HUMAN CAPITAL AND THE ENTREPRENEURIAL CAREERS OF SCIENTISTS AND ENGINEERS

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HUMAN CAPITAL AND THE ENTREPRENEURIAL CAREERS OF SCIENTISTS AND ENGINEERS

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To my parents John and Beverly, my sister Chelsea, and my fiancé John

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SUMMARY

I examine the role of human capital in shaping entrepreneurial activity by studying the entrepreneurial careers of scientists and engineers from entry to exit. I analyze how the development of human capital through education and employment affects entrepreneurial entry, performance, and exit. Empirically I utilize the restricted-use National Science Foundation (NSF) Scientists and Engineers Statistical Data System (SESTAT) which is a large data set focused on scientists and engineers to identify possible drivers of transitions to entrepreneurship amongst knowledge workers. Additionally, I am able to analyze the extent to which transitioning to entrepreneurship allows scientists and engineers to increase their financial and non-financial work outcomes and finally, what mechanisms are associated with their exit from entrepreneurship and subsequent return to wage work.

CHAPTER 1

INTRODUCTION

This dissertation lies at the nexus of strategic management and entrepreneurship, with a focus on the role of human capital in shaping entrepreneurial entry, performance and exit. In particular I study the acquisition of general human capital through education and employment. I examine the extent to which certain motivations for building human capital predict whether someone will enter entrepreneurship and how they will perform in entrepreneurship. There is a growing body of literature that examines how workers' employment experiences shape subsequent entrepreneurship. I advance this body of work by considering how work experiences are shaped jointly by both features of the organization and by attributes of the worker, including the degree to which there is a match or mismatch with respect to important dimensions, such as skills and capabilities. I focus on four main research questions.

1. What drives people to leave employment in wage work to enter entrepreneurship?
2. What is the role of human capital in shaping entrepreneurial activity?
3. When people move to entrepreneurship, are they able to increase their pecuniary and non-pecuniary benefits?
4. What mechanisms prompt someone to exit entrepreneurship and return to wage work?

I address these questions in several chapters of this dissertation. In the following, I provide a brief overview of each chapter.

Chapter Two, "Educational Mismatch, Work Outcomes, and Entry into Entrepreneurship," examines why scientists and engineers leave their jobs to change employers or to enter entrepreneurship. In doing so, I focus on the role of educational mismatch, defined as a discrepancy between the skills acquired in formal education and those used on the job. I advance beyond prior work in two important ways. First, much of the prior work on educational mismatch has focused on mismatches due to a lack of adequate positions and has emphasized negative consequences for work outcomes such as low wages or job satisfaction. I suggest that individuals may also enter mismatches voluntarily in expectation of certain pecuniary and non-pecuniary benefits and that these types of mismatches may have qualitatively different implications for current work outcomes as well as for future career trajectories. Second, while prior work argues that mismatch affects labor mobility by lowering wages and job satisfaction, and thus opportunity costs, I also consider human capital development as a potential mediating mechanism affecting entry into entrepreneurship. In particular, while educational mismatch may be tied to a depreciation of knowledge in the field of training, it may also allow workers to build new skills and competences, possibly leading to a broader skillset that is particularly well suited for entrepreneurship. Using longitudinal data from over 22,000 scientists and engineers in the restricted-use National Science Foundation (NSF) Scientists and Engineers Statistical Data System (SESTAT) from 2003 to 2008, I find that those who are mismatched are more likely to enter entrepreneurship. I find that those who are mismatched due to labor market frictions are more likely to move in general (to a new employer in wage work or to entrepreneurship), but those who are mismatched for voluntary reasons such as for a change in career interests or personal reasons are more

likely to enter into entrepreneurship in particular, an effect that is distinct from general labor mobility. Both opportunity costs and skill variety play mediating roles between educational mismatch and future entrepreneurial entry.

In chapter Three, "Does Entrepreneurship Pay or Satisfy?", I analyze the extent to which there are pecuniary and non-pecuniary benefits to transitioning to entrepreneurship. Much research has been conducted studying entry into entrepreneurship and the corresponding rewards and consequences of entrepreneurship on wages. This literature finds mixed results regarding whether workers enter entrepreneurship to maximize their wages or to maximize their non-pecuniary benefits. I suggest that whether workers are able to increase their pecuniary or non-pecuniary benefits in entrepreneurship depends on their motivations for entering entrepreneurship in the first place. I use longitudinal SESTAT data on over 28,000 scientists and engineers to track employment changes and changes in work outcomes over time for the same individuals. I examine changes in pecuniary and non-pecuniary work outcomes when wage workers transition to entrepreneurship, compared to those who do not change employers, as well as to those who change employers but do not transition to self-employment. This allows me to gain a deeper look at the implications of different types of mobility on work outcomes, instead of just comparing entrepreneurs to wage workers. I find that in general those who transition to entrepreneurship experience less growth in their wages and more growth in their non-pecuniary benefits compared to those who move to a new employer in wage work or do not change employers, however this result does differ depending on the motivation for moving. Additionally, using job satisfaction as a proxy measure for non-pecuniary benefits, I find that while those who enter entrepreneurship from wage work do

generally improve their job satisfaction, job satisfaction rises for all movers in general, not just for those who enter entrepreneurship.

Chapter Four "Entrepreneurial Exit," studies the factors that predict whether an entrepreneur will leave entrepreneurship to re-enter wage work. Although many people make the choice to exit entrepreneurship to return to wage work, there is a much greater understanding in the literature about why people enter into entrepreneurial ventures rather than why they exit. Using longitudinal data of over 8,000 scientists and engineers I study the mechanisms by which entrepreneurs exit entrepreneurship and re-enter wage work. My findings reveal that while salary does influence entrepreneurial exit, non-pecuniary benefits also appear to have a significant impact on why people exit. I determined that the lower the job satisfaction a person experiences, the more likely they are to exit entrepreneurship in the subsequent period, regardless of where their salary falls in the entrepreneurial salary distribution. Most notably, I find that those securing higher salary but reporting lower job satisfaction compared to other entrepreneurs are those who are the mostly likely to exit in the next period. I argue that this relationship is dependent on the type of human capital an entrepreneur possesses. This paper highlights the importance of studying not only the role of salary, but also job satisfaction in the study of entrepreneurial exit.

CHAPTER 2

EDUCATIONAL MISMATCH, WORK OUTCOMES, AND ENTRY INTO ENTREPRENEURSHIP

2.1 Introduction

A growing body of research examines how workers' employment experiences shape subsequent entrepreneurship. Among others, scholars have examined the impact of organizations' structural characteristics, firms' appropriability strategies, as well as influences of workplace peers (Sorensen, 2007; Agarwal et al., 2009; Elfenbein et al., 2010; Nanda & Sørensen, 2010). Recent work considers the joint role of characteristics of the workplace as well as of individual workers, including the degree to which there is a "match" with respect to important dimensions such as skills and capabilities. For example, Astebro et al. (2011) argue that labor market frictions may leave some workers in jobs where their skill profile does not complement well the skills of other workers in the firm. Such mismatched workers will suffer from lower wages, reducing their opportunity cost for switching jobs and entering entrepreneurship. The focus on labor market frictions as a driver of mismatch is consistent with a large body of prior work that studies skill mismatches and the underutilization of human capital and tends to show negative outcomes for the affected workers (Tsang & Levin, 1985; Bowlus, 1995; Oyer, 2008).

In this paper, we focus on a particular type of mismatch – when an individual works in a job that is not closely related to his or her training and education ("educational mismatch"). We add to the understanding of educational mismatch and its role in shaping

entrepreneurial entry in two important ways. First, we highlight that individuals may be mismatched for very different reasons. While some individuals may be forced into a mismatch due to labor market conditions, others may choose jobs that involve a mismatch for a number of other reasons. Different reasons for a mismatch, in turn, may relate in very different ways to work outcomes such as wages or job satisfaction. Second, while mismatch may have negative consequences in terms of pay and job satisfaction, it may also lead employees to engage in new kinds of activities and to acquire corresponding skills that go beyond what was learned in formal education. The resulting broader set of skills, in turn, may be exactly what is needed to enter entrepreneurship (Lazear, 2005). As such, while the prior literature has focused on lower opportunity costs as the primary mechanism mediating the relationship between educational mismatch and entrepreneurship, a broadening of the skill base may provide a complementary explanation.

We draw on longitudinal data from a sample of over 22,000 scientists and engineers to examine the relationships between educational mismatch and work outcomes such as wages, job satisfaction, and skill variety, as well as the relationship between mismatch and subsequent entry into entrepreneurship. In doing so, we distinguish between different reasons for mismatch, focusing especially on the degree to which the mismatch was "involuntary" due to labor market frictions (i.e., lack of other job opportunities) versus the workers' choice for career or personal reasons. Descriptively, we find that in our sample of scientists and engineers, mismatches due to a lack of job opportunities are considerably less common than mismatches for career reasons, suggesting the need to consider different types of mismatch more explicitly.

Focusing first on the relationships between educational mismatch and work outcomes in current employment, we find that mismatch is generally associated with lower salary and job satisfaction. However, these relationships are much stronger for employees who mismatch due to market frictions than for those who chose a mismatch for career or personal reasons. With respect to skill variety, we find that employees who are mismatched for career or personal reasons engage in a smaller range of R&D activities but in a broader range of non-R&D activities such as finance, sales, and marketing. In contrast, respondents who are mismatched due to labor market frictions perform a smaller range of R&D activities without expanding their range of non-R&D activities. Thus, educational mismatch may have important implications for the development of human capital, though the patterns appear to be different depending on the nature of the mismatch.

Exploiting the longitudinal nature of the data, we find that employees who are mismatched in employment are more likely to transition into entrepreneurship in the next period.[1] However, mobility patterns differ depending on the reasons for a mismatch. Workers who are mismatched due to a lack of positions in their field have high levels of mobility in general, being more likely to move both to new employers and into entrepreneurship. Workers who are mismatched for career or personal reasons are more likely to move into entrepreneurship but are not more likely to leave their jobs for a

[1] Not all cases of self-employment represent entrepreneurship, i.e., the exploitation of opportunities in new ventures (Shane & Venkataraman, 2000). However, we follow the prior literature in using measures of self-employment as proxies for entrepreneurship (Elfenbein et al., 2010; Braguinsky et al., 2012) and we will use the terms interchangeably in the subsequent discussion. We suggest that the correspondence between self-employment and entrepreneurship is stronger in our sample of highly-trained scientists and engineers than in the general population.

different employer. Lower opportunity costs (i.e., lower wages and job satisfaction) play an important role as mediators linking educational mismatch to transitions into both new employment and entrepreneurship. Skill variety also strongly relates to subsequent entrepreneurship, although its role as a mediator is more limited.

This study contributes to two related literatures. First, we add to a growing body of research on the drivers of entrepreneurial activity. While prior work has considered factors such as individual characteristics, institutional context, or prior employment in small firms (Shane, 2003; Lazear, 2005; Elfenbein et al., 2010; Braguinsky et al., 2012; Campbell et al., 2012; Eesley & Roberts, 2012), we examine the mismatch between a worker's education and the skill requirements of her job. In doing so, we build upon recent work by Astebro et al. (2011) which highlights the potential role of skill mismatch and provides suggestive evidence using a general population sample from Korea. Conceptually, we complement this prior work by distinguishing between different types of mismatch and by considering not only lower opportunity costs but also skill variety as potential mechanisms linking mismatch to subsequent entrepreneurship. Empirically, we exploit rich data on U.S. knowledge workers that allows us to measure key constructs that are often unobserved, including educational mismatch, non-pecuniary job benefits, as well as skill variety. Taken together, our results highlight the value of studying mismatch between employees and employers as a potential driver of entrepreneurship but also suggest the need to gain a deeper understanding of why individuals work in certain organizational contexts in the first place. Moreover, we integrate different streams of entrepreneurship research – focusing on opportunity cost and skill variety, respectively –

to develop a richer conceptual discussion and to examine the relative role of different mechanisms in the same paper.

