1980s and 1990s are marked by a significant restructuring of the semiconductor industry. Previously, the semiconductor manufacturing industry was characterized by rapid technological change and very high capital costs accompanied by continual product price declines and demanding quality standards. These industry characteristics led to the growth of large integrated firms where design, manufacturing, testing, and marketing were all done in-house. Because fabrication capacity was very expensive, the barriers to entry for small firms were large.

However in the late 1980s, this traditional market structure was altered with the introduction of the semiconductor foundry model. Foundries owned fabrication capacity and would fabricate the designs for other firms on a contract basis, eliminating the need for new firms to invest in fabrication plants. Soon after the birth of the foundry model, competition in the market for design tools put downward pressure on the cost of designing chips. As the barriers to entry decreased in the late 1980s and 1990s, start-up activity in the industry increased.

Increased start-up activity and increased market competition in the industry lead to high risks and returns to product innovation and lead to competitive pressures to bring improved products quickly to market. The semiconductor industry is deeply competitive both in the short run (that is, the typical two-year product cycle) through price reductions and in the long run through the introduction of new and better products.

With lower barriers of entry and increased competition in the 1990s, the semiconductor industry experienced large numbers of firm births and deaths in an innovative and competitive environment. In order to compete in such an environment, start-up firms participate in regional networks (Appleyard, 1996; Almeida and Kogut, 1999; and Almeida, Dokko, and Rosenkopf, 2003) and develop alliances with stronger firms (Eisenhardt and Schoonhoven, 1996). As a result, workers in start-ups often have strong social networks and may be more likely to find alternative employment if their firm fails than workers with less extensive social networks.

Employment in the industry increased from approximately 56,510 in 1990 to a peak of 94,766 in the second quarter of 2001 then decreased to 83,583 in the fourth quarter of 2001, see Figure 1. Payroll growth accelerated sharply at the tail end of the late-1990s technology boom and quickly decelerated after the market turned. Total real quarterly industry payroll was \$600M in the first quarter of 1990 and grew to \$3.5B in the first quarter of 2001, by the end of the sample, payroll decreased to \$2.1B. The earnings covered in the data include wage and salary earnings, all taxable bonuses (including cash and non-pecuniary bonuses), and taxable stock options. The run-up in earnings at the peak of the boom may be partially attributable to an increase in non-wages/non-salary compensation.

The semiconductor industry comprises a significant portion of California's manufacturing economy. Semiconductor firms employ approximately 5% of California's 1.7M manufacturing employees in year 2001 and pay approximately 9% of California's \$28B quarterly manufacturing payroll in 2001[3].

As demonstrated in Figure 2, the semiconductor industry in California grew from 481 firms in 1990 to 636 firms in the last quarter of 1999 and then shrank to 558 firms at the end of the sample. Figure 2 also contains the value of shipments in the industry from domestic firms. There are business-cycle peaks in 1995 and 2001 for the U.S. semiconductor industry.

[3] California labor market statistics available from the State of California Employment Development Department at http://www.calmis.ca.gov.

The value of total shipments in the U.S. semiconductor industry increased from 1990 Q1 to 1995 Q4. The U.S. industry then entered a recession between 1996 Q1 and 1998 Q2. Growth resumed from 1998 Q3 to 2000 Q4.

3 Data and Measurement Issues

In this analysis, I construct a dataset combining administrative data collected as part of the California Unemployment Insurance (UI) System with stock market data from the Center of Research in Security Prices (CRSP). The UI data allow me to track the earnings and employers of California workers covered by the UI system. The CRSP data allow me to identify which firms are publicly traded and when these firms became publicly traded.

The California UI system compiles quarterly earnings and employment records for all workers covered by the UI system. For each of the 52 quarters in the sample, I obtain wages and employer information for all workers who have ever been employed in the semiconductor industry, as defined by Standard Industry Classification and North American Industry Classification System codes. For a detailed description of the data and variable creation, see Appendix A-1.

Each observation includes a worker identifier, firm identifier, and quarterly earnings for each quarter in the data. If an individual works at multiple firms in the quarter, each individual-firm pair is an observation.

The strength of the data is that it is universal and covers a long time period. The number of observations is very large which allows the data to be cut in a variety of ways. The data are also administrative data and are highly accurate.

The primary weakness is that there are few controls in the data. There are no controls for the standard demographics of age, gender, race, nor are there controls for the standard human capital variables of education and occupation. Further, experience and tenure are left censored.

Given the large number of observations, I employ a matching methodology which mitigates the effects of the lack of controls.

3.1 Matching Charter Employees with Non-Charter Employees

I am interested in the labor-market outcomes of workers who leave established firms to work at young, risky start-ups. Specifically, I examine the following group of workers:

Charter Employees: employees who leave an established firm in the semiconductor industry and join a start-up in the start-up firm's first quarter of existence.

As demonstrated in Figure 3, employees who have ever been a charter employee at a start-up have substantially greater median earnings than the rest of the sample. Because charter employees are observably different from the rest of the sample, I construct a reference group of similar workers who have never worked at a start-up. The matched sample is defined as follows:

Matched Employees: each charter employee is matched to his or her nearest neighbor in the wage distribution of the charter employee's pre-start-up employer in the charter employee's last full quarter of employment at the pre-start-up employer.

In other words, in the quarter before a charter employee leaves for a start-up they are matched with an employee at the same established firm who earns a very similar amount. Each charter employee should be matched to a worker with very similar skills, background, and other characteristics that may affect earnings potential.

The fundamental counterfactual is that the matched employees represent the outcomes for the charter employees had they not chosen to work for a start-up. The two groups are constructed to have similar observable characteristics and to face similar economic conditions. The groups may differ across unobservable characteristics such as age, experience, occupation, field of specialization,"entrepreneurial skill", opportunity to work at a start-up, or underlying risk-preferences.

Table 3 presents the earnings distributions for the charter employees and matched sample in the quarter prior to charter employees leaving for a start-up. The distributions of quarterly earnings and annual earnings are very similar. At the median, the quarterly earnings of the two groups differ by $164 or less than 1%. Annual earnings differ by just $2 at the median.

Another source of potential bias is what happens to workers when they disappear from the sample. I observe all workers who have ever worked in the semiconductor industry for every quarter that they receive earnings in the UI covered sector. If I do not observe an employee in a quarter, they may be employed in an uncovered sector, employed out of state, unemployed, or retired. However, if the matched sample has the same distribution of reasons for disappearing from the data, then the bias attributed to this form of sample selection is minimized.

I use the set of worker pairs to examine a variety of events in the work history of a charter employee. Specifically, I examine several effects:

- The initial earnings effect of working for a start-up and return to tenure for charter employees relative to their matched counterparts.
- The effect of start-up death on a displaced charter employee's earnings and earnings growth relative to their counterparts.
- The effect of IPO on earnings and earnings growth for charter employees relative to their counterparts.
- The effect of leaving an established employer to work for a start-up relative to the effect of other job changes for charter employees and their counterparts.

3.2 Identifying Firm Birth, Death, and IPO

In order to identify charter employees and estimate the return to firm life-cycle events, I must accurately calculate the date of firm birth, death, and IPO in the data.

I identify new firms by the first quarter the firm appears in the data. However, firms that are spun-off of existing firms will be misidentified as start-ups. Also, new firms that are the result of a merger of two existing firms may be misidentified as start-ups, as will established out-of-state firms that are entering California for the first time and firms that change employer identification number. When any of these existing firms receive a new employer identification number in California, they will appear as a start-up in the data set. To clean the artificial firm births out of the data, I do not consider any firm birth where 50 percent or more of the charter employees all come from the same firm and there are more than 20 charter employees. Similarly, acquisitions will be misidentified as a firm death. I employ similar rules to identify artificial firm deaths. See Appendix A-1 for more detail.

Table 1 presents tabulations of firm births and deaths by year for the California semiconductor industry. In the raw data (not shown), there are 808 potential firm-births. I identify that 266 of these are likely to be artificial births leaving 542 firm births that do not appear to be the result of spin-offs, entry of an out-of-state firm, or administrative recode. Similarly, there are 481 potential firm deaths in the raw data. After accounting for 56 events that appear to be mergers or acquisitions and administrative recodes, there are 425 valid firm deaths.

481 firms enter the sample in Q1 1990. Of these 481 firms, 218 survive to the end of the sample. The years with the greatest number of firm births are 1996-1998 with 68, 57, and

58 new firms respectively. The years with the smallest number of firm births are 2001 and 1993 with 3 and 36 valid firm births.

At the end of the sample, there are 558 surviving firms, 542 of which have valid firm births. Of the 425 valid firm deaths, 58 occurred in 2000 and 56 occurred in 1999. The years with fewest deaths are 1995 and 1991 with 26 and 28 firm deaths.