Second, our results provide new insights into the nature and implications of educational mismatch, a phenomenon that has received considerable attention among scholars as well as policy makers (Sicherman, 1991; Bowlus, 1995; Groot & Maassen Van Den Brink, 2000; Wolbers, 2003; Cyranoski et al., 2011). We highlight that mismatch can occur for several different reasons and our results suggest that its impact on wages and job satisfaction depends on why the mismatch occurred. We also suggest the possibility that while mismatch typically implies an underutilization of the skills acquired during formal training, it may provide learning and training opportunities in new and different types of skills. From an empirical perspective, much of the prior work on educational mismatch has used general population samples (e.g., Sicherman, 1991; Wolbers, 2003; Astebro et al., 2011), and we provide complementary insights by using data from highly trained knowledge workers. The richness of the survey instrument provides us with unique measures of key constructs while allowing us to control for a range of factors that are typically unobserved in studies using general population samples. We discuss additional implications for scholars and policy makers in the final section of the paper.

2.2 Background

2.2.1 Educational Mismatch and Work Outcomes in Employment

An educational mismatch occurs when the skills that are necessary in the worker's job differ from the skills acquired in formal education. Such a mismatch may involve "over-education", where the level of education obtained by the employee exceeds that

demanded by the employer (Freeman, 1976; Hartog & Oosterbeek, 1988; Halaby, 1994; Hartog, 2000). However, educational mismatch can also involve differences in the types and nature of skills (Allen & Van der Velden, 2001; Wolbers, 2003).[2] The two forms of mismatch are related in that jobs that require individuals to work outside of their area of education will typically also require less use of the skills acquired in the area of education. We will consider potential consequences of educational mismatch for three particularly important work outcomes: wages, job satisfaction, and human capital development as it relates to the variety of a worker's skills.

2.2.1.1 Wages and Job Satisfaction

A large body of work has studied the consequences of educational mismatch for productivity and individuals' wages. This line of research suggests that an employee whose skills are not fully utilized is less productive and earns lower wages compared to a situation where skills and work requirements match (Sattinger, 1993; Bowlus, 1995; Di Pietro & Urwin, 2006; Oyer, 2008). Moreover, to the extent that future employers consider prior wages as a signal of ability, a lower wage in early employment can have persistent negative effects on future wages regardless of true (but unobserved) ability (Beaudry & DiNardo, 1991; Gibbons & Waldman, 2004). Other studies have examined the impact of mismatch on workers' job satisfaction, which can be considered a proxy for a broader range of pecuniary and especially non-pecuniary benefits individuals derive from their work (Freeman, 1978; Tsang & Levin, 1985; Bender & Heywood, 2009).

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[2] To illustrate, a PhD in biology working in an R&D job that requires only skills at the levels of a Masters in biology would experience an educational mismatch along the "levels of skills" dimension. In contrast, a PhD in biology working in a job that requires skills of a PhD in finance would experience educational mismatch along the "type of skills" dimension.

Regardless of levels of pay, mismatch may decrease job satisfaction if workers feel that their skills are not being utilized to their full potential, if tasks are perceived as routine or boring, or if low productivity results in a lack of recognition and positive feedback. Low levels of such non-pecuniary benefits from work may be particularly problematic for scientists and engineers who are trained to solve challenging problems and who may have self-selected into technical fields based on their interest in an intellectually stimulating job (Amabile, 1996; Sauermann & Cohen, 2010; Stephan, 2012).

Proposition 1a: Workers in an educational mismatch have lower salary and job satisfaction than those in a match.

Much of the prior work as well as public discussions see mismatch as a consequence of labor market frictions and the lack of employment opportunities (Bowlus, 1995; Astebro et al., 2011; Cyranoski et al., 2011; Stephan, 2012). Consistent with this view, studies show that college graduates who enter the labor market in a poor economy are more likely to be mismatched (Oyer, 2006, 2008; Stevens, 2008; Oreopoulos et al., 2012) and that mismatch is generally more common in times of high unemployment (Bowlus, 1995; Wolbers, 2003; Kahn, 2010). We argue, however, that not all individuals may be in an educational mismatch due to labor market conditions, especially in science and engineering where unemployment rates tend to be low (National Science Board, 2012). Rather, we suggest that some individuals may choose to take mismatching jobs for personal reasons or because these jobs offer higher levels of certain financial or non-financial payoffs. With respect to the latter, for example, a scientist or engineer may decide to switch out of their field of training into other fields that offer higher salaries or other kinds of benefits such as better working conditions or more time for leisure.

Similarly, some individuals move from technical to managerial positions as they advance in their careers. While likely drawing less on the technical knowledge acquired during formal education, management positions may typically offer more pay and responsibilities (Allen & Katz, 1992). Finally, other scientists and engineers may take jobs that involve an educational mismatch because they have lost interest in their original field of study and seek to work on something new and different. As such, even if the new job does not pay as much, it may offer these employees higher levels of intrinsic benefits such as challenge or feelings of accomplishment. In addition to potential reasons related to financial or non-financial benefits associated with the job itself, workers may also take mismatching positions for personal reasons such as family (e.g., children, spouse moved) or because they preferred a particular location.[3]

While we cannot anticipate all the possible reasons why workers may enter an educational mismatch, educational mismatch is likely to have different implications for wages and job satisfaction depending on the underlying reason. Considering for simplicity the three broader classes of market related (market frictions), career/job related (e.g., move into management, field changes, better working conditions), and personal reasons (e.g., family, location), we expect that both wages and job satisfaction are lowest for those workers who are in an educational mismatch because of market frictions since these individuals do not take advantage of their full human capital while also not benefiting from offsetting financial or non-financial benefits. On the other hand, workers

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[3] This discussion highlights that the match between a person and a job can be evaluated along a number of dimensions and a mismatch along one dimension (e.g., workers' formal education and skill requirements of the job) does not have to be a mismatch along another (e.g., salary and workers preferences for money).

who took a mismatching job because of career reasons should suffer the least negative consequences because any negative consequences from not utilizing the human capital acquired during education are at least partially offset by financial or non-financial benefits resulting from a move into a high-paying field, a managerial position, or a job that is perceived more intrinsically interesting. Finally, individuals who take a mismatching job for personal reasons are likely to have lower wages and job satisfaction than those who do so for career reasons. While personal reasons still imply a choice that is more or less "voluntary" (versus imposed by a lack of positions), the primary benefits from making that choice are outside the work environment (e.g., better family life, enjoying the location) and therefore these benefits are not likely to be reflected in the direct work outcomes of wages or job satisfaction.

Proposition 1b: The implications of a mismatch for salary and job satisfaction are less negative for workers who take a mismatching position for career/job reasons than for workers who are in a mismatch because of labor market conditions or because of personal reasons.

2.2.1.2 Human Capital Development

While much of the prior work focuses on the impact of educational mismatch on wages and job satisfaction, there may also be consequences for the retention and the development of workers' human capital, particularly their skills and knowledge. A salient concern is that jobs that do not draw on the skills acquired during education will offer no opportunities to develop and hone these skills, leading to a depreciation of skills acquired during education, especially in fields characterized by fast technical change (Ducatel, 1994; Witte & Kalleberg, 1995). Little is known about the rate of skill depreciation, and

it is likely that depreciation is faster for some skills than for others. However, assuming that depreciation is gradual, even workers in an educational mismatch should retain some level of the skills acquired through education for an extended period of time.

An exclusive focus on potentially detrimental effects on skills in the area of education, however, neglects potential effects of educational mismatch on other types of skills. In particular, working in a position that requires skills that are different from those already acquired in the past may increase individuals' human capital by encouraging the development of new and different skills. For example, technically trained workers who enter jobs that require them to also perform managerial tasks may be stimulated to develop managerial skills and consequently possess a broader skill base than workers who continue to focus solely on technical work. Similarly, scientists whose jobs require them to engage with less familiar downstream development functions or to interact with customers may acquire important knowledge of these activities and may gain a better understanding of how to combine science and commercialization (Gittelman & Kogut, 2003).

Proposition 2a: Workers in an educational mismatch acquire additional skills in areas outside of their education.

Our arguments regarding skill depreciation as well as the development of new skills rest on the premise that an educational mismatch may reflect not only an underutilization of existing skills ("over-education") but also that the job requires the use and development of new sets of skills. The degree to which each applies, however, may depend on the reason for a mismatch. In particular, prior work suggests that many of the workers who cannot find adequate positions tend to remain in the area of their education

but take jobs that do not fully exploit their skills, i.e., they are "overeducated" and have few opportunities to acquire new skills and knowledge (Smith, 1986; Hartog & Oosterbeek, 1988; Groot & Maassen Van Den Brink, 2000; Hartog, 2000). In contrast, our earlier discussion suggests that workers who move into an educational mismatch for job or career reasons tend to move into jobs that are qualitatively different (e.g., jobs in different fields, management positions) and thus require different sets of skills. Thus, while all types of mismatches are likely to result in a (partial) depreciation of the skills acquired during education, we expect that workers who are in mismatches for job and career reasons are more likely to broaden their skills than workers who are in a mismatch because of job market frictions.

Proposition 2b: The implications of a mismatch for skill variety are more positive for workers who take a mismatching position for career/job reasons than for workers who are in a mismatch because of labor market conditions.

2.2.2 Educational Mismatch and Transitions to Entrepreneurship

Workers who experience negative consequences of a mismatch can seek to improve their situation by searching for better jobs. For example, Jovanovic (1979) presents a model where workers remain in high quality matches but leave low quality matches to search for employers offering a better match. Consistent with such a search model, prior work has shown a positive relationship between mismatch and mobility (Tsang & Levin, 1985; Sicherman, 1991; Wolbers, 2003; Oreopoulos et al., 2012). Similarly, Alba-Ramirez (1993) finds that mobility tends to increase the match between workers and their jobs. While most of the prior work has considered mobility with respect to workers taking new positions in existing firms, Astebro et al. (2011) highlight

that mismatched workers may also start their own firms in order to mitigate mismatch and its negative consequences.[4] We build on this important insight to consider more explicitly how different types of mismatch may be related to employees' decision to enter into entrepreneurship.

Astebro et al. (2011) emphasize an opportunity cost argument, arguing that mismatched workers who experience low wages in their prior jobs have less to lose from quitting their jobs and moving into entrepreneurship. That logic should generalize to non-pecuniary payoffs as well, i.e., mismatched workers who experience low job satisfaction should also be more likely to quit their jobs and enter entrepreneurship. In addition to reflecting opportunity costs, however, a worker's decision to quit a job and to become an entrepreneur should also depend on the degree to which the worker has the skills required to succeed in entrepreneurship. In particular, Lazear (2005) argues that entrepreneurs need to perform a broader range of work activities than employees in established firms since entrepreneurship offers fewer opportunities for specialization. As such, entrepreneurs will be more successful if they possess a broad range of skills ("Jack-of-all-trades"). To the extent that Lazear's theory holds, highly specialized scientists and engineers would not appear to be good entrepreneurs since they are likely to have relatively low levels of the non-R&D skills an entrepreneur also needs.[5] As discussed in

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[4] Individuals may also enter entrepreneurship because they cannot find any employment at all (Evans & Leighton, 1990; Taylor, 1996; Thurik et al., 2008). While potentially important in general worker populations, this mechanism is likely to be less important in the S&E population where unemployment tends to be very low (National Science Board, 2012).