Of the valid firm births, 12% die with in their first 4 quarters of existence, 19% die within their first two years of existence, and 27% die within their first three years of existence. Firm birth is dated by the first quarter that a firm pays payroll taxes so these start-ups are more established than the iconic garage-based company. The firms have already acquired some form of revenue or venture financing that allows them to pay employees. Given that these start-ups are mature enough to have a payroll, these mortality rates are fairly large.

It is the goal of many start-up firms to have an initial public offering. There are 107 firms in the data that are publicly traded, see Table 2. Of these 107 firms, 46 were publicly traded from the beginning of the sample, 39 additional firms were born before the sample started and became publicly traded during the course of the sample. The remaining 22 firms were born and became publicly traded during the period of observation. Three of the remaining 22 firms experience an initial public offering before they enter California. Of the 19 firms with observable firm birth date and IPO date, 8 firms became public within three years of firm birth. Of the 542 valid firm births, 8 have an IPO within three years of birth which implies that the probability of a start-up becoming publicly-traded within 3 years of birth is just under 1.5%.

To summarize the success and failure rates facing new firms, 1.5% of start-ups go public within three years, while 27% of start-ups die within three years. In other words, start-ups are 18 times more likely to die than to go public during their first three years of existence.

In the next section I examine the long-term earnings implications for workers who choose to work at a start-up firm.

4 Career Profiles for Charter Employees Is Working at a Start-up Worth It?

I divide the analytical section into four components. First, I look at the long-term earnings implications of working for a start-up. I then compare the long-term effects of working for a start-up to workers who change jobs to work for established firms. Third, I examine the effect of experiencing a firm death or initial public offering on the future earnings of charter employees and their matched counterparts. Finally, I present some back-of-the-envelope calculations of the level of risk aversion of charter employees.

In each section, I use the matched sample of charter employees and their counterparts to examine the counterfactual: What would happen to a charter employee had they not chosen to work for a start-up?

I adapt the methodology of Jacobson, LaLonde, and Sullivan (1993) to examine the impact of firm life-cycle events on the earnings profiles of workers.

Jacobson, LaLonde, and Sullivan estimate the following fixed effects model:

$$\ln W_{it} = \alpha_i + x_{it}\beta + D_{it}\delta + \epsilon_{it} \tag{1}$$

where W_{it} is total quarterly earnings and α_i is the "fixed effect" capturing all permanent observed and unobserved worker characteristics (including age, race, and gender). The vector x_{it} contains observed time-varying characteristics of individuals and their jobs.

The vector D_{it} contains a series of dummy variables that indicate the timing of a firm life-cycle event during an individual's work history. The life-cycle events of interest include: an individual is employed at a firm in the firm's first quarter of existence, an individual changes jobs, an individual is employed at a firm when the firm dies, and an individual is employed in a firm when the firm has an initial public offering. The dummy variables are constructed to capture the years before, the quarter of, and the years after the firm event occurred. For example, $D_{i,-1}$ indicates that individual i is observed in the year prior to experiencing the event of interest, D_i0 indicates that individual i is observed in the quarter that the firm event first affects the worker, D_i1 indicates that individual i is observed one year after the firm event. The dummy variables with negative subscripts capture pre-event effects, the D_0 variable captures immediate effects, and the positively-subscripted variables capture the long-term effects after an individual experiences the event of interest.

In the following sections, I examine the impact of firm events on the earnings and earnings profiles of charter employees relative to their matched counterparts. To allow coefficients to vary between the charter employees and their reference group, I estimate the following interacted model:

$$\ln W_{it} = \alpha_i + x_{it}\beta + D_{it}\delta + C_i * x_{it}\beta^c + C_i * D_{it}^c\delta + \epsilon_{it} \tag{2}$$

where C_i is a dummy variable that equals one if the individual was a charter employee at a start-up firm in any quarter of the sample.

This model yields estimates of the effect of personal characteristics and work-history events on the earnings of charter employees and their matched counterparts. These estimates control for permanent differences in observable and unobservable characteristics of charter employees and their matched counterparts, time-varying differences in observable characteristics, and, of most interest, the effect of work history events on the pre- and post-event earnings of both groups of workers.

In the following sections, I apply the model in Equation 2 to examine the effect of (1) choosing to work for a start-up relative to staying with the same established employer; (2) experiencing a firm death; and (3) experiencing an initial public offering; and (4) choosing to work for a start-up relative to switching jobs to an established firm.

4.1 The Long-Term Implications of Working for a Start-up

Figure 4 demonstrates the earnings profile of charter employees before and after leaving an established employer to work at a start-up. The reference group consists of their matched counterparts.

This figure graphically represents the counterfactual earnings if a charter employee does not choose to leave their established firm to join a start-up. Earnings of the charter employees and matched sample are very similar prior to the charter employees leaving for the start-up, however, the charter employees experience a large earnings dip in the quarter of job change, return to their initial earnings level one quarter after the job change, and then experience a higher earnings trajectory than the matched counterparts. Under the assumption that the matched counterpart represents the earnings path of the charter employee had the charter employee not left the established firm to join the start-up, it appears that there are positive returns to joining a start-up.

The size of the earnings dip at the median worker is -\$2,166. Within five quarters the sum of post-start-up earnings for the median charter employee are greater than the sum of earnings for the median matched counterpart. After two years, the charter employee has earned \$1,425 more than his or her counterpart, after three years, \$4,556 more, and after 5 years, \$13,772 more than the matched counterpart.

Table 4 provides the estimates for Equation 2 as applied to the same comparison discussed above. The sample for the regression include workers who join start-up firms and the matched sample of workers who did not join start-ups. I present two specifications. Model I includes only the timing variables indicating the years before and after a worker leaves an established firm to work for a start-up. Model II includes worker and job controls.

In the specification without controls, workers who join start-ups experience a small (although statistically insignificant) earnings dip during the quarter of job change to the start-up. In subsequent years, the charter employees receive large returns to working at the start-up. After 3 years, the charter employee earns approximately 50% more than he or she earned in the year prior to joining the start-up.

In Model II, I include controls for number of quarters the observation has been in the sample (a proxy for experience), the number of previous jobs the observation held during the sample, the number of jobs held in the quarter, firm size, and a an indicator for publicly-traded firms. I also interact these controls with a dummy variable indicating that a worker is a charter employee. I find that charter employees experience an earnings dip of 13% during the quarter of job change, but quickly recover and earn 31% more than their pre-separation income after three years.

Including returns to experience, after 12 quarters a charter employee earns approximately 46% more than his or her pre-separation earnings[4]. Workers in the matched sample of non-charter employees earn 13% more than their base earnings. At the mean, start-up employees outperform their matched counterparts, even after controlling for fixed effects and time varying observables.

I also find that the return to holding previous jobs is positive and significant for both groups of workers, although the effect is not significantly different between the two groups of workers. The firm size premium is also positive and significant for both groups, but not significantly different between groups. Publicly-traded firms pay significantly higher wages, although charter employees receive less of a wage premium from employment at public firms.

In the next section I examine the firm events that conventionally make working at start-ups high risk and high reward. Specifically, I look at the impact of firm death and initial public offering on the cash earnings of charter employees.

4.2 The Effect of Firm Death and IPO on Workers' Career Profiles

As mentioned earlier, the probability that a start-up dies within the first three years of existence is approximately 27% while the probability of going public in the first three years of existence is about 1.5%.

[4]The returns to experience at the start-up at the three year mark is the return to being a charter employee at a start-up that has been in existence for 12 quarters (0.3052) plus 12 quarters of additional experience (12*(0.0111 - 0.0015)) which equals 45.6%.

In this section, I look at the earnings effect of working at a firm in the quarter in which it dies and the earnings effect of working at a firm in the quarter in which it goes public.

I choose to examine firm death/plant closure instead of layoffs to eliminate the lemons effect of layoffs (Gibbons and Katz, 1991 and Doiron, 1995). Alternative employers assume that the initial employing firm has inside knowledge of the quality of the worker. If the worker is laid-off that is interpreted as a negative signal to worker quality which biases the estimation of post-displacement earnings.

Aannual earnings for charter employees and the matched sample before and after firm death[5] and IPO are quite noisy. Using the data extract of matched workers yields small sample sizes of workers who experienced firm death and IPO, so the effect is difficult to measure precisely. However, there does appear to be preseparation earnings loss[6] and then quick recovery after separation for both sets of employees. The earnings recovery is consistent with findings from the Displaced Worker Survey (Ruhm, 1991b).

Unemployment Insurance data provide an excellent foundation for studying the impact of firm death and plant closure on the future earnings of individuals. Typically, job displacement analysis relies on the Displaced Worker Survey (DWS), but the DWS has small sample sizes, short time coverage, and is subject to "retrospective bias" where workers do not accurately recall their displacement status and recall levels vary across population (Evans and Leighton, 1995). UI data have large sample sizes and extensive longitudinal time frame. Additionally, UI data are administrative and eliminate the problem of "retrospective bias".

The firm death results are in Table 5. After controlling for worker and job characteristics, there are very little long-term effects of firm death on workers earnings profiles. Workers experience pre-separation earnings loss in the year prior to firm death. Workers at firms that will soon die earn on average 9% less in the year before firm death than workers earned two years prior to firm death. In the quarter of firm death, employees at dying firms experience an earnings dip of 21%, but workers experience full recovery in the following period. There are no significant differences in the effect of firm death on the career profiles of workers in

[5]There is an extensive literature on the impact of layoffs and plant closure on earnings profiles. Podgursky and Swaim (1987), Ruhm (1991a), and Fallick (1996) all examine the relationship of personal characteristics and the effect of job displacement on earnings. Weinberg (2001), Neal (1995), Carrington and Zaman (1994), Carrington (1993), and Howland and Peterson (1988) all argue that post-separation earnings losses are driven primarily by industry, occupation, and local recessions and are not driven by the loss of firm-specific earnings power. Kletzer (1989) demonstrates that returns to tenure do not dissipate after displacement for high-skill workers, while returns to tenure do dissipate for low-skilled workers. See Kletzer (1998) for additional review.

[6]In the Displaced Worker Supplements around 9% of pre-separation earnings are lost prior to separation indicating that firms attempt to prevent layoffs and plant closing my reducing payroll (de la Rica, 1995). However, there is evidence that wage give backs do not prevent plant closings (Hamermesh, 1988).

the charter sample relative to all other workers.

The effects of experiencing an initial public offering on the earnings profiles of charter and non-charter employees are presented in Table 6. Workers who are employed at a firm that goes public do not experience wage gains. Average earnings for non-charter employees are actually less after an IPO than before: average earnings for charter employees are roughly constant pre- and post-IPO. However, these results are difficult to interpret because the data do not capture all non-cash compensation. If workers at public firms are compensated in a manner that is not reportable to the Unemployment Insurance system (for example, through certain forms of stock options) then total compensation is unidentified in this sample. However, in terms of straight reported cash compensation, the effect of IPO on earnings profiles is small and negative.

Contrary to expectations, firm death and IPO have very little impact on the earnings profiles of charter employees relative to their matched counterparts.

One potential criticism is the endogeneity of job change. Workers will only change jobs if the expected value of the new job is greater than the expected value of the previous job. If this is true, then it is not surprising that workers who change jobs to work at start-ups are better off than had they not changed jobs. In the next section, I address this concern by comparing the earnings profiles of charter employees before and after joining a start-up with the earnings profiles of the same group of workers before and after a job change to a non-start-up. I then compare the outcomes of charter employees before and after a job change to an established firm to the outcomes of matched workers before and after a job change to an established firm.

4.3 Job Change to Start-up vs. Job Change to Established Firm

Figure 5 depicts the long-term outcomes of three groups: charter employees who join start-ups; charter employees with job change to an established firm; and matched workers with job change to an established firm. All three groups of workers experience a large dip in the quarter of separation, a quick recovery in the quarter after separation and then an upward sloping earnings profile.

All three paths are very similar prior to the separation, but after job change the path of charter employees who join start-ups dominates the earnings paths of charter employees with job change to established firms and matched employees with job change to established firm. This provides evidence that the returns to joining a start-up are large relative to joining an established firm.

After four quarters, the start-up employees earn approximately \$2,000 more per quarter than the other job changers, this gap is consistent over the time of the sample. After three years, start-up employees at the median have earned a total of approximately \$30,000 more than the other job changers. After five years, the difference in total post-separation earnings is approximately \$50,000.

Estimates of Equation 2 as applied to the sample of charter employees before and after job change to a start-up and job change to an established firm are presented in Table 7. Model I includes only the time dummies, while Model II includes personal and job characteristics. The estimates in the bottom half of the table represent the returns to any job change for charter employees, the estimates in the top-half are the interaction of job change with job-change to a start-up. I find that employees in the charter sample experience an earnings dip of 33% during the quarter of job change to an established firm, while the same workers experience an earnings dip of only 14% when changing jobs to work for a start-up. One year after job change, workers who change jobs to an established firm are back to the pre-job change earnings, while workers at start-ups earn 22% more than their pre-change earnings. After three years, the earnings gap between employees in the charter sample at start-ups and employees in the charter sample at established firms is approximately 10%.

These results indicate that even after controlling for all unobserved characteristics, job change from an established firm to a start-up dominates job change between two established firms. These results also suggest that the returns accrued by individuals working for a start-up may be driven by the characteristics of the job and not by the characteristics of the individual. I explore this point in the next set of specifications.

Table 8 presents a comparison of workers in the charter sample who change jobs to work for established firms and the matched sample of non-charter observation who change jobs to work for established firms. Again, Model I includes only the time dummies, while Model II includes personal and job characteristics. In the specification without personal and job controls, there are no significant differences between the long-term outcomes of charter employees and their matched counterparts with respect to job change to an established firm. In the specification with controls, the matched counterparts earn more than the charter employees. After three years, the matched sample earn 10% more than the charter employees.

To summarize the results from the two previous regressions, employees who have at least one spell working for a start-up (charter employees) do no better than a set of comparable workers who have never worked at a start-up when changing jobs to employment at an established firm. However, when the charter employees change jobs to employment at a start-up they earn significantly more than when these same workers change employment to an established firm.

This suggests that either start-up employment is beneficial to the earnings profiles of all workers, or that there are positive returns to matching of specific workers into start-up firms. Either way, it appears that part of the charter/start-up earnings premium is attributable to characteristics of the job and not just the characteristics of the individual.

In the previous sections I have demonstrated that the mean and median value of choosing to work at a start-up are greater than the value of not leaving the established firm. However, if workers are risk averse, it is the distribution of outcomes that affects workers' decisions. In the next section I present some simple estimates of workers' risk preferences given their job path decisions.

4.4 Risk Preferences and Start-up Choice

If workers are risk averse, then their optimization problem when making a decision under uncertainty depends upon the entire distribution of potential outcomes. Table 9 displays statistics from the earnings distribution of charter employees and their matched counterparts after charter workers separate from their pre-start-up employer. The table gives the sum of total earnings after separation occurs, with the sum of total earnings expressed as a multiple of the sum of earnings in the four quarters prior to separation. For example, the median of the distribution of sum earnings growth three years after the start-up event is 4.37 for the charter workers and 3.76 for the matched counterparts. This means that the median value of a charter employee's first three years of earnings after joining a start-up is 4.37 times the earnings of his or her last year at the established firm, compared to 3.76 for the matched employee.

The distribution of outcomes after three years and five years are graphically represented in Figure 6 and Figure 7. These figures depict kernel density estimates of the total earnings after start-up separation for both the charter employee and the matched sample. It is easily seen that the distribution of the charter sample has a larger median and mean value. The charter distribution also has fatter tails, as a result, the variance of outcomes for workers who join start-ups is much larger than the variance of outcomes for the matched workers.

The decision to join a start-up involves some downside risk as well as large potential rewards. There is great likelihood that a charter employee will earn more at a start-up than they would earn if they stayed with their original employer, but there is a fraction of workers who are not made better off by joining a start-up, and the increase in variance of outcomes as a result of joining a start-up is very large. The risk preferences of workers determine whether they maximize utility by selecting the high-mean/high-variance earnings draw of working at a start-up or the lower mean/lower variance earnings draw of staying at the established employer.

In order to estimate the level of risk aversion at which employees are indifferent between joining a start-up and staying with their original employer, I assume the following:

1. Total earnings after joining a start-up are a random draw from the observed distribution of earnings for charter employees. Total earnings after not joining a start-up are a random draw from the observed distribution of earnings for matched employees.

2. Workers know the entire distribution of possible outcomes in both states.

3. Workers have Constant Relative Risk Aversion Utility:

$$U(c) = \frac{c^{1-\gamma}}{1-\gamma} \tag{3}$$

   where γ is the coefficient of relative risk aversion.

For any given γ workers will choose to work at a start-up if and only if:

$$EU_{su}(c) \geq EU_{nc}(c)$$

where $EU_{su}(c)$ indicates expected utility from working at a start-up and $EU_{nc}(c)$ is expected utility from not changing employer.

Given the observed outcomes, I calculate the ex post expected utility of joining a start-up and the ex post expected utility of staying at an established firm at a variety of γs.

Under the assumptions given above, I find that if the relevant time-horizon is one year, workers with $\gamma = 1.39$ are indifferent between working for a start-up and staying at their previous employer. If workers look at a three year time-horizon, workers with $\gamma = 1.84$ are indifferent between the two options, and in a five year horizon $\gamma = 1.99$ is the switching point. See Table 9.

These levels of γ, the coefficient of relative risk aversion, are within the reasonable bounds expected by most economists. Chetty (2003) posits that γ should fall between 1 and 5, although higher levels may be possible. Given the expected levels of γ in the population, the estimated γs here fall in the low to moderate end of the distribution.