[5] Scientists' non-R&D skills are not necessarily worse than those in the general population. However, their specialized R&D skills garner relatively high wages (even in a mismatch situation) such that low-value entrepreneurship is not an attractive outside option. A high-value entrepreneurial venture, however, likely requires higher levels of non-R&D skills.

the previous section, however, we suggest that an educational mismatch may not only lower wages and job satisfaction (thus reducing opportunity costs), but may also encourage workers to develop new skills, including skills that are beneficial for entrepreneurship. In our particular context, we conjecture that skills related to downstream activities, such as marketing and sales, as well as financial and general management skills may be particularly useful complements to science and engineering related knowledge. Interestingly, while such non-R&D skills are likely to be more important for entrepreneurs than for scientists and engineers working in established firms, high levels of technical skills in the field of education may be less important. As such, any skill depreciation individuals may have experienced in an educational mismatch may be less problematic in entrepreneurship, increasing the attractiveness of entrepreneurship relative to employment in R&D.

Proposition 3a: Workers in an educational mismatch are more likely to transition into entrepreneurship in a subsequent period than workers in a match.

Proposition 3b: The relationship between educational mismatch and transitions into entrepreneurship is mediated by lower opportunity cost (i.e., lower salary and job satisfaction) as well as by higher skill variety.

2.3 Data and Measures

2.3.1 Data

Our empirical analysis uses data from the National Science Foundation's Scientists and Engineers Statistical Data System (SESTAT). SESTAT is an integrated database that includes demographic, employment and educational information about scientists and engineers in the U.S. It is an integration of three surveys: The National

Survey of Recent College Graduates (NSRCG), the National Survey of College Graduates (NSCG), and the Survey of Doctoral Recipients (SDR). It was constructed to represent the general population of scientists and engineers in the U.S and includes individuals who have at least a Bachelor's degree. The SESTAT surveys consistently receive high response rates, typically in the range of 70-80%. Complementing prior work using older SESTAT surveys, we employ data collected in the years 2003, 2006, and 2008. Using recent data from after the technology boom of the early 2000s allows us to gain insights into educational mismatches in the current generation of scientists and engineers.[6]

SESTAT provides a unique opportunity to study educational mismatch and entry into entrepreneurship. First, SESTAT includes data on a large number of highly educated scientists and engineers, allowing us to complement prior work using general population samples. Second, the data include a rich set of measures for important constructs that are often unobserved, including educational mismatch, reasons for mismatches, and skill variety. Finally, the SESTAT data are longitudinal in nature, allowing us to follow individuals' employment trajectories and to examine the relationships between educational mismatch and subsequent job changes.

We make several restrictions to eliminate unnecessary heterogeneity. First, we exclude individuals who were not in the labor force during the observation period as well as those who were unemployed. We exclude individuals under the age of 22 and over the

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[6] NSF drew a new sample for most of the SESTAT surveys after 2000, limiting the number of waves available for longitudinal analysis. More information on the SESTAT surveys is available at http://www.nsf.gov/statistics/sestat/.

age of 65 to account for potentially different dynamics among those still in training or close to retirement. We limit our sample to full-time employees (defined as working at least 30 hours per week and 30 weeks per year) working in the U.S. and in a for-profit organization; we exclude individuals who are employed in academia, government, or non-profit organizations, as these sectors are likely characterized by different labor market dynamics. Finally, since we focus on educational mismatches among scientists and engineers, we also exclude individuals whose highest degrees are outside of science and engineering, as well as individuals who have a professional degree (e.g., JD, MBA, or MD). Our final sample includes 22,862 unique individuals, 14,355 of which were observed in all three time periods and 8,507 of which were observed in 2 time periods.[7]

2.3.2 Variables

2.3.2.1 Main Variables

Educational mismatch and reasons for mismatch: Our measure of educational mismatch is based on the following survey question: "To what extent was your work on your principal job related to your highest degree?" Respondents answered using a 3-point scale ranging from "*closely related*" to "*somewhat related*" and "*not related*." 11% of the sample report that their job is not related to their highest degree (henceforth called a "mismatch"), while 31% report that the job is somewhat related, and 58% of respondents indicate that their job is closely related to their education.[8]

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[7] Since we are concerned with transitions to entrepreneurship between periods, we exclude individuals who were observed only once.

[8] In an unpublished manuscript, Ohyama (2007) uses this variable from an older version of the SESTAT data base as a proxy for the level of advanced technical knowledge entrepreneurs possess and how much value they are able to create. We interpret this measure more closely as reflecting the match between a

Those respondents who reported that their job was not related to their education were also asked about the primary reason for the mismatch: "What was the most important reason for working in an area outside the field of your highest degree?". Response options included "pay, promotion opportunities," "working conditions (e.g., hours, equipment, working environment)," "job location," "change in career or professional interests," "family-related reasons (e.g., children, spouse's job moved)," "job in highest degree field not available," and "some other reason." For our main analyses, we aggregate these reasons into four broader categories: Respondents who indicated that their mismatch reflected that a job in their highest degree field was not available are coded as being in a *market mismatch*, while those who reported mismatches due to pay or promotion opportunities, change in career or professional interests, or working conditions are coded as being in a *career mismatch*. Those who report being mismatched for family or location reasons are coded as being in a *personal mismatch*, while those who report mismatch for other reasons are coded as being in an *other mismatch.*

A potential limitation of these measures is that the reasons for mismatch are self-reported after respondents have entered a mismatch, and experiences the respondents have while working in the job may potentially influence how they rationalize being in the mismatch. At the same time, reasons for making certain choices are by their very nature subjective and it would be virtually impossible to ascertain them in a non-experimental setting without asking the individuals themselves. Moreover, while mismatch and reasons

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worker and his job, and we focus on the implications of mismatch in employment rather than in entrepreneurship.

are measured during employment, these measures precede our measures of labor mobility (see below) and, as such, reverse causality with respect to mobility is less of a concern.

Salary: Respondents reported their basic annual salary (not including bonuses or overtime pay). To make this measure comparable across time periods, we adjust it for inflation using a GDP deflator with base year 2005, taken from the US Bureau of Economic Analysis. Given the skewed distribution of salary, we add 1 and use the natural logarithm in our empirical analysis (*lnsalary*).[9]

Job Satisfaction: Respondents rated their overall satisfaction in their primary job using a 4-point scale that ranged from "very dissatisfied," "somewhat dissatisfied," "somewhat satisfied" to "very satisfied." Job satisfaction is a useful proxy for the overall utility employees receive from their job, including both pecuniary and non-pecuniary job attributes (Wood & LeBold, 1970; Freeman, 1978; Idson, 1990; Cable & Edwards, 2004).

Skill variety: The surveys asked respondents which of a list of work activities occupied more than 10% of their time during a typical work week. R&D related activities in this list include "Basic research-study directed toward gaining scientific knowledge primarily for its own sake," "Applied research-study directed toward gaining scientific knowledge to meet a recognized need," "Development-using knowledge gained from research for the production of materials, devices," "Design of equipment, processes, structures and models," and "Computer applications, programming, systems development." The count of R&D activities that occupy at least 10% each of

[9] SESTAT also includes a measure of total earnings (fixed and variable components) for all jobs combined. The qualitative results using this measure are the same (available upon request).

respondents' time forms our variable *R&D count*. Non-R&D activities included "Accounting, finance, contracts," "Employee relations-including recruiting, personnel development, internal training," "Managing or supervising people or projects," "Production, operations, maintenance," "Professional services," "Sales, purchasing, marketing, customer service, public relations," "Quality or productivity management," "Teaching," and "Other." The number of non-R&D activities that occupy at least 10% each of respondents' time is our variable *non-R&D count*.

We suggest that these measures of work activities can serve as useful proxies for the skills respondents acquire during their employment. In particular, given that all our respondents have a science and engineering educational background, engaging in non-R&D activities is likely to broaden their skills and experience through on the job training, increasing their skill variety. On the other hand, respondents who focus on R&D activities may deepen their skills in the R&D domain but will overall have a narrower skill base than those who also engage in non-R&D activities (Ganco, 2014). While our featured analysis will focus on the counts of R&D and non-R&D activities, we will also use the more detailed measures of individual activities in auxiliary analyses.

Employment status: Respondents indicated the type of their primary employer. Individuals who reported that their employer is a for-profit organization are coded as employed. Individuals who reported that they are self-employed are coded as self-employed. The survey also asked respondents whether they had changed employers since the last survey. Given the longitudinal nature of the data, these measures allow us to distinguish for each pair of time periods t and t+1 individuals who stayed with their same employer, individuals who moved to a new employer, and individuals who moved from

employment into entrepreneurship. Following prior work (Elfenbein et al., 2010), we coded a transition to entrepreneurship when someone reported being self-employed in period t+1 but not in period t and reported either that they had changed employers or had a job tenure of 3 years or less. We observe 757 transitions into entrepreneurship between 2003 and 2006 and 763 transitions between 2006 and 2008. For comparison, 2,763 individuals changed from one employer in wage work to another between 2003 and 2006, and 2,983 changed employers between 2006 and 2008.

2.3.2.2 Control Variables

It is conceivable that educational mismatch, especially a market mismatch, is more likely for individuals with lower ability or with degrees from lower level institutions. To address this concern, we create a range of proxies to control for ability and the quality of education. In particular, we control for the respondent's highest degree (*Bachelor's, Master's* or *PhD*), the *Carnegie classification* of the degree granting institution (i.e., research I, research II, doctorate granting institution, etc.) and whether the degree granting institution was a *private* or public school. In auxiliary analyses using only the subsample of PhDs, we additionally include the *NRC's rating* of PhD program quality (National Research Council, 2010). We control for professional tenure using the number of years since graduation (*highest degree tenure* and *highest degree tenure squared)* and we also control for individuals' tenure in their current job *(job tenure* and *job tenure squared)*. All regressions control for the *field of the highest degree*.

We include demographic controls including *race, marital status, citizenship,* and *gender*. In addition, we include fixed effects for the state of employment.

2.4 Results

2.4.1 Empirical Approach

Our empirical analysis has two main parts. In the first part, we seek to gain a deeper understanding of educational mismatch and its relationships with direct work outcomes. In doing so, we explicitly consider that mismatch can occur for different reasons and that the implications of a mismatch may be quite different depending on why employees work in a job that is not related to their highest degree. This first set of analyses utilizes only the sample of respondents who are wage workers in a given time period. We estimate models using salary, job satisfaction, as well as the counts of R&D and non-R&D work activities as the dependent variables. Using salary as an example, we estimate:

$$LNSALARY_{it} = \alpha + \beta MISMATCH_{it} + \gamma \mathbf{X}_i + \delta \mathbf{Z}_{it} + \nu_{it} \qquad [1]$$

where $MISMATCH_{it}$ indicates individual i's degree of educational mismatch in period t, the vector $\mathbf{X}_i$ is a set of time-invariant individual characteristics such as gender, $\mathbf{Z}_{it}$ is a vector of time-variant characteristics such as age, highest degree tenure, and job tenure, and ν_{it} is an error term. To examine the role of different reasons for mismatch, we replace the MISMATCH variable with the four broader categories of mismatch, and then with the more specific different reasons for mismatch reported in the survey. Standard errors are clustered at the level of the individual.

In a second set of analyses, we examine the relationship between educational mismatch and subsequent mobility, as well as the degree to which any such relationship is mediated by direct work outcomes. Using multinomial logit regression, we estimate:

$$EMPL_{i(t+1)} = \alpha + \beta MISMATCH_{it} + \gamma \mathbf{X}_i + \delta \mathbf{Z}_{it} + \theta \mathbf{A}_{it} + \nu_{it+1} \qquad [2]$$

Where $EMPL_{i(t+1)}$ indicates employment status (same employer as in period t, new employer, self-employment) and $\mathbf{A}_{it}$ is a vector of our focal mediators (salary, job satisfaction as well as R&D and non-R&D work activity counts). Changes in β once the elements of $\mathbf{A}_{it}$ are included provide insights into the degree to which work outcomes in employment mediate the relationship between mismatch and subsequent mobility (Baron & Kenny, 1986; Elfenbein et al., 2010). To focus on transitions from wage employment, these models are estimated using only those individuals that were not entrepreneurs in period t.