Although at most points in the distribution the returns to joining a start-up dominate the returns to staying, the large variance in outcomes for charter employees may dissuade risk averse workers from leaving their established firm.

5 Conclusion

Using a dataset covering the universe of workers at semiconductor start-ups in California from 1990-2002, I estimate the returns to working for a start-up relative to other employment decisions. The primary question is: Does working at a start-up make economic sense? The analysis indicates that it does indeed make economic sense for workers with low to moderate risk aversion to join start-ups.

Using UI data from the state of California, I construct quarterly panel data on all workers at semiconductor firms who leave established firms to work for a start-up in the start-up's first quarter of record (called charter employees). As a reference group, I match all charter employees with their nearest neighbor in the wage distribution of the established firm that the charter employees left.

I use the charter employees and the matched reference group to examine two key counterfactuals. I look at what charter employees would earn had they not left their established employer and what charter employees would earn had they changed jobs to an established firm instead of to a start-up. I also examine the impact of firm death and initial public offering on the long-term earnings profiles of charter employees and their matched sample.

The main findings for California's semiconductor industry are: (1) workers who leave established firms to work for start-ups suffer an initial earnings dip but quickly recover and after four quarters are earning more than their matched counterparts; (2) workers who change jobs to start-ups experience substantially better earnings than workers who change jobs to established firms; and (3) firm death and IPO have very little impact on the cash earnings of workers in this industry and time period.

Specifically, after three years, charter employees have earned approximately \$4,500 more than the matched group who remained at the established firm. Relative to comparable workers who change jobs to established firms, workers who change to start-up firms earn approximately \$30,000 more over the first three years.

The substantial return for workers who work at start-ups is accompanied by very little risk. Although 27% of start-ups fail in the first three years, workers at failed start-ups are not penalized in the labor market.

The answer to the question "Is Working for a Start-Up Worth It? is "Yes, for workers who are not highly risk averse, it made economic sense to work for a start-up in California's semiconductor industry from 1990-2002." Although there is substantial variation in outcomes, the upside is high but the downside risk is low.

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APPENDIX

A-1 Data Description and Variable Creation

A-1.1 Data from the California Unemployment Insurance Program

This analysis focuses on workers who were employed in California's Semiconductor Industry for at least four quarters at any time between 1990 and 2002. The Semiconductor Industry is identified by North American Industry Classification System (NAICS) 333295 - Semiconductor Machinery Manufacturing and 334413 - Semiconductor and Related Device Manufacturing.

I identify all workers who have worked in the Semiconductor Industry at any time during the time period, and pull their entire wage record over the time period. The resulting data consists of over 17 million observation over 52 quarters on over 800,000 unique individuals. The data in the California UI system are from two components - Business Unit Data, and Wage Record Data.

A-1.1.1 Business Unit Data

The California Employment Development Department (EDD) collects data from all private-sector employers in the state. The data come from quarterly tax records and include monthly employment, quarterly total and taxable wages and contributions for wage and salaried employees[7].

All business units that employ one or more individuals, pay wages greater than $100 in the quarter, and are in the covered sector are included in the data. Monthly employment figures include the number of employees receiving any wages in the pay period that includes the 12th of the month. Workers of all types of payroll are included (i.e. daily, weekly, monthly). Quarterly payroll figures include the total wages, share payments, bonuses, lump-sum vacation pay outs, and other covered compensation for all workers employed in that quarter. Payroll figures do not reflect any top-coding.

The following employees are excluded from the California UI program: "interstate railroad employees, the self-employed, some domestic service in private homes, children under 18 employed by a parent, persons employed by a son, daughter, or spouse, certain athletes during off-season training, illegal aliens, professional and non-professional employees of public and nonprofit schools during periods between academic years or terms, all school employees of public and nonprofit schools during vacation or holidays, and certain other small groups of workers.[8]" None of these worker categories are expected to comprise a significant portion of the semiconductor industry.

[7] http://www.calmis.ca.gov/file/es202/CEW-About.htm
[8] http://www.calmis.ca.gov/FILE/INDSIZE/0APPSIZE.htm

Business units are assigned an industry classification by employees at the EDD. Business units in the data from 1990-2000 were originally classified according to the Standard Industry Classification (SIC) system of 1987. Business units in the data after 2000 are classified by the North American Industry Classification System (NAICS). For longitudinal consistency, the EDD has re-coded all business units from 1990-2000 using the current NAICS system.

In the semiconductor industry the NAICS-SIC correspondence is straight-forward:

NAICS 333295 "Semiconductor Machinery Manufacturing" is a subset of SIC 3559 - "Industrial and Commercial Machinery and Equipment, NEC"

NAICS 334413 "Semiconductor and Related Device Manufacturing" is identical to SIC 3674 - "Semiconductors and Related Devices"

All California semiconductor equipment and manufacturing firms identified by the Sloan Competitive-Semiconductor Manufacturing Program are included in the EDD sample. Most fabless firms identified by the industry center are included (several fabless firms are classified by the function of their final products, the largest of these mis-classified fabless firms are identified and included in the data).

The business unit data are aggregated to the firm-level. For firms that only operate in the semiconductor industry, this covers all of their establishments and employment. If firms have establishment that operate in other industries, I am only accounting for the employment and payroll in the semiconductor divisions.

All dollar amounts are reported in real terms for the fourth quarter of 2001 using the Employment Cost Index (ECI). The ECI measures quarterly changes in labor costs[9].

A-1.1.2 Wage Records

The California UI system compiles quarterly earnings and employment records for all workers covered by the UI system. For each of the 48 quarters in the sample, I obtain wages and employer information for all workers who have ever been employed in the semiconductor industry, as defined above.

Each observation includes a worker identifier, firm identifier, and quarterly earnings for each quarter in the data. If an individual works at multiple firms in the quarter, each individual-firm pair is an observation.

Individuals with multiple employers in a quarter may represent workers employed at multiple jobs in parallel during the quarter or may indicate workers working multiple jobs in serial during the quarter. For each individual-quarter, I assign the primary employer as the firm that pays the largest share of an individual's earnings in that quarter.

I construct a time-series for each individual tracking their employment history and gross earnings over time. Within the time series, I classify any change from one dominant employer to a new dominant employer as a job separation. Individuals who drop out of the UI data are either retired, unemployed, no longer living in California, or no longer in the covered

[9] http://www.bls.gov/ncs/summary.htm

sector. I focus on separations in which the individual remained in the California labor force as indicated by receiving positive earnings in the California covered sector at any time in the following four quarters.

A-1.2 Data from the Center of Research in Security Prices

The Center of Research in Security Prices (CRSP) at the Graduate School of Business, University of Chicago provides historical stock price data. The CRSP U.S. stock database contains end-of-day pricing for every common stock listed on the NYSE, AMEX, and NASDAQ stock markets. The series starts in 1962.

A-1.3 Variable Construction

A-1.3.1 Identifying Public Firms and IPO date

I use the CRSP-UI data linkage to identify public firms and specify the quarter of initial public offering. Because the CRSP is universal in coverage of firms traded on the major exchanges and the UI data cover the universe of California Semiconductor firms, the intersection of the two sets will provide the universe of public California Semiconductor firms. The first date of trading identifies the quarter of initial public offering.

A-1.3.2 Identifying Start-ups

Firm start-up date is determined by the first quarter that the firm appears in the UI data. Firms may be operating prior to this quarter, but appearance in the UI data indicates that they have received an employer identification number and are paying positive wages in California.

I identify new firms by the first quarter the firm appears in the data. If the new firm is moderately large (employment greater than 20) and more than half of the first quarter employees worked for the same firm in the previous quarter, I assume the firm is a spin-off of an existing California firm. If the new firm is greater than 10 people and 75% of all employees came from the same frim, I assume that the firm identifier represents a previously existing firm that changed their administrative firm identifier in the California UI system. Additionally, if the employment in a firm's first quarter of record is greater than 20 employees where more than half of the employees are in the data for the first time, I assume that the firm is a new establishment of a company that previously existed only outside of California. I do not consider these firms to be start-ups.

I identify all of the firms that enter the data in Q2 of 1990 or later and do not appear to be spin-offs, administrative artifacts, or the first California locations of an out-of state firm as start-ups. Firms that may be misclassified as start-ups include smaller spin offs, small firms experiencing an identifier change, small branches of out-of-state firms. It is likely that there are a non-zero number of firms in this category, however I expect their effect to be small. Start-ups that would be misclassified as established firms include firms that start out of moderately large size (greater than 20 employment) where most workers are new to the labor force or all came from the same company, but who no longer have an official connection to their previous employer. It is unlikely that there are many firms meeting these criteria.

There are 808 potential firm births in the raw data. I classify 266 of these as artificial firm births. This represents 32.9% of the potential firm births.

A-1.3.3 Identifying Firm Deaths

I identify date of firm death as the last quarter in which a firm appears in the UI data. Firm death represents the permanent cessation of operations in the California semiconductor industry and may include the following events: firm closure, firm exit from California, SIC change indicating exit from the semiconductor industry.

Firms that are merged or acquired will be misidentified as firms that have died. If 50 percent or more of the employees at the firm exiting the database are employed by the same employer in the next quarter, I classify this as an artificial firm death and do not consider their exit from the database as a firm death.

In the raw data, there are 481 potential firm deaths. Fifty-six of these potential firm deaths are not valid, this represents 11.6% of the potential deaths.

Table 1: Firm Birth and Death by Year

	Death Year												
Birth Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 and later	
1990 and earlier	31	28	29	26	30	13	15	18	19	24	25	275	533
1991		0	5	4	0	1	3	3	0	1	0	20	37
1992			2	5	1	1	1	3	0	3	3	20	39
1993				3	3	1	5	3	2	1	1	17	36
1994					1	6	4	1	3	4	4	25	48
1995						4	4	2	4	8	2	26	50
1996							4	5	6	4	5	44	68
1997								5	4	5	7	36	57
1998									3	5	7	43	58
1999										1	3	45	49
2000											1	44	45
2001												3	3
	31	28	36	38	35	26	36	40	41	56	58	598	1023

Note: Author's own tabulations from California UI and ES202 data. "Birth Year" indicates the first year a firm has a payroll in California. "Death Year" indicates year of last appearance in the data.

Table 2: Firm IPO by California Birth Year

	Year of IPO												
Birth Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 and later	
1990 and earlier	45	2	2	5	9	6	4	7	1	3	1		85
1991				1		1					1		3
1992													0
1993		1		1	1			1		1			5
1994						2							2
1995	1									1	3		5
1996										1		1	2
1997									1	1			2
1998			1										1
1999								1			1		2
2000													0
2001													0
	46	3	3	7	10	9	4	9	2	7	6	1	107

Note: Authors' own tabulations using California UI, ES202 data, and Center for Research in Security Prices data. "Birth Year" indicates the first year a firm has a payroll in California. Birth year may be greater than IPO year if a firm was founded in a different state, had an initial public offering and then opened an establishment in California.

Table 3: Earnings Distribution of Charter and Matched Observations ($2003)

	Charter Employees	Matched Observations	Difference
Quarterly Earnings			
1st Quartile	8,536	9,184	-648
Median	17,365	17,529	-164
3rd Quartile	29,949	29,518	431
Annual Earnings			
1st Quartile	36,202	38,184	-1,982
Median	69,906	69,904	2
3rd Quartile	119,416	116,810	2,606
N	1078	1078	

Note: Author's own tabulations from California UI and ES202 data. "Matched Observation" is the nearest neighbor to the charter employee at the employer in the quarter prior to the charter event.

Table 4: Charter Employment vs. Staying at Established Firm

Dependent Variable = Log(Quarterly Earnings)				
	Model I		Model II	
3 years prior to Firm Birth	-0.4032	***	-0.2665	***
	(0.0269)		(0.0263)	
2 years prior to Firm Birth	-0.0434		-0.0001	
	(0.0303)		(0.0294)	
Quarter of Firm Birth	-0.0501		-0.1338	***
	(0.0381)		(0.0372)	
1 year after Firm Birth	0.2723	***	0.2096	***
	(0.0269)		(0.0262)	
2 years after Firm Birth	0.3846	***	0.2555	***
	(0.0244)		(0.0240)	
3 years after Firm Birth	0.5007	***	0.3052	***
	(0.0294)		(0.0290)	
4 years after Firm Birth	0.5622	***	0.3203	***
	(0.0309)		(0.0306)	
5+ years after Firm Birth	0.7682	***	0.4185	***
	(0.0270)		(0.0276)	
Number of Quarters in Sample			0.0111	***
			(0.0005)	
Charter x Quarters in Sample			-0.0015	**
			(0.0006)	
Number of Previous Jobs			0.0195	***
			(0.0035)	
Charter x Number of Previous Jobs			0.0018	
			(0.0044)	
Number of Jobs in Quarter			0.1739	***
			(0.0113)	
Charter x Number of Jobs in Quarter			-0.0191	
			(0.0150)	
Firm Size (1000s)			0.0114	***
			(0.0013)	
Charter x Firm Size (1000s)			0.0030	
			(0.0023)	
Publicly Traded Firm			0.0461	**
			(0.0216)	
Charter x Publicly Traded			-0.0797	**
			(0.0360)	
Constant	9.0428	***	8.8848	***
	(0.0255)		(0.0323)	
Number of Observations	70104		70104	
Number of Individuals	2098		2098	
R^2 within	0.0366		0.0941	
R^2 between	0.0138		0.0114	
R^2 overall	0.0239		0.0367	

Note: Author's own tabulations from California UI and ES202 data. All models are fixed-effects regressions. Excluded group is "1 Year before Firm Birth". Model II includes seasonal dummies.
*** = 99% significance, ** = 95% significance, * = 90% significance.

Table 5: Earnings Implications of Firm Death

Dependent Variable = Log(Quarterly Earnings)				
	Model I		Model II	
3 years prior to Firm Death	-0.2389	***	0.0508	***
	(0.0125)		(0.0138)	
2 years prior to Firm Death	0.0422	***	0.0947	***
	(0.0162)		(0.0158)	
Quarter of Firm Death	-0.1491	***	-0.2083	***
	(0.0237)		(0.0231)	
1 year after Firm Death	0.0538	***	-0.0276	
	(0.0194)		(0.0191)	
2 years after Firm Death	0.1271	***	-0.0276	
	(0.0170)		(0.0169)	
3 years after Firm Death	0.2611	***	0.0172	
	(0.0225)		(0.0225)	
4 years after Firm Death	0.2775	***	-0.0174	
	(0.0246)		(0.0249)	
5+ years after Firm Death	0.4437	***	-0.0193	
	(0.0185)		(0.0207)	
Charter x 3 years prior to Firm Death	-0.1018	*	0.0893	
	(0.0580)		(0.0593)	
Charter x 2 years prior to Firm Death	0.0454		0.1094	
	(0.0733)		(0.0726)	
Charter x Quarter of Firm Death	0.1525		0.1153	
	(0.1128)		(0.1100)	
Charter x 1 year after Firm Death	0.1012		0.0838	
	(0.0725)		(0.0741)	
Charter x 2 years after Firm Death	-0.0091		-0.0440	
	(0.0645)		(0.0666)	
Charter x 3 years after Firm Death	0.1116		0.0493	
	(0.0774)		(0.0785)	
Charter x 4 years after Firm Death	-0.0311		-0.1571	*
	(0.0927)		(0.0936)	
Charter x 5+ years after Firm Death	0.1612	**	0.0146	
	(0.0772)		(0.0796)	
Worker and Job Characteristics?			Yes	
Number of Observations	70104		70104	
Number of Individuals	2098		2098	
R^2 within	0.0304		0.0853	
R^2 between	0.0112		0.0089	
R^2 overall	0.0001		0.0279	

Note: Author's own tabulations from California UI and ES202 data. All models are fixed-effects regressions. Excluded group is "1 Year before Firm Death". Worker and Job Characteristics include Number of Quarters in the Sample, Job Change Indicator, Number of Jobs Held in the Quarter, Total Number of Previous Jobs, Firm Size, Publicly-Traded Employer Indicator, seasonal dummies, and interactions with the Charter Employee Indicator.
*** = 99% significance, ** = 95% significance, * = 90% significance.

Table 6: The Return to Initial Public Offering

Dependent Variable = Log(Quarterly Earnings)				
	Model I		Model II	
3 years prior to IPO	-0.2346	***	-0.0528	
	(0.0414)		(0.0400)	
2 years prior to IPO	0.0006		0.0526	
	(0.0507)		(0.0487)	
Quarter of IPO	-0.0731		-0.0960	
	(0.0752)		(0.0722)	
1 year after IPO	0.0944	*	-0.1474	**
	(0.0500)		(0.0722)	
2 years after IPO	0.0901	**	-0.2310	***
	(0.0443)		(0.0686)	
3 years after IPO	0.2036	***	-0.1709	**
	(0.0537)		(0.0744)	
4 years after IPO	0.2606	***	-0.1633	**
	(0.0579)		(0.0773)	
5+ years after IPO	0.3748	***	-0.1677	**
	(0.0467)		(0.0700)	
Charter x 3 years prior to IPO	0.0752		0.1341	*
	(0.0718)		(0.0716)	
Charter x 2 years prior to IPO	0.0290		0.0493	
	(0.0899)		(0.0875)	
Charter x Quarter of IPO	0.2341	*	0.2131	
	(0.1368)		(0.1317)	
Charter x 1 year after IPO	0.0273		0.2354	**
	(0.0888)		(0.1035)	
Charter x 2 years after IPO	-0.0043		0.2006	**
	(0.0788)		(0.0956)	
Charter x 3 years after IPO	0.0450		0.2052	*
	(0.0949)		(0.1082)	
Charter x 4 years after IPO	-0.1552		0.0079	
	(0.1102)		(0.1215)	
Charter x 5+ years after IPO	0.0015		0.1670	
	(0.0908)		(0.1060)	
Worker and Job Characteristics?			Yes	
Number of Observations	70104		70104	
Number of Individuals	2098		2098	
R^2 within	0.0055		0.0830	
R^2 between	0.0131		0.0035	
R^2 overall	0.0034		0.0240	

Note: Author's own tabulations from California UI and ES202 data. All models are fixed-effects regressions. Excluded group is "1 Year before IPO". Worker and Job Characteristics include Number of Quarters in the Sample, Job Change Indicator, Number of Jobs Held in the Quarter, Total Number of Previous Jobs, Firm Size, Publicly-Traded Employer Indicator, seasonal dummies, and interactions with the Charter Employee Indicator.
*** = 99% significance, ** = 95% significance, * = 90% significance.