2.4.2 Mismatch and Work Outcomes

2.4.2.1 Descriptive Results

Table 2.1 shows summary statistics for our main variables, including breakdowns by type of mismatch and Table 2.2 shows the correlations.

Table 2.1: Summary Statistics

Variable	Full Sample Mean	SD	Min	Max	Job closely related Mean	Job somewhat related Mean	Job not related Mean	Career mismatch Mean	Personal mismatch Mean	Market mismatch Mean	Other mismatch Mean
Dependent Variables											
Ln Salary	11.24	0.76	0.00	§	11.26	11.27	11.09	11.22	10.94	10.85	10.87
Real Salary	88525	47344	0.00	§	88411	90986	81989	91353	70614	65646	65594
Job satisfaction	3.32	0.70	1.00	4.00	3.40	3.23	3.12	3.27	3.06	2.80	2.86
R&D count	2.18	1.42	0.00	5.00	2.40	2.07	1.39	1.47	1.29	1.26	1.16
Non R&D count	2.18	1.67	0.00	9.00	2.11	2.26	2.31	2.39	2.44	2.00	2.38
Transition to self-employment 03 to 06	0.04	0.21	0.00	1.00	0.04	0.05	0.06	0.06	0.05	0.08	0.04
Transition to self-employment 06 to 08	0.04	0.19	0.00	1.00	0.03	0.03	0.05	0.04	0.07	0.05	0.05
Mismatch Variables											
Job not related	0.11	0.31	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Job somewhat related	0.31	0.46	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Job closely related	0.58	0.49	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Career mismatch	0.07	0.25	0.00	1.00	0.00	0.00	0.61	1.00	0.00	0.00	0.00
Personal mismatch	0.01	0.11	0.00	1.00	0.00	0.00	0.12	0.00	1.00	0.00	0.00
Market mismatch	0.02	0.15	0.00	1.00	0.00	0.00	0.22	0.00	0.00	1.00	0.00
Other mismatch	0.00	0.07	0.00	1.00	0.00	0.00	0.04	0.00	0.00	0.00	1.00
Mismatch reason: pay and promotion	0.03	0.18	0.00	1.00	0.00	0.00	0.31	0.51	0.00	0.00	0.00
Mismatch reason: career change	0.03	0.16	0.00	1.00	0.00	0.00	0.24	0.39	0.00	0.00	0.00
Mismatch reason: working conditions	0.01	0.08	0.00	1.00	0.00	0.00	0.06	0.10	0.00	0.00	0.00
Mismatch reason: family	0.01	0.08	0.00	1.00	0.00	0.00	0.06	0.00	0.46	0.00	0.00
Mismatch reason: location	0.01	0.08	0.00	1.00	0.00	0.00	0.07	0.00	0.54	0.00	0.00
Mismatch reason: job not available	0.02	0.15	0.00	1.00	0.00	0.00	0.22	0.00	0.00	1.00	0.00
Mismatch reason: other	0.00	0.07	0.00	1.00	0.00	0.00	0.04	0.00	0.00	0.00	1.00
Main controls											
Age	41.34	9.85	22.00	65.00	40.89	41.82	42.35	42.30	43.22	41.62	44.45
Male	0.78	0.41	0.00	1.00	0.78	0.78	0.75	0.77	0.67	0.76	0.77
Married	0.76	0.43	0.00	1.00	0.76	0.75	0.72	0.73	0.74	0.69	0.68
White	0.74	0.44	0.00	1.00	0.74	0.74	0.75	0.75	0.79	0.72	0.77
US citizen	0.88	0.32	0.00	1.00	0.87	0.89	0.91	0.92	0.94	0.89	0.93
Highest degree: Bachelor's	0.52	0.50	0.00	1.00	0.54	0.49	0.55	0.54	0.58	0.53	0.62
Highest degree: Master's	0.21	0.41	0.00	1.00	0.25	0.18	0.12	0.12	0.11	0.13	0.15
Highest degree: PhD	0.26	0.44	0.00	1.00	0.22	0.33	0.33	0.34	0.31	0.34	0.23
Private school	1.44	0.65	1.00	3.00	1.44	1.43	1.44	1.45	1.41	1.44	1.49
Highest degree tenure	14.77	9.52	0.00	48.00	14.28	15.22	16.10	16.27	17.08	14.91	16.97
Job tenure	6.46	6.84	0.00	41.00	6.88	6.13	5.21	4.99	6.57	5.13	4.94

Table 2.2: Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Ln Salary	1															
2	Job satisfaction	0.0665*	1														
3	R&D count	0.0622*	0.0411*	1													
4	Non R&D count	0.0222*	0.0674*	-0.0924*	1												
5	Transition to self-employment 03 to 06	-0.0301*	-0.0592*	-0.0172*	0.0424*	1											
6	Transition to self-employment 06 to 08	-0.0307*	-0.0276*	-0.013	0.0283*	.*	1										
7	Job not related	-0.0718*	-0.0983*	-0.1940*	0.0270*	0.0283*	0.0226*	1									
8	Job somewhat related	0.0203*	-0.0852*	-0.0559*	0.0328*	0.0029	-0.005	-0.2364*	1								
9	Job closely related	0.0261*	0.1419*	0.1747*	-0.0479*	-0.0201*	-0.01	-0.4071*	-0.7913*	1							
10	Career mismatch	-0.0087	-0.0189*	-0.1327*	0.0338*	0.0183*	0.0113	0.7645*	-0.1807*	-0.3112*	1						
11	Personal mismatch	-0.0459*	-0.0433*	-0.0732*	0.0182*	0.0033	0.0205*	0.3334*	-0.0788*	-0.1357*	-0.0310*	1					
12	Market mismatch	-0.0823*	-0.1165*	-0.1015*	-0.0175*	0.0249*	0.0086	0.4505*	-0.1065*	-0.1834*	-0.0419*	-0.0183*	1				
13	Other mismatch	-0.0333*	-0.0445*	-0.0489*	0.0083	0.0001	0.0071	0.1958*	-0.0463*	-0.0797*	-0.0182*	-0.008	-0.0107*	1			
14	Mismatch reason: pay and promotion	0.0075	-0.0177*	-0.0846*	0.0447*	0.0003	0.0094	0.5364*	-0.1268*	-0.2184*	0.7017*	-0.0217*	-0.0294*	-0.0128*	1		
15	Mismatch reason: career change	-0.0007	0.0007	-0.0842*	-0.002	0.0230*	0.0012	0.4690*	-0.1108*	-0.1909*	0.6135*	-0.0190*	-0.0257*	-0.0112*	-0.0306*	1	
16	Mismatch reason: working conditions	-0.0426*	-0.0202*	-0.0540*	0.0072	0.0093	0.0113	0.2319*	-0.0548*	-0.0944*	0.3034*	-0.009	-0.0127*	-0.006	-0.0151*	-0.0132*	1
17	Mismatch reason: family	-0.0344*	-0.0210*	-0.0564*	0.0193*	-0.001	0.0193*	0.2248*	-0.0531*	-0.0915*	-0.0209*	0.6741*	-0.0123*	-0.005	-0.0147*	-0.0128*	-0.006
18	Mismatch reason: location	-0.0306*	-0.0393*	-0.0473*	0.0068	0.0058	0.0102	0.2448*	-0.0579*	-0.0996*	-0.0228*	0.7341*	-0.0134*	-0.006	-0.0160*	-0.0140*	-0.007
19	Mismatch reason: job not available	-0.0823*	-0.1165*	-0.1015*	-0.0175*	0.0249*	0.0086	0.4505*	-0.1065*	-0.1834*	-0.0419*	-0.0183*	1.0000*	-0.0107*	-0.0294*	-0.0257*	-0.0127*
20	Mismatch reason: other	-0.0333*	-0.0445*	-0.0489*	0.0083	0.0001	0.0071	0.1958*	-0.0463*	-0.0797*	-0.0182*	-0.008	-0.0107*	1.0000*	-0.0128*	-0.0112*	-0.006
21	Age	0.1941*	0.0299*	-0.0895*	0.0428*	-0.006	-0.0371*	0.0358*	0.0329*	-0.0535*	0.0259*	0.0221*	0.0045	0.0216*	0.0183*	0.0226*	-0.006
22	Male	0.1099*	0.0064	0.1175*	-0.0165*	-0.006	-0.0152*	-0.0220*	0.0058	0.0084	-0.007	-0.0300*	-0.01	-0.002	0.0147*	-0.0147*	-0.0257*
23	Married	0.1220*	0.0439*	0.0116*	0.0232*	0.0071	-0.0274*	-0.0307*	-0.002	0.0212*	-0.0177*	-0.004	-0.0253*	-0.0115*	-0.005	-0.0119*	-0.0208*
24	White	0.0246*	0.0330*	-0.0976*	0.0591*	-0.011	-0.006	0.0069	0.0007	-0.005	0.0055	0.0130*	-0.007	0.004	0.0085	-0.004	0.0058
25	US citizen	0.0213*	0.0185*	-0.1094*	0.0858*	-0.0184*	-0.0188*	0.0347*	0.0284*	-0.0486*	0.0295*	0.0194*	0.0032	0.0107*	0.0184*	0.0163*	0.0176*
26	Highest degree: Bachelor's	-0.1627*	-0.005	-0.1370*	0.1238*	0.0387*	0.0260*	0.0161*	-0.0410*	0.0285*	0.0092	0.0130*	0.0023	0.0126*	0.0175*	-0.0177*	0.0242*
27	Highest degree: Master's	0.0363*	0.0092	0.0708*	-0.0463*	0.0056	0.0132	-0.0749*	-0.0536*	0.0975*	-0.0590*	-0.0285*	-0.0305*	-0.01	-0.0442*	-0.0345*	-0.0148*
28	Highest degree: PhD	0.1506*	-0.003	0.0896*	-0.0973*	-0.0486*	-0.0419*	0.0513*	0.0962*	-0.1227*	0.0442*	0.0117*	0.0257*	-0.005	0.0211*	0.0520*	-0.0137*
29	Private school	0.0194*	-0.002	0.0091	-0.0289*	0.0210*	-0.004	0.0032	-0.004	0.0017	0.004	-0.005	0.0014	0.0053	-0.002	0.0044	0.0075
30	Highest degree tenure	0.1748*	0.0341*	-0.1299*	0.0700*	0.0007	-0.0352*	0.0485*	0.0317*	-0.0603*	0.0418*	0.0282*	0.0023	0.0158*	0.0285*	0.0312*	0.0036
31	Job tenure	0.0949*	0.0278*	0.0011	-0.0146*	-0.0665*	-0.0796*	-0.0638*	-0.0325*	0.0707*	-0.0575*	0.0018	-0.0306*	-0.0151*	-0.0268*	-0.0508*	-0.0170*

		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
17	Mismatch reason: family	1														
18	Mismatch reason: location	-0.0067	1													
19	Mismatch reason: job not available	-0.0123*	-0.0134*	1												
20	Mismatch reason: other	-0.0054	-0.006	-0.0107*	1											
21	Age	0.0134*	0.0177*	0.0045	0.0216*	1										
22	Male	-0.0316*	-0.0116*	-0.01	-0.002	0.1263*	1									
23	Married	-0.0001	-0.005	-0.0253*	-0.0115*	0.2569*	0.1364*	1								
24	White	0.0038	0.0141*	-0.007	0.004	0.0892*	0.0596*	-0.0138*	1							
25	US citizen	0.0069	0.0199*	0.0032	0.0107*	0.1601*	-0.0144*	-0.0397*	0.3471*	1						
26	Highest degree: Bachelor's	0.0033	0.0145*	0.0023	0.0126*	-0.1695*	-0.0256*	-0.1083*	0.1862*	0.1930*	1					
27	Highest degree: Master's	-0.0176*	-0.0223*	-0.0305*	-0.01	-0.01	-0.0346*	0.0249*	-0.1332*	-0.1521*	-0.5441*	1				
28	Highest degree: PhD	0.0125*	0.0043	0.0257*	-0.005	0.2010*	0.0611*	0.0996*	-0.0874*	-0.0776*	-0.6284*	-0.3108*	1			
29	Private school	0.0049	-0.0112*	0.0014	0.0053	0.0559*	-0.0132*	0.0400*	-0.1164*	-0.2690*	-0.0339*	0.0757*	-0.0318*	1		
30	Highest degree tenure	0.0139*	0.0255*	0.0023	0.0158*	0.8552*	0.1269*	0.2184*	0.1390*	0.1903*	0.0826*	-0.0901*	-0.0100*	0.0871*	1	
31	Job tenure	0.0061	-0.003	-0.0306*	-0.0151*	0.4111*	0.0716*	0.1105*	0.0987*	0.1346*	0.0297*	-0.0266*	-0.009	-0.0206*	0.4326*	1