Table 7: Job Change to Start-ups vs. Job Change to Established Firms: Charter Employees

Dependent Variable = Log(Quarterly Earnings)				
	Model I		Model II	
3 years prior to Job Change to Start-Up	-0.3837	***	-0.3772	***
	(0.0326)		(0.0321)	
2 years prior to Job Change to Start-Up	-0.1102	***	-0.1090	***
	(0.0374)		(0.0367)	
Quarter of Job Change to Start-Up	0.2094	***	0.1924	***
	(0.0468)		(0.0460)	
1 year after Job Change to Start-Up	0.2209	***	0.2244	***
	(0.0329)		(0.0323)	
2 years after Job Change to Start-Up	0.1901	***	0.1870	***
	(0.0299)		(0.0294)	
3 years after Job Change to Start-Up	0.2058	***	0.2048	***
	(0.0356)		(0.0350)	
4 years after Job Change to Start-Up	0.1735	***	0.1696	***
	(0.0371)		(0.0365)	
5+ years after Job Change to Start-Up	0.2299	***	0.2524	***
	(0.0319)		(0.0313)	
3 years prior to Job Change	-0.0195		0.1154	***
	(0.0171)		(0.0173)	
2 years prior to Job Change	0.0668	***	0.1108	***
	(0.0205)		(0.0202)	
Quarter of Job Change	-0.2595	***	-0.3315	***
	(0.0254)		(0.0251)	
1 year after Job Change	0.0514	***	-0.0171	
	(0.0177)		(0.0176)	
2 years after Job Change	0.1945	***	0.0641	***
	(0.0161)		(0.0162)	
3 years after Job Change	0.2949	***	0.0943	***
	(0.0187)		(0.0190)	
4 years after Job Change	0.3888	***	0.1429	***
	(0.0190)		(0.0195)	
5+ years after Job Change	0.5383	***	0.1547	***
	(0.0155)		(0.0175)	
Worker and Job Characteristics?			Yes	
Number of Observations	80386		80386	
Number of Individuals	2156		2156	
R^2 within	0.0665		0.1005	
R^2 between	0.0140		0.0176	
R^2 overall	0.0232		0.0397	

Note: Author's own tabulations from California UI and ES202 data. All models are fixed-effects regressions. Excluded groups are "1 Year prior to Job Change to Established Firm" and "1 Year prior to Job Change to Start-up". Worker and Job Characteristics include Number of Quarters in the Sample, Number of Jobs Held in the Quarter, Total Number of Previous Jobs, Firm Size, Publicly-Traded Employer Indicator, and seasonal dummies.
*** = 99% significance, ** = 95% significance, * = 90% significance.

Table 8: Job Change to Established Firms: Charter Employees vs. Matched Sample

Dependent Variable = Log(Quarterly Earnings)				
	Model I		Model II	
3 years prior to Job Change to Established Firm	-0.0749	***	0.0364	*
	0.0185		0.0206	
2 years prior to Job Change to Established Firm	0.0024		0.0493	**
	0.0219		0.0219	
Quarter of Job Change to Established Firm	-0.1752	***	-0.2190	***
	0.0253		0.0253	
1 year after Job Change to Established Firm	0.0675	***	0.0440	**
	0.0182		0.0186	
2 years after Job Change to Established Firm	0.1768	***	0.1143	***
	0.0168		0.0186	
3 years after Job Change to Established Firm	0.2745	***	0.1688	***
	0.0197		0.0230	
4 years after Job Change to Established Firm	0.3532	***	0.2197	***
	0.0203		0.0251	
5+ years after Job Change to Established Firm	0.4593	***	0.2380	***
	0.0167		0.0283	
Charter x 3 years prior to Job Change to Est. Firm	0.0580	**	0.0999	***
	0.0246		0.0269	
Charter x 2 years prior to Job Change to Est. Firm	0.0674	**	0.0693	**
	0.0293		0.0292	
Charter x Quarter of Job Change to Est. Firm	-0.0816	**	-0.1185	***
	0.0350		0.0350	
Charter x 1 year after Job Change to Est. Firm	-0.0134		-0.0681	***
	0.0248		0.0253	
Charter x 2 years after Job Change to Est. Firm	0.0204		-0.0659	***
	0.0227		0.0249	
Charter x 3 years after Job Change to Est. Firm	0.0231		-0.0994	***
	0.0265		0.0306	
Charter x 4 years after Job Change to Est. Firm	0.0382		-0.1082	***
	0.0271		0.0329	
Charter x 5+ years after Job Change to Est. Firm	0.0814	***	-0.1329	***
	0.0223		0.0365	
Worker and Job Characteristics?			Yes	
Number of Observations	70104		70104	
Number of Individuals	2097		2097	
R^2 within	0.0733		0.0941	
R^2 between	0.0021		0.0183	
R^2 overall	0.0160		0.0353	

Note: Author's own tabulations from California UI and ES202 data. All models are fixed-effects regressions. Excluded groups are "1 Year prior to Job Change to Established Firm" and "Charter x 1 Year prior to Job Change to Established Firm". Worker and Job Characteristics include Number of Quarters in the Sample, Number of Jobs Held in the Quarter, Total Number of Previous Jobs, Firm Size, Publicly-Traded Employer Indicator, and seasonal dummies.
*** = 99% significance, ** = 95% significance, * = 90% significance.

Table 9: Distribution of Post-Start-Up Separation Earnings: Charter Employees vs. Matched Sample

Year	Sample	10%	25%	50%	75%	90%	Mean	Variance	N	γ
1	Charters	1.03	1.22	1.41	1.89	2.93	2.11	10.43	272	1.39
	Matched	1.08	1.22	1.35	1.51	1.91	1.50	1.26	285	
2	Charters	1.67	2.22	2.65	3.88	5.96	4.32	55.25	224	1.83
	Matched	1.96	2.22	2.49	2.82	3.84	2.82	2.54	214	
3	Charters	2.35	3.34	4.37	6.73	12.75	7.50	203.05	165	1.84
	Matched	2.82	3.26	3.76	4.37	6.10	4.40	8.23	152	
4	Charters	3.06	4.63	6.04	9.63	15.21	10.65	504.05	124	1.37
	Matched	3.55	4.40	4.88	5.81	8.10	5.98	19.27	93	
5	Charters	3.36	5.82	7.63	14.01	23.68	11.46	164.53	86	1.99
	Matched	4.33	5.24	6.27	7.51	10.05	7.77	54.27	65	

Note: Author's own tabulations from California UI and ES202 data. "Post-Start-Up Separation Earnings" are total earnings earned since charter employee left for a start-up. The figures presented are multiples of pre-start-up separation annual earnings. "Matched Sample" is the nearest neighbor to the charter employee at the employer in the quarter prior to the charter event. "Year" indicates years since charter employee left for a start-up. γ indicated the coefficient of relative risk aversion at which an individual with constant relative risk aversion is indifferent between leaving for a start-up and staying with the established firm.