* Significant at 5%

Figure 2.1 shows the distribution of reasons for a mismatch among those respondents who report that their job is not related to their highest degree. While prior work has largely assumed that educational mismatch reflects market frictions or imbalances, most of the scientists and engineers in the SESTAT sample report their mismatch being for other reasons. Figure 2.1 shows that the most common reason for mismatch is pay or promotion opportunities, followed by a change in career or professional interests. The career mismatch category alone (pay, career change and working conditions) makes up over for 60% of the mismatched cases. In contrast, 22% indicate that they are in a mismatch because of market conditions (a job was not available in their field).[10]

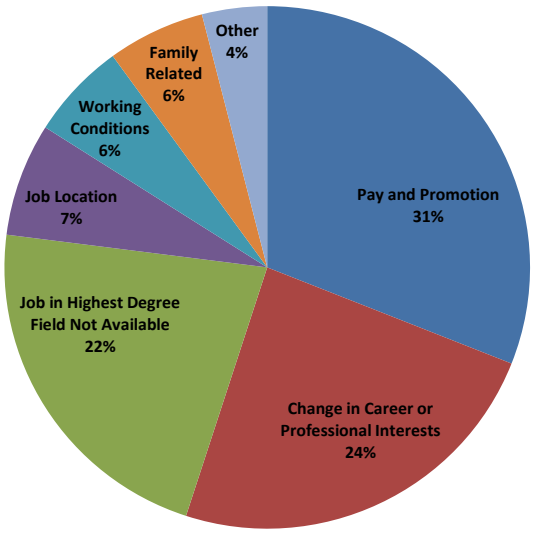

Figure 2.1: Primary Reason for Mismatch

Note: Observations for which the job is not related to the highest degree (N=4,195).

[10] In auxiliary analyses, we regressed mismatch status on the annual U.S. unemployment rate for the year in which an individual started his or her current job. We find that the unemployment rate is positively and significantly related to market mismatch but not to other types of mismatch. This finding suggests that market mismatch indeed reflects a lack of job options.

2.4.2.2 Regression Results

Table 2.3 shows the salary regressions. Consistent with Proposition 1a, we observe that an educational mismatch is significantly and negatively related to salary (model 1). Compared to respondents whose job is closely related to their highest degree, individuals whose job is only somewhat related report 3.2% lower salaries. Individuals whose job is unrelated to their degree report 16.1% lower salaries. In model 2, we distinguish between the broader categories of reasons for mismatch. Consistent with Proposition 1b, the negative coefficient for market mismatch is largest, suggesting a 36% lower salary. In contrast, individuals in a mismatch for personal reasons have 26% lower salary, while those in a career mismatch have a 6.1% lower salary than those in a match. In model 3, we examine different reasons at an even more fine-grained level, using the detailed survey measures. While almost all reasons for mismatch have a strong negative association with salary, mismatches entered because of pay and promotion opportunities do not. Models 4-6 explore potential differences in the role of mismatch across the pay distribution. In particular, model 4 uses quantile regression (Koenker & Hallock, 2001) to estimate the relationship between mismatch and the bottom 10^{th} percentile of the wage distribution. We find that all mismatch categories have a strong and negative coefficient. By contrast, the results for the 90^{th} percentile look quite different (model 6); while a market mismatch is still associated with lower salary (-19.5%), a career mismatch now has a significant positive coefficient (+6%).

Table 2.3: Mismatch and Salary

	1	2	3	4	5	6
	OLS	OLS	OLS	Qreg(.10)	Qreg(.50)	Qreg(.90)
	Ln salary	Ln salary	Ln salary	Ln salary	Ln salary	Ln salary
Job closely related	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	-0.032**	-0.032**	-0.032**	-0.087**	-0.029**	0.006
	[0.008]	[0.008]	[0.008]	[0.009]	[0.004]	[0.006]
Job not related	-0.161**					
	[0.014]					
Career mismatch		-0.061**		-0.301**	-0.042**	0.060**
		[0.016]		[0.016]	[0.007]	[0.011]
Personal mismatch		-0.259**		-0.599**	-0.197**	-0.106**
		[0.040]		[0.033]	[0.014]	[0.024]
Market mismatch		-0.360**		-0.798**	-0.294**	-0.195**
		[0.027]		[0.025]	[0.011]	[0.018]
Other mismatch		-0.304**		-0.798**	-0.251**	-0.140**
		[0.044]		[0.055]	[0.024]	[0.040]
Mismatch reason: pay and promotion			-0.002			
			[0.019]			
Mismatch reason: career change			-0.073**			
			[0.027]			
Mismatch reason: working conditions			-0.317**			
			[0.042]			
Mismatch reason: family			-0.305**			
			[0.063]			
Mismatch reason: location			-0.223**			
			[0.055]			
Mismatch reason: job not available			-0.360**			
			[0.027]			
Mismatch reason: other			-0.305**			
			[0.044]			
Male	0.093**	0.092**	0.090**	0.096**	0.062**	0.080**
	[0.010]	[0.010]	[0.010]	[0.010]	[0.004]	[0.007]
Married	0.067**	0.067**	0.067**	0.083**	0.056**	0.059**
	[0.009]	[0.009]	[0.009]	[0.009]	[0.004]	[0.007]
White	0.061**	0.061**	0.061**	0.039**	0.028**	0.049**
	[0.010]	[0.010]	[0.010]	[0.010]	[0.004]	[0.007]
US citizen	0.023	0.023	0.024	0.030*	-0.006	0.018
	[0.017]	[0.017]	[0.017]	[0.015]	[0.006]	[0.010]
Highest degree: Master's	0.182**	0.182**	0.182**	0.192**	0.160**	0.164**
	[0.009]	[0.009]	[0.009]	[0.011]	[0.004]	[0.008]
Highest degree: PhD	0.298**	0.297**	0.295**	0.357**	0.408**	0.395**
	[0.016]	[0.016]	[0.016]	[0.016]	[0.007]	[0.012]
Private school	0.052**	0.050**	0.051**	0.043**	0.045**	0.061**
	[0.010]	[0.010]	[0.010]	[0.009]	[0.004]	[0.007]
Highest degree tenure	0.046**	0.045**	0.045**	0.044**	0.040**	0.045**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
Highest degree tenure squared	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Job tenure	-0.001	-0.001	-0.001	0.003*	-0.003**	-0.005**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
Job tenure squared	0.000	0.000	0.000	0.000	0.000**	0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.	incl.	incl.
Observations	38161	38161	38161	38161	38161	38161

Notes: Clustered standard errors in brackets. Omitted categories: Job closely related, Highest degree: Bachelor's, Public school.
* Significant at 5%; ** significant at 1

Next, we examine the relationship between mismatch and job satisfaction, using ordered probit regression (Table 2.4, models 1-4). Consistent with Proposition 1a, those who are mismatched experience significantly lower job satisfaction (model 1). We again distinguish between different types of mismatch (model 2) and observe the largest significant negative coefficient for a market mismatch (Proposition 1b). Since job satisfaction may reflect non-financial as well as financial job attributes (Freeman, 1978), we control for salary to gain a clearer impression of non-financial aspects (model 3). While salary strongly predicts satisfaction, our focal results change little, suggesting significantly lower levels of non-financial job attributes for workers in a mismatch. Model 4 distinguishes reasons for mismatch at a detailed level and confirms that job satisfaction is lowest among those who are mismatched because no job in their field of education was available. However, even those who report being mismatched for career, personal, and other reasons tend to be less satisfied with their jobs than those in an educational match.[11]

Finally, we use Poisson quasi-maximum likelihood estimation to analyze how having a mismatch relates with the count of R&D activities (models 5-7) and non-R&D activities (models 8-10). Given that all the individuals in our sample have a science and engineering background, we expect that an educational mismatch will be associated with

[11] While the results are consistent with our prediction that workers in a career mismatch suffer less in terms of lower wages and job satisfaction than workers in a market mismatch, it is not clear why they still experience lower salary and job satisfaction than those in a match. One possibility is that individuals take mismatching positions in the expectation of higher levels of certain job benefits but that such benefits fail to materialize ex post. Relatedly, it may be that scientists and engineers underestimate negative consequences of working outside one's area of education (e.g., less interesting work, lack of interactions with peers, etc.) when making career decisions. Finally, it may be that our cross-sectional analysis does not fully account for individual heterogeneity with respect to ability. We address this possibility using more detailed ability measures for the PhD sample in section 2.4.5.

fewer R&D activities. Model 5 confirms this expectation and models 6 and 7 show that this result holds for all types of mismatches. The results for non-R&D activities look quite different. Consistent with Proposition 2a, model 8 suggests that a mismatch generally is associated with a higher number of non-R&D activities. However, models 9 and 10 show that this relationship differs sharply depending on the reason for mismatch. In particular, workers who are mismatched for family reasons or because of pay and promotion opportunities engage in a broader range of non-R&D activities than those who are matched (roughly 16% and 14% higher counts, respectively), while workers in a market mismatch have a 6% lower count of non-R&D activities, consistent with Proposition 2b.[12] Recall from model 6 that being mismatched for market reasons is negatively related with R&D activities and, as such, it appears that people who take a mismatching position because no other job was available engage in a narrower range of R&D activities without a compensating increase in non-R&D activities. Interpreting non-R&D activities as an opportunity to acquire a broader range of skills and experiences, this result suggests that those who mismatch for personal and career reasons tend to broaden their skill base while those who are mismatched for market reasons do not. At the same time, all those who mismatched are also potentially experiencing a depreciation of R&D related skills. In summary, our first set of analyses suggests that a mismatch is associated with lower salary and lower job satisfaction, yet these relationships are much weaker for those individuals who are in a career mismatch than for those who are in a market mismatch, with personal mismatch between these extremes. A mismatch is also

[12] We will explore in section 4.4 which particular non-R&D activities are associated with the different types of mismatch.

associated with a lower number of R&D activities, regardless of the reason for the mismatch. At the same time, workers in a personal or career mismatch tend to engage in a broader range of non-R&D activities, which may involve a broadening of their skill base. Recall that in our sample of highly trained scientists and engineers, career mismatches are significantly more prevalent than other types of mismatch (see Figure 1) and, as such, distinguishing between different reasons for mismatch and recognizing their different implications for work outcomes appears to be particularly important. In the next section, we examine the relationship between mismatch and subsequent entry into entrepreneurship, considering salary, job satisfaction, and skill variety as potential mediating variables.