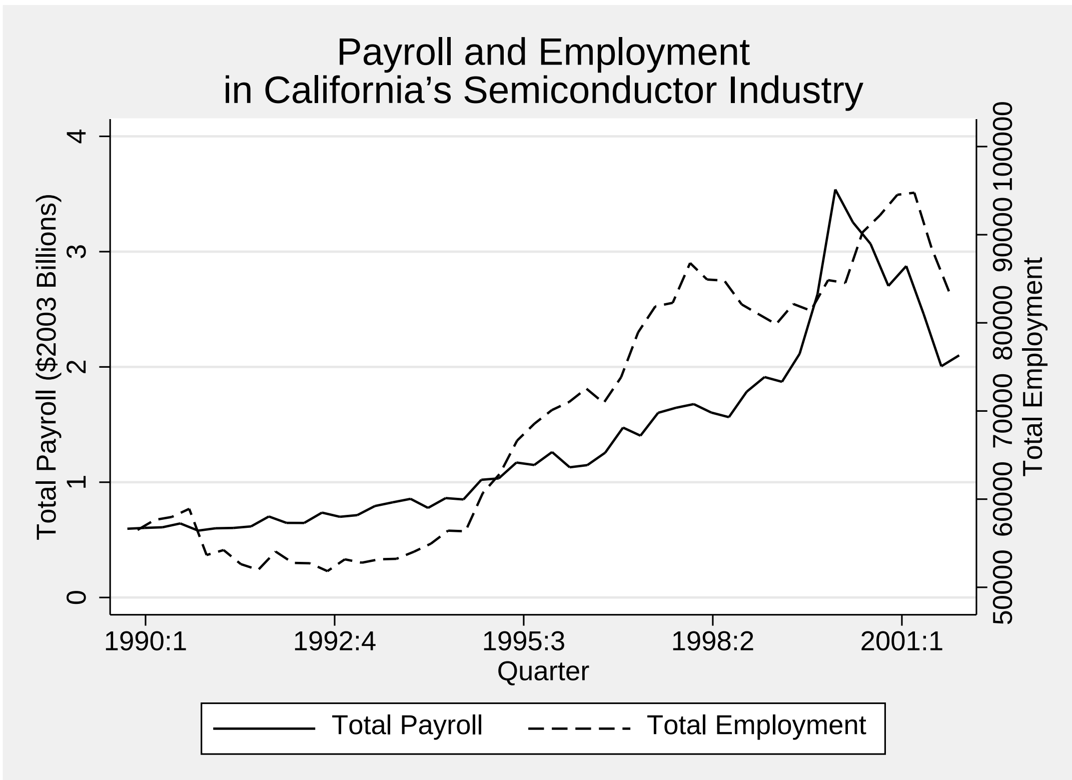

Figure 1: Payroll and Employment in California's Semiconductor Industry.
Note: Author's own tabulations using California UI and ES202 data.

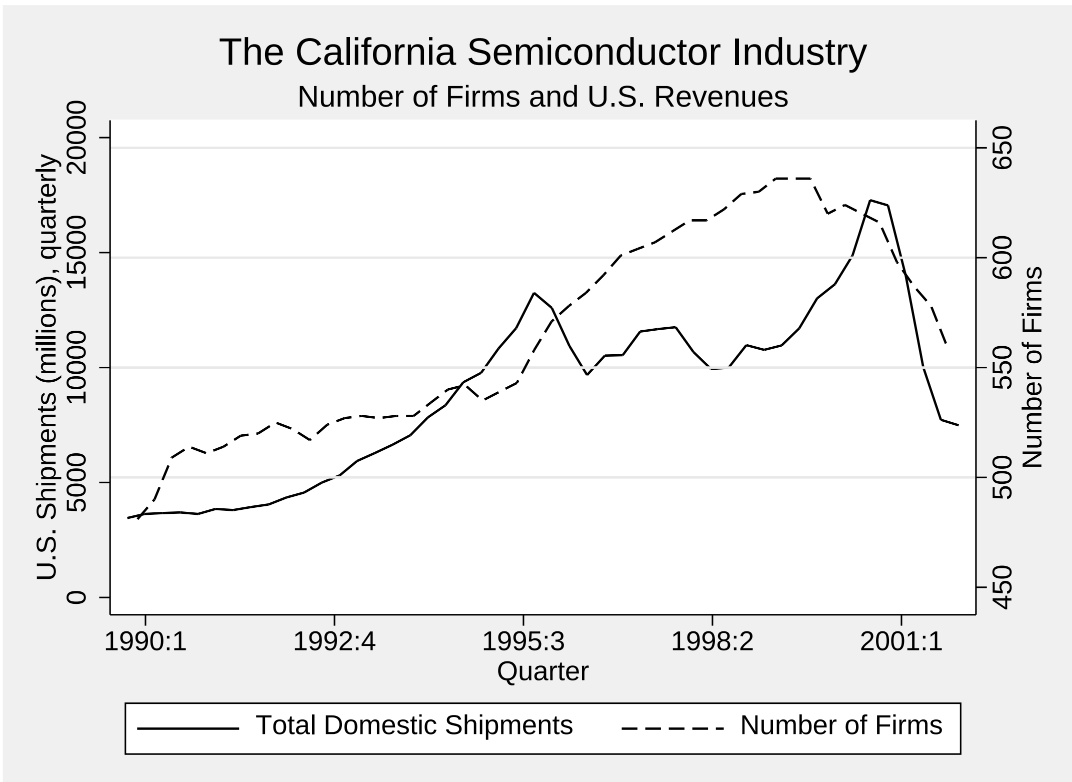

Figure 2: Number of Firms and Industry Revenues in California's Semiconductor Industry.
Note: Author's own tabulations using California UI and ES202 data.

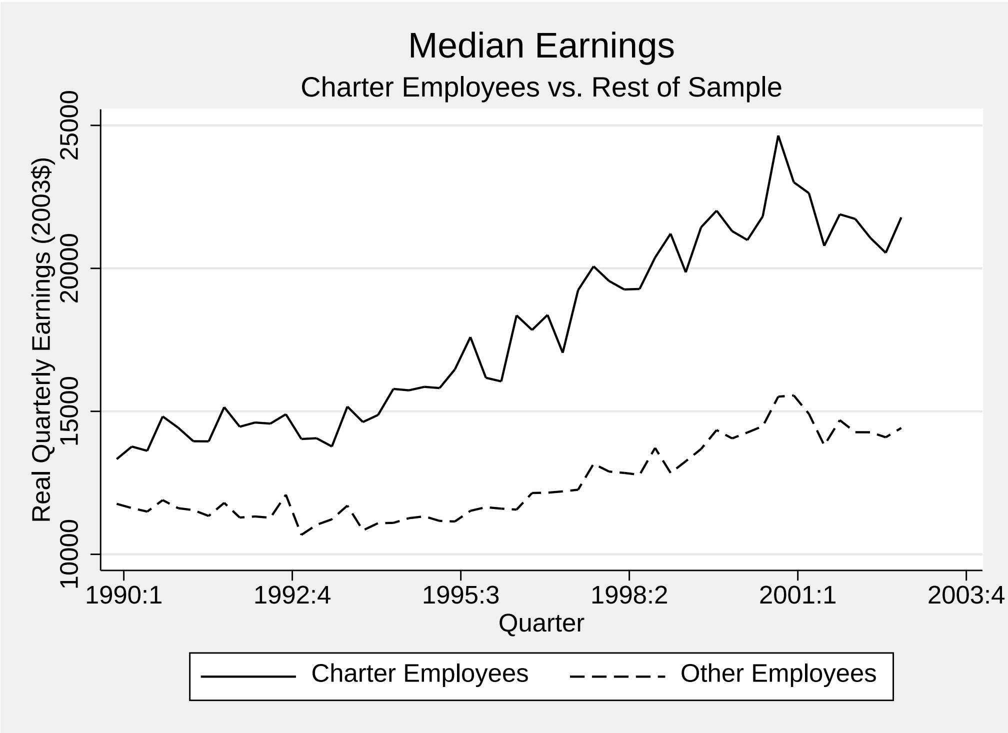

Figure 3: Earnings of Charter Employees vs. Matched Counterparts - Median.
Note: Author's own tabulations using California UI and ES202 data.

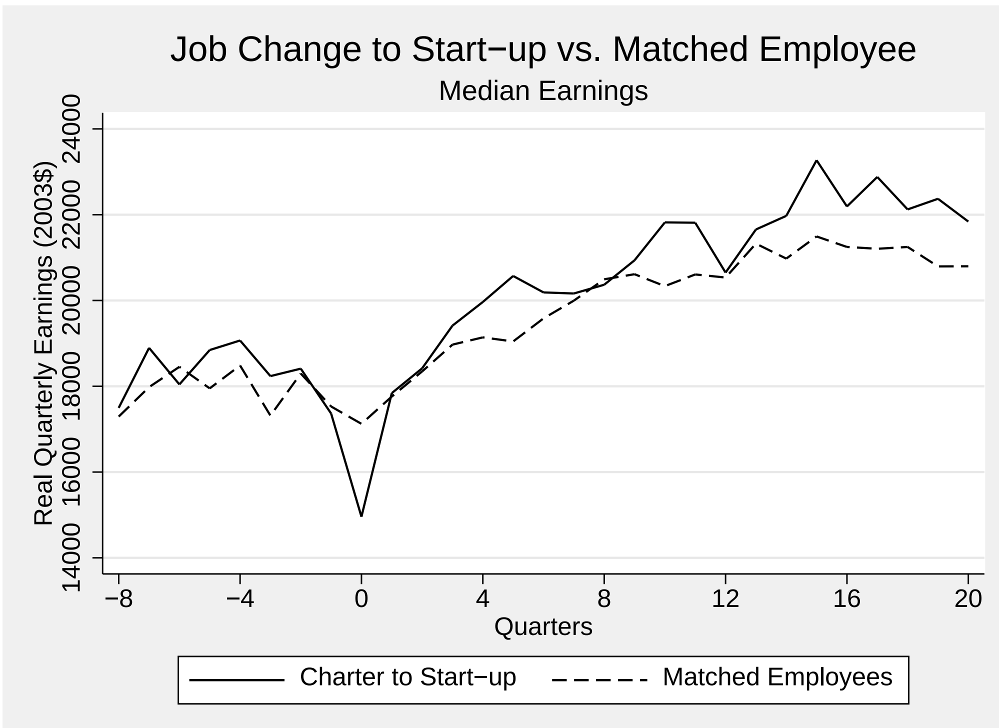

Figure 4: Earnings of Charter Employees vs. Matched Counterparts - Median.
Note: Author's own tabulations using California UI and ES202 data.

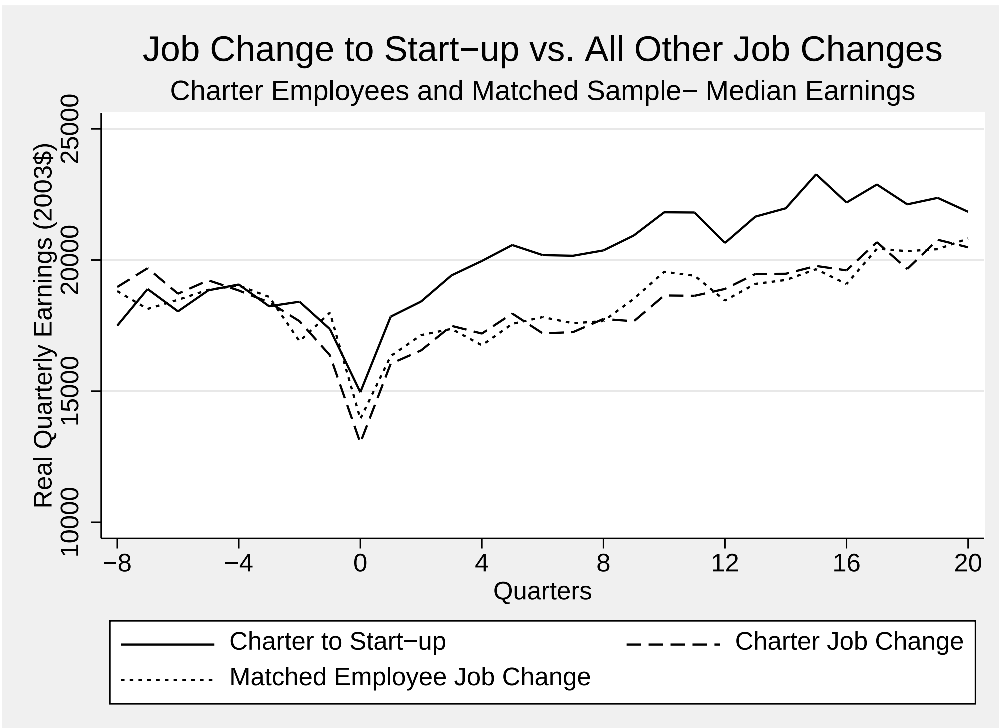

Figure 5: Return to Job Change to Start-up vs. Return to Job Change to Established Firm: Charter Employees vs. Matched Sample - Median.

Note: Author's own tabulations using California UI and ES202 data.

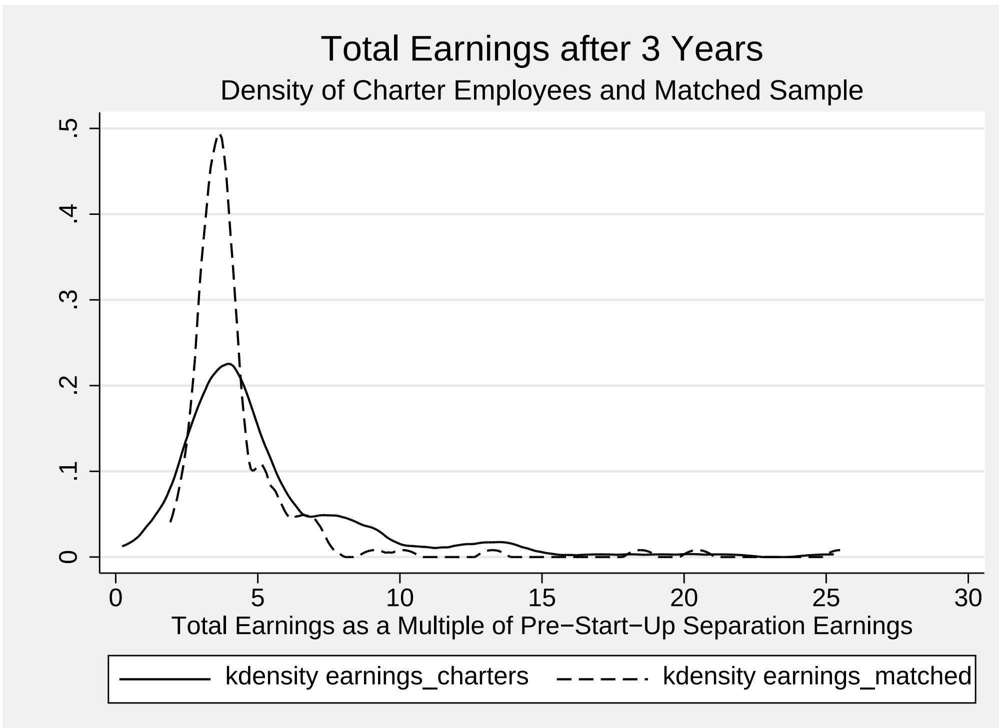

Figure 6: Total Earnings in the First Three Years after Start-up Separation

Note: Author's own tabulations using California UI and ES202 data. Total Earnings after Start-Up Separation are total earnings earned since charter employee left for a start-up. The figures presented are multiples of pre-start-up separation annual earnings.

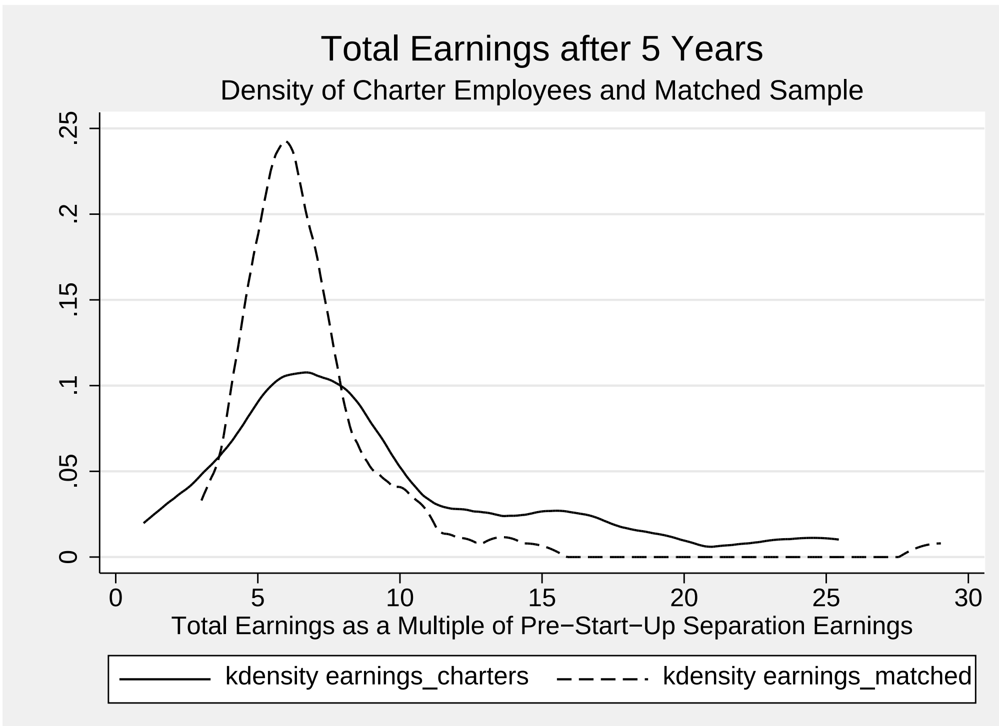

Figure 7: Total Earnings in the First Five Years after Start-up Separation
Note: Author's own tabulations using California UI and ES202 data in Campbell (2005). Total Earnings after Start-Up Separation are total earnings earned since charter employee left for a start-up. The figures presented are multiples of pre-start-up separation annual earnings.