Table 2.4: Mismatch, Job Satisfaction, and Skill Variety

	1	2	3	4	5	6	7	8	9	10
	Oprobit Jobsatis	Oprobit Jobsatis	Oprobit Jobsatis	Oprobit Jobsatis	Poisson R&D ct	Poisson R&D ct	Poisson R&D ct	Poisson Non R&D ct	Poisson Non R&D ct	Poisson Non R&D ct
Job closely related	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	-0.527**	-0.529**	-0.525**	-0.528**	-0.173**	-0.173**	-0.173**	0.085**	0.085**	0.084**
	[0.024]	[0.024]	[0.024]	[0.024]	[0.008]	[0.008]	[0.008]	[0.009]	[0.009]	[0.009]
Job not related	-0.791**				-0.516**			0.045**		
	[0.040]				[0.018]			[0.014]		
Career mismatch		-0.412**	-0.404**			-0.451**			0.070**	
		[0.047]	[0.047]			[0.021]			[0.017]	
Personal mismatch		-1.019**	-0.973**			-0.570**			0.088**	
		[0.107]	[0.107]			[0.048]			[0.032]	
Market mismatch		-1.638**	-1.582**			-0.652**			-0.060*	
		[0.079]	[0.079]			[0.036]			[0.028]	
Other mismatch		-1.470**	-1.420**			-0.656**			0.043	
		[0.183]	[0.182]			[0.082]			[0.052]	
Mismatch reason: pay and promotion				-0.470**			-0.406**			0.128**
				[0.063]			[0.027]			[0.022]
Mismatch reason: career change				-0.256**			-0.482**			-0.003
				[0.070]			[0.033]			[0.026]
Mismatch reason: working conditions				-0.737**			-0.581**			0.025
				[0.151]			[0.071]			[0.047]
Mismatch reason: family				-0.812**			-0.680**			0.152**
				[0.156]			[0.076]			[0.047]
Mismatch reason: location				-1.195**			-0.484**			0.032
				[0.140]			[0.059]			[0.042]
Mismatch reason: job not available				-1.639**			-0.652**			-0.060*
				[0.079]			[0.036]			[0.028]
Mismatch reason: other				-1.471**			-0.656**			0.043
				[0.183]			[0.082]			[0.052]
Log salary			0.163**							
			[0.021]							
Male	0.007	0.003	-0.012	0.004	0.125**	0.124**	0.124**	0.040**	0.040**	0.039**
	[0.029]	[0.029]	[0.029]	[0.029]	[0.010]	[0.010]	[0.010]	[0.011]	[0.011]	[0.011]
Married	0.180**	0.179**	0.170**	0.179**	-0.009	-0.009	-0.01	0.048**	0.048**	0.047**
	[0.028]	[0.028]	[0.028]	[0.028]	[0.009]	[0.009]	[0.009]	[0.011]	[0.011]	[0.011]
White	0.153**	0.152**	0.142**	0.152**	-0.064**	-0.064**	-0.064**	-0.005	-0.005	-0.005
	[0.027]	[0.027]	[0.027]	[0.027]	[0.009]	[0.009]	[0.009]	[0.012]	[0.012]	[0.012]
US citizen	0.096*	0.095*	0.093*	0.096*	-0.033**	-0.033**	-0.032**	0.091**	0.091**	0.092**
	[0.038]	[0.038]	[0.038]	[0.038]	[0.012]	[0.012]	[0.012]	[0.018]	[0.018]	[0.018]
Highest degree: Master's	0.033	0.034	0.005	0.032	0.101**	0.101**	0.101**	-0.099**	-0.099**	-0.098**
	[0.030]	[0.030]	[0.030]	[0.030]	[0.010]	[0.010]	[0.010]	[0.013]	[0.013]	[0.013]
Highest degree: PhD	0.056	0.052	0.005	0.049	0.177**	0.176**	0.176**	-0.229**	-0.230**	-0.229**
	[0.046]	[0.046]	[0.047]	[0.046]	[0.014]	[0.014]	[0.014]	[0.019]	[0.019]	[0.019]
Private school	0.005	-0.001	-0.009	-0.001	-0.006	-0.007	-0.007	0.001	0.000	0.001
	[0.028]	[0.028]	[0.028]	[0.028]	[0.009]	[0.009]	[0.009]	[0.011]	[0.011]	[0.011]
Highest degree tenure	-0.017**	-0.018**	-0.026**	-0.019**	-0.010**	-0.010**	-0.010**	0.015**	0.015**	0.015**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Highest degree tenure squared	0.001**	0.001**	0.001**	0.001**	0.000	0.000	0.000	-0.000**	-0.000**	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Job tenure	-0.015**	-0.014**	-0.014**	-0.014**	0.006**	0.006**	0.006**	-0.004*	-0.004*	-0.004*
	[0.005]	[0.005]	[0.005]	[0.005]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
Job tenure squared	0.001**	0.001**	0.001**	0.001**	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Observations	38161	38161	38161	38161	38161	38161	38161	38161	38161	38161

Notes: Clustered standard errors in brackets. Omitted categories: Job closely related, Highest degree: Bachelor's, Public school.
* Significant at 5%; ** significant at 1%

2.4.3 Mismatch and Entrepreneurial Transitions

In a series of multinomial regressions (Table 2.5), we now examine how educational mismatch in employment in period t is related to three possible outcomes in period t+1: continued employment with the same employer (omitted), moves into a job at a new employer, and transitions into entrepreneurship. These regressions exclude individuals who were already self-employed in period t.

Consistent with Proposition 3a, model 1 shows that individuals in an educational mismatch are significantly more likely to move into entrepreneurship in the next period than those who are matched. Moreover, the coefficient is significantly larger in the equation predicting entry into entrepreneurship than in the equation predicting moves into a job at a new employer (Columns 1b vs. 1a; $Chi^2(1)=5.50$, $p<0.05$). Thus, mismatch is strongly related to entry into entrepreneurship, and this effect goes beyond an increase in general labor mobility per se. In terms of effect size, the relative risk of transitioning into entrepreneurship versus staying with the same employer increases by a factor of 1.45 for employees in an educational mismatch versus those in a match. In model 2, we distinguish between different types of mismatch and find that market mismatch strongly predicts mobility into both employment at new employers as well as into self-employment. Career mismatch and personal mismatch also strongly predict entry into entrepreneurship but are not related to mobility into employment at new employers. Thus, while individuals in a market mismatch seem to exploit a broad range of opportunities to find a better match, those who chose a mismatch for personal or career reasons do not seem to actively search for new jobs in existing firms, but they are more likely to transition into entrepreneurship.

Model 3 includes the work outcomes as potential mediators. To allow for nonlinear effects of salary, we include a set of dummy variables for different salary percentiles, omitting the 40-60% category. Consistent with prior work, column 3b shows a U-shape pattern, suggesting that transitions into entrepreneurship are more likely to come from the top and bottom of the wage distribution in paid employment (Elfenbein et al., 2010; Astebro et al., 2011). However, the effects are stronger for employees with salaries in the bottom percentiles, consistent with the notion of lower opportunity costs. Individuals in the tails of the wage distribution are also more likely to move to a new employer (column 3a), but the coefficients are smaller than for transitions into entrepreneurship. As predicted, low job satisfaction is a strong predictor of transitions to both new employers and entrepreneurship, further supporting the notion of lower opportunity costs (with respect to pecuniary as well as non-pecuniary work benefits) as a driver of mobility. Turning to our proxies for skills, we find that the count of R&D activities is not significantly related to subsequent entry into entrepreneurship. In contrast, the number of non-R&D activities is highly significant; an additional non-R&D activity is associated with a relative risk of transitioning into self-employment increasing by a factor of 1.10.. This result is consistent with our conjecture that involvement in non-R&D activities in employment may provide scientists and engineers (who tend to have a specialized technical education) with the opportunity to acquire a broader set of skills and that these skills are at least partially transferable into entrepreneurship.[13] The count of non-R&D work activities also has a positive coefficient

[13] In supplementary regressions, we disaggregate the count of non-R&D activities and find that the

in the regression predicting moves to a new employer, but this coefficient is significantly smaller than that in the regression predicting entrepreneurship ($Chi^2(1)=19.54$, $p<0.01$). This observation is consistent with Lazear's (2005) argument that skill variety is particularly useful in entrepreneurship but less important in paid employment. Once the work outcomes are included, all mismatch variables become insignificant, suggesting that opportunity costs and skill variety play an important mediating role in the relationship between mismatch and transitions into entrepreneurship (Proposition 3b).

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particular activities that are most strongly related with subsequent entrepreneurship are accounting/finance/contracts, professional services, and sales/purchasing/marketing.

Table 2.5 Mismatch and Entrepreneurial Transitions

	1a Mlogit New employer	1b Mlogit Self employment	2a Mlogit New employer	2b Mlogit Self employment	3a Mlogit New employer	3b Mlogit Self employment
Job closelyrelated	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	0.090**	0.118	0.091**	0.118	-0.024	0.008
	[0.034]	[0.062]	[0.034]	[0.062]	[0.035]	[0.064]
Job not related	0.159**	0.371**				
	[0.051]	[0.083]				
Career mismatch			0.109	0.291**	0.008	0.173
			[0.062]	[0.103]	[0.064]	[0.104]
Personal mismatch			0.058	0.585**	-0.209	0.290
			[0.140]	[0.196]	[0.146]	[0.202]
Market mismatch			0.358**	0.490**	-0.024	0.085
			[0.092]	[0.150]	[0.098]	[0.161]
Other mismatch			-0.009	0.236	-0.388	-0.150
			[0.226]	[0.347]	[0.236]	[0.362]
Lnsalary category <10%					0.199**	0.647**
					[0.064]	[0.105]
Lnsalary category 10-20%					0.205**	0.231*
					[0.061]	[0.109]
Lnsalary category 20-30%					0.071	0.161
					[0.058]	[0.102]
Lnsalary category 30-40%					0.097	0.091
					[0.060]	[0.110]
Lnsalary category 40-60%					omitted	omitted
Lnsalary category 60-70%					-0.019	0.040
					[0.062]	[0.112]
Lnsalary category 70-80%					0.059	-0.120
					[0.065]	[0.124]
Lnsalary category 80-90%					0.178**	0.117
					[0.063]	[0.116]
Lnsalary category 90-100%					0.271**	0.413**
					[0.071]	[0.123]
Job satisfaction					-0.566**	-0.436**
					[0.022]	[0.038]
Non R&D count					0.021*	0.099**
					[0.010]	[0.017]
R&D count					0.013	0.028
					[0.012]	[0.021]
Male	0.201**	0.021	0.201**	0.024	0.206**	0.032
	[0.039]	[0.068]	[0.040]	[0.068]	[0.040]	[0.069]
Married	-0.115**	0.003	-0.114**	0.003	-0.074*	0.051
	[0.036]	[0.067]	[0.036]	[0.067]	[0.037]	[0.068]
White	-0.105**	-0.116	-0.105**	-0.117	-0.097*	-0.105
	[0.038]	[0.065]	[0.038]	[0.065]	[0.039]	[0.065]
US citizen	-0.151**	-0.265**	-0.150**	-0.265**	-0.156**	-0.292**
	[0.054]	[0.092]	[0.054]	[0.092]	[0.054]	[0.092]
Highest degree: Master's	-0.092*	-0.116	-0.092*	-0.116	-0.071	-0.045
	[0.041]	[0.070]	[0.041]	[0.070]	[0.043]	[0.072]
Highest degree: PhD	-0.283**	-0.662**	-0.283**	-0.661**	-0.249**	-0.526**
	[0.063]	[0.116]	[0.063]	[0.116]	[0.068]	[0.124]
Private school	-0.015	-0.028	-0.014	-0.025	-0.014	-0.021
	[0.038]	[0.068]	[0.038]	[0.068]	[0.038]	[0.068]
Highest degree tenure	0.002	0.023	0.002	0.023	-0.002	0.026
	[0.008]	[0.013]	[0.008]	[0.013]	[0.008]	[0.014]
Highest degree tenure squared	-0.000	-0.000	-0.000*	-0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Job tenure	-0.168**	-0.197**	-0.169**	-0.198**	-0.175**	-0.199**
	[0.007]	[0.013]	[0.007]	[0.013]	[0.008]	[0.013]
Job tenure squared	0.004**	0.005**	0.004**	0.005**	0.004**	0.005**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	32334	32334	32334	32334	32334	32334

Notes: Clustered standard errors in brackets. Omitted outcome category: Same employer. Omitted categories: Job closely related, Lnsalary_40-60%, Highest degree: Bachelor's, Public school. * Significant at 5%; ** significant at 1%

2.4.4 Supplementary Analyses

We conduct a number of additional analyses to gain a deeper understanding of the nature of the various types of mismatch. In Table 2.6, we regress the different types of mismatch on a number of demographic characteristics as well as the dummy variables indicating which work activities respondents are engaged in for at least 10% of their time. Focusing first on the former, we find that men are less likely to be mismatched for personal reasons, perhaps indicating that men are less likely than women to accept a mismatching position to accommodate family needs. Married individuals are less likely to be mismatched for market or career reasons (consistent with prior research showing that married individuals tend to do better in the labor market (Korenman & Neumark, 1991). Turning to indicators of ability and education, we find that PhDs are more likely to report an educational mismatch than individuals with either a bachelor's or master's degree, and are especially more likely to be in a market mismatch. While this result may seem surprising in light of the low unemployment rates among S&E PhDs (National Science Board, 2012), it is consistent with recent concerns that highly trained and specialized PhDs are often "underemployed" because of a lack of adequate positions (Murray & Hsi, 2007; Cyranoski et al., 2011; Stephan, 2012). Finally, we observe that workers with greater professional tenure (time since highest degree) are more likely to be mismatched for career reasons, presumably because they had more time and opportunities to move away from their original field of work. At the same time, they are less likely to be market mismatched, perhaps because initial mismatches due to market frictions can be remedied through mobility over time (Jovanovic, 1979). Controlling for professional tenure, tenure in the current job is associated with less mismatch, likely reflecting

survival effects in that workers who find themselves in a mismatch situation are more likely to leave jobs (see our main regressions in Table 2.5).

Turning to the indicators of work activities, we find as expected that scientists and engineers who spend a significant amount of time on research, development, and design activities are less likely to report an educational mismatch than those who do not. On the other hand, individuals who spend a significant amount of time in accounting/finance/contracts and especially sales or marketing activities are more likely to report a mismatch. Most interestingly, scientist and engineers who are engaged in professional services as well as management are less likely to report an educational mismatch. Thus, while the latter activities do not form part of traditional R&D activities, they do seem to rely heavily on the skills and knowledge respondents acquired during their formal training.[14] This result is particularly interesting with respect to management given our conjecture that moves into management would result in an educational mismatch (Section 2.2.1.1). We can further probe this result using a different measure available in the survey, indicating whether management is the respondent's *primary* work activity (vs. simply occupying more than 10% of the time). Using this measure, we find that "full time" managers indeed report higher levels of mismatch than those whose primary activity is R&D, especially for career related reasons (available upon request). Thus, while workers with a limited amount of managerial responsibility report a high

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[14] SESTAT also includes occupational codes for each respondent, allowing us to compare the field of highest degree with the current occupation. While most respondents who report an educational mismatch also work in a field that is different from their highest degree (92%), a large share of those who report an educational match also work in a field different from their highest degree (39%). Thus, field mismatch is a very noisy measure of the degree to which workers draw on their education.

level of educational match, full time managers (presumably higher in the hierarchy) draw significantly less on their educational background.

An interesting question is whether workers' choices to enter a position with an educational mismatch can be interpreted as a deliberate effort to acquire a broader range of skills for subsequent entrepreneurship (see Franco & Filson, 2006; Elfenbein et al., 2010; Ganco, 2014). While our measures of reasons for taking a mismatching job do not explicitly break out entrepreneurial aspirations, we suggest that of the available options "change in career or professional interests" would be the most appropriate answer to check. Thus, the absence of a significant relationship between this particular reason and the count of non-R&D activities (Table 2.4, model 10) provides no evidence that higher levels of non-R&D activities among mismatched workers reflect purposeful investments by those aspiring to become entrepreneurs. Of course, this exercise is only indirect and suggestive; further research using more direct measures is clearly warranted.

Table 2.6 Correlates of Mismatch

	1a Mlogit Job somewhat related	1b Mlogit Career mismatch	1c Mlogit Personal mismatch	1d Mlogit Market mismatch	1e Mlogit Other mismatch
10% basic research	-0.271**	-0.523**	-0.787**	-0.744**	-0.866**
	[0.034]	[0.077]	[0.166]	[0.132]	[0.307]
10% applied research	-0.369**	-0.993**	-1.013**	-1.133**	-1.202**
	[0.031]	[0.063]	[0.123]	[0.100]	[0.216]
10% development	-0.151**	-0.608**	-0.528**	-0.737**	-0.539**
	[0.030]	[0.055]	[0.110]	[0.085]	[0.187]
10% design	-0.286**	-0.441**	-0.631**	-0.671**	-0.468*
	[0.028]	[0.054]	[0.115]	[0.086]	[0.201]
10% computer applications	0.037	0.321**	-0.065	0.031	-0.172
	[0.030]	[0.059]	[0.125]	[0.097]	[0.209]
10% accounting	0.179**	0.235**	0.295*	0.159	0.028
	[0.033]	[0.061]	[0.118]	[0.100]	[0.209]
10% employee relations	0.006	0.096	0.220	-0.029	-0.126
	[0.031]	[0.059]	[0.118]	[0.103]	[0.215]
10% management	-0.085**	-0.344**	-0.643**	-0.790**	-0.480**
	[0.030]	[0.056]	[0.116]	[0.085]	[0.183]
10% production	0.062*	-0.125*	0.057	-0.063	0.350
	[0.031]	[0.062]	[0.123]	[0.097]	[0.186]
10% professional services	-0.314**	-0.495**	-0.873**	-0.646**	-0.832**
	[0.044]	[0.082]	[0.165]	[0.125]	[0.314]
10% quality management	0.167**	0.135*	0.190	0.123	-0.127
	[0.030]	[0.055]	[0.116]	[0.089]	[0.198]
10% sales	0.328**	0.637**	0.836**	0.709**	0.936**
	[0.033]	[0.057]	[0.106]	[0.085]	[0.170]
10% teaching	0.051	0.149	0.082	-0.029	0.509*
	[0.044]	[0.078]	[0.155]	[0.139]	[0.229]
10% other	0.255**	0.047	0.099	0.402**	0.978**
	[0.059]	[0.106]	[0.193]	[0.132]	[0.232]
Male	-0.066	0.130	-0.485**	0.031	0.244
	[0.036]	[0.067]	[0.124]	[0.098]	[0.203]
Married	-0.101**	-0.227**	-0.116	-0.268**	-0.341
	[0.033]	[0.059]	[0.125]	[0.088]	[0.175]
White	-0.122**	-0.300**	-0.064	-0.318**	-0.225
	[0.035]	[0.065]	[0.132]	[0.097]	[0.201]
US Citizen	0.190**	0.329**	0.521*	0.256	0.521
	[0.050]	[0.099]	[0.220]	[0.147]	[0.363]
Highest degree: Bachelor's	omitted	omitted	omitted	omitted	omitted
Highest degree: Master's	-0.084*	-0.425**	-0.418*	-0.284*	-0.196
	[0.038]	[0.083]	[0.173]	[0.124]	[0.236]
Highest degree: PhD	0.547**	0.474**	0.600**	0.800**	0.387
	[0.043]	[0.083]	[0.153]	[0.122]	[0.262]
Private school	0.205**	0.282**	-0.125	0.009	0.290
	[0.034]	[0.063]	[0.132]	[0.103]	[0.193]
Highest degree tenure	0.014*	0.044**	0.011	-0.040**	-0.025
	[0.005]	[0.010]	[0.020]	[0.014]	[0.027]
Highest degree tenure squared	-0.000	-0.001*	0.000	0.001**	0.001*
	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]
Job tenure	-0.039**	-0.101**	-0.007	-0.074**	-0.115**
	[0.006]	[0.010]	[0.021]	[0.016]	[0.033]
Job tenure squared	0.001*	0.002**	-0.001	0.001	0.002
	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.	incl.
Observations	38161	38161	38161	38161	38161

Notes: Clustered standard errors in brackets. * Significant at 5%; ** significant at 1%

2.4.5 Robustness Checks

Our sample includes respondents with different levels of education (bachelor's, master's, and PhD degrees), yet labor market dynamics among PhDs may differ from those of others (Stern, 2004; Stephan, 2012). As such, we run key models separately for the PhD sample. Another advantage of this analysis is that it allows us to further control for ability, both because a PhD sample is naturally more homogenous than one spanning different degrees and because we are able to utilize the National Research Council's ratings of PhD program quality as an additional control (National Research Council, 2010). Models 1-6 in Table 2.7 are estimated using the PhD sample but do not include the NRC rating. Consistent with our main results, mismatch is associated with lower pay and job satisfaction, although the coefficients in the salary regressions are weaker than in the full sample and only that of market mismatch is significant. As before, all types of mismatch have a negative relationship with R&D activities, yet only career mismatches are associated with more non R&D activities (models 3 and 4). Regarding mobility, model 5 shows that PhDs who are mismatched for career or personal reasons are more likely to move into entrepreneurship. While career mismatch also predicts movement to new employers, the coefficient is considerably smaller. Market mismatch has no relationship with either type of mobility. Once we include salary, job satisfaction and work activities as mediators (model 6), the mismatch variables become insignificant, in line with our main results. The coefficients for salary are weak, however, suggesting that among PhDs, mismatch is linked to entrepreneurship primarily via low job satisfaction and skill variety. In models 7-12 we include the NRC rating of program quality as an additional control. As expected, this proxy for ability has a positive relationship with

salary. It has no relationship with job satisfaction and it has a negative relationship with the number of non-R&D activities, suggesting that high ability PhDs tend to focus primarily on research and development work. The NRC rating has no effect in the regression of transitions into entrepreneurship or moves to positions at new employers. Most importantly, the inclusion of this additional proxy for ability has no impact on our featured coefficients in any of the regressions, suggesting that unobserved ability is unlikely the key driver of our featured results. Overall, the regressions using the PhD sample suggest that the overall qualitative patterns hold, although mismatched PhDs seem to suffer less in terms of wages, and market mismatch (though relatively common) plays less of a role in shaping mobility than other types of mismatch. Including the NRC rating as an additional control for ability does not affect our results.

Table 2.7: PhD Sample

	1 OLS	2 Oprobit	3 Poisson	4 Poisson	5a Mlogit	5b Mlogit	6a Mlogit	6b Mlogit
	Ln salary	Job satisfaction	R&D count	Non R&D count	New employer	Self employment	New employer	Self employment
Job closelyrelated	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	-0.002	-0.481**	-0.152**	0.039	0.324**	0.334*	0.188*	0.188
	[0.024]	[0.050]	[0.013]	[0.021]	[0.074]	[0.168]	[0.076]	[0.171]
Career mismatch	0.055	-0.474**	-0.440**	0.093**	0.330**	0.709**	0.139	0.473
	[0.040]	[0.089]	[0.034]	[0.035]	[0.121]	[0.239]	[0.126]	[0.247]
Personal mismatch	-0.058	-1.242**	-0.353**	0.006	0.245	1.147**	-0.122	0.716
	[0.055]	[0.277]	[0.069]	[0.074]	[0.277]	[0.415]	[0.298]	[0.477]
Market mismatch	-0.134**	-1.474**	-0.386**	-0.084	0.214	-0.047	-0.185	-0.531
	[0.051]	[0.154]	[0.048]	[0.065]	[0.201]	[0.482]	[0.214]	[0.509]
Other mismatch	-0.141	-1.171**	-0.372**	0.201	0.689	0.516	0.260	-0.038
	[0.088]	[0.438]	[0.142]	[0.118]	[0.491]	[1.035]	[0.523]	[1.035]
Lnsalary category <10%							-0.013	0.708*
							[0.136]	[0.287]
Lnsalary category 10-20%							-0.252	0.038
							[0.138]	[0.321]
Lnsalary category 20-30%							0.002	-0.015
							[0.128]	[0.326]
Lnsalary category 30-40%							-0.112	0.028
							[0.127]	[0.318]
Lnsalary category 40-60%							omitted	omitted
Lnsalary category 60-70%							0.032	0.175
							[0.137]	[0.326]
Lnsalary category 70-80%							0.098	0.544
							[0.135]	[0.285]
Lnsalary category 80-90%							0.163	0.258
							[0.141]	[0.314]
Lnsalary category 90-100%							0.368*	0.858**
							[0.157]	[0.314]
Job satisfaction							-0.624**	-0.639**
							[0.048]	[0.100]
Non R&D count							0.040	0.185**
							[0.025]	[0.047]
R&D count							-0.053	-0.037
							[0.029]	[0.063]
NRC rating								
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Demographic dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.				
Observations	8389	8389	8389	8389	6833	6833	6833	6833

Notes: Clustered standard errors in brackets. Omitted categories: Job closely related, Lnsalary_40-60%; * Significant at 5%; ** significant at 1%

Table 2.7 (continued)

	7 OLS	8 Oprobit	9 Poisson	10 Poisson	11a Mlogit	11b Mlogit	12a Mlogit	12b Mlogit
	Ln salary	Job satisfaction	R&D count	Non R&D count	New employer	Self employment	New employer	Self employment
Job closelyrelated	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	-0.003	-0.482**	-0.151**	0.04	0.324**	0.337*	0.188*	0.190
	[0.024]	[0.050]	[0.013]	[0.021]	[0.074]	[0.168]	[0.076]	[0.171]
Career mismatch	0.053	-0.475**	-0.440**	0.095**	0.330**	0.712**	0.140	0.476
	[0.039]	[0.089]	[0.034]	[0.035]	[0.121]	[0.239]	[0.125]	[0.247]
Personal mismatch	-0.06	-1.243**	-0.352**	0.007	0.245	1.144**	-0.122	0.715
	[0.055]	[0.277]	[0.069]	[0.075]	[0.277]	[0.416]	[0.298]	[0.478]
Market mismatch	-0.131*	-1.472**	-0.387**	-0.086	0.214	-0.049	-0.186	-0.532
	[0.051]	[0.154]	[0.048]	[0.064]	[0.202]	[0.483]	[0.214]	[0.509]
Other mismatch	-0.147	-1.175**	-0.370**	0.205	0.689	0.522	0.262	-0.033
	[0.089]	[0.438]	[0.142]	[0.119]	[0.491]	[1.037]	[0.523]	[1.041]
Lnsalary category <10%							-0.013	0.705*
							[0.136]	[0.287]
Lnsalary category 10-20%							-0.253	0.031
							[0.138]	[0.322]
Lnsalary category 20-30%							0.002	-0.018
							[0.128]	[0.326]
Lnsalary category 30-40%							-0.112	0.027
							[0.127]	[0.318]
Lnsalary category 40-60%							omitted	omitted
Lnsalary category 60-70%							0.032	0.177
							[0.137]	[0.326]
Lnsalary category 70-80%							0.098	0.550
							[0.135]	[0.286]
Lnsalary category 80-90%							0.164	0.266
							[0.142]	[0.314]
Lnsalary category 90-100%							0.369*	0.866**
							[0.158]	[0.314]
Job satisfaction							-0.624**	-0.638**
							[0.048]	[0.100]
Non R&D count							0.040	0.184**
							[0.025]	[0.047]
R&D count							-0.053	-0.038
							[0.029]	[0.063]
NRC rating	0.056**	0.031	-0.015	-0.045**	0.001	-0.053	-0.006	-0.046
	[0.020]	[0.038]	[0.010]	[0.016]	[0.052]	[0.104]	[0.054]	[0.107]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Demographic dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.				
Observations	8389	8389	8389	8389	6833	6833	6833	6833

Notes: Clustered standard errors in brackets. Omitted categories: Job closely related, Lnsalary_40-60%; * Significant at 5%; ** significant at 1%

In a second set of analyses, we examine how our results are affected by additional controls for the size of the employer. It is conceivable that scientists and engineers in small firms are more likely to be mismatched because small firms (like entrepreneurship) may offer less opportunity for specialization in R&D.[15] At the same time, small firms pay lower wages (Oi & Idson, 1999) and small firm employees are also more likely to transition into entrepreneurship compared to large firm employees (Elfenbein et al., 2010; Tag et al., 2013). As such, firm size may be an underlying driver of some of the key variables in our analysis.[16] The regressions reported in Table 2.8 replicate our key models including a set of dummy variables to control for the size of the employer. Consistent with prior work, we find that small firms pay significantly less than large firms (model 1). However, including firm size controls does not change the strong negative coefficients of all types of mismatch in the salary regression. Similarly, including firm size controls does not lead to noticeable changes in the mismatch coefficients in regressions of job satisfaction or skill variety (models 2-4). We find that employees working in small firms are more likely to transition into self-employment, providing evidence that the "small firm effect" continued to persist after the dotcom bubble and the significant changes that occurred in the S&E labor market in the early 2000's (model 5). The mismatch variables continue to strongly predict entry into entrepreneurship. Moreover, the coefficients of the mismatch indicators are significantly

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[15] 13% of cases in small firms (<100 employees) indicate a mismatch, compared to 10% among the cases working in firms with more than 25,000 employees.

[16] Alternatively, mismatch might provide a parsimonious explanation for both lower wages in small firms and for the observation that small firm employees are more likely to transition into self-employment.

reduced once salary, job satisfaction, and work activities are included as mediators. Overall, controlling for firm size does not change our substantive results.

Table 2.8: Firm Size Controls

	1 OLS Ln salary	2 Oprobit Job satisfaction	3 Poisson R&D count	4 Poisson Non R&D count	5a Mlogit New employer	5b Mlogit Self employment	6a Mlogit New employer	6b Mlogit Self employment
Job closelyrelated	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	-0.034**	-0.527**	-0.173**	0.087**	0.109**	0.147*	-0.000	0.043
	[0.008]	[0.024]	[0.008]	[0.009]	[0.035]	[0.063]	[0.036]	[0.064]
Career mismatch	-0.061**	-0.414**	-0.452**	0.073**	0.151*	0.329**	0.065	0.230*
	[0.016]	[0.047]	[0.021]	[0.017]	[0.063]	[0.104]	[0.064]	[0.105]
Personal mismatch	-0.245**	-1.037**	-0.570**	0.076*	0.039	0.528**	-0.196	0.279
	[0.039]	[0.107]	[0.048]	[0.032]	[0.141]	[0.198]	[0.147]	[0.204]
Market mismatch	-0.354**	-1.647**	-0.652**	-0.065*	0.338**	0.454**	-0.004	0.117
	[0.027]	[0.079]	[0.036]	[0.028]	[0.092]	[0.150]	[0.098]	[0.159]
Other mismatch	-0.288**	-1.499**	-0.657**	0.029	-0.024	0.190	-0.384	-0.160
	[0.043]	[0.183]	[0.082]	[0.051]	[0.230]	[0.347]	[0.239]	[0.360]
Lnsalary category <10%							0.018	0.359**
							[0.066]	[0.108]
Lnsalary category 10-20%							0.085	0.068
							[0.062]	[0.109]
Lnsalary category 20-30%							0.007	0.064
							[0.058]	[0.103]
Lnsalary category 30-40%							0.054	0.035
							[0.061]	[0.111]
Lnsalary category 40-60%							0.000	0.000
							[.]	[.]
Lnsalary category 60-70%							0.020	0.087
							[0.062]	[0.112]
Lnsalary category 70-80%							0.104	-0.066
							[0.065]	[0.124]
Lnsalary category 80-90%							0.214**	0.148
							[0.062]	[0.116]
Lnsalary category 90-100%							0.299**	0.450**
							[0.071]	[0.122]
Job satisfaction							-0.580**	-0.458**
							[0.022]	[0.038]
Non R&D count							0.011	0.085**
							[0.010]	[0.017]
R&D count							0.011	0.021
							[0.012]	[0.021]
Firm size: 1-10	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Firm size: 11-24	0.197**	-0.251**	0.007	-0.021	-0.042	-0.297*	-0.080	-0.297*
	[0.038]	[0.079]	[0.025]	[0.026]	[0.106]	[0.142]	[0.107]	[0.144]
Firm size: 25-99	0.249**	-0.295**	0.007	-0.085**	0.020	-0.505**	-0.016	-0.485**
	[0.037]	[0.067]	[0.022]	[0.023]	[0.090]	[0.124]	[0.091]	[0.125]
Firm size: 100-499	0.264**	-0.333**	-0.017	-0.118**	-0.130	-0.892**	-0.172	-0.865**
	[0.036]	[0.066]	[0.022]	[0.022]	[0.087]	[0.123]	[0.089]	[0.125]
Firm size: 500-999	0.284**	-0.376**	-0.014	-0.142**	-0.271**	-1.080**	-0.313**	-1.051**
	[0.037]	[0.072]	[0.024]	[0.025]	[0.099]	[0.151]	[0.100]	[0.152]
Firm size: 1000-4999	0.306**	-0.396**	-0.025	-0.177**	-0.455**	-1.192**	-0.510**	-1.163**
	[0.036]	[0.065]	[0.021]	[0.022]	[0.088]	[0.126]	[0.090]	[0.128]
Firm size: 5000-24999	0.333**	-0.362**	-0.003	-0.175**	-0.584**	-1.360**	-0.636**	-1.320**
	[0.036]	[0.064]	[0.021]	[0.022]	[0.088]	[0.126]	[0.090]	[0.128]
Firm size: 25000+	0.350**	-0.361**	0.019	-0.202**	-0.835**	-1.501**	-0.892**	-1.455**
	[0.036]	[0.062]	[0.020]	[0.021]	[0.086]	[0.119]	[0.088]	[0.122]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Demographic dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Observations	38161	38161	38161	38161	32334	32334	32334	32334

Notes: Clustered standard errors in brackets. Omitted categories: Job closely related, Lnsalary_40-60%, Firm size:1-10
* Significant at 5%; ** significant at 1%

In a final set of analyses, we explore whether our results may reflect unobserved heterogeneity in individuals' "tastes" and preferences for certain kinds of job attributes. In particular, while we build on a large body of work suggesting that skill variety is useful for entrepreneurship (Lazear, 2005; Wagner, 2006; Silva, 2007), an alternative explanation for our findings would be that individuals who voluntarily enter jobs requiring new sets of skills have a "taste for variety" that may also lead them to be more interested in entering entrepreneurship (Astebro & Thompson, 2011). Similarly, it is conceivable that individuals who are less risk averse are more likely to take positions outside their area of education and are also more likely to find entrepreneurship attractive. The 2003 survey asked respondents to rate the importance of a number of job attributes, including "responsibility" and "job security". We use these measures as proxies for the degree to which respondents value responsibility for a broader range of tasks (task variety) and for their risk aversion, respectively. Descriptively, we find that the correlations between these measures and mismatch are very low and tend to be negative, ranging from 0 to -0.03. When including these measures as additional controls (Table 2.9), we find as expected that individuals with stronger preferences for security are less likely to be mobile, especially into entrepreneurship. Taste for variety predicts entry into entrepreneurship but not mobility to different employers. Most importantly, including the measures of preferences does not change the coefficients of our featured variables, mitigating concerns about taste for variety or risk aversion as an alternative explanation for our key results.

Table 2.9: Controls for Taste for Variety and Risk Aversion

	1a Mlogit New employer	1b Mlogit Self employment	2a Mlogit New employer	2b Mlogit Self employment	3a Mlogit New employer	3b Mlogit Self employment	4a Mlogit New employer	4b Mlogit Self employment
Job closely related	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Job somewhat related	0.081*	0.117	-0.027	0.024	0.079*	0.118	-0.026	0.027
	[0.038]	[0.068]	[0.039]	[0.070]	[0.038]	[0.068]	[0.039]	[0.070]
Career mismatch	0.097	0.332**	-0.002	0.235*	0.095	0.332**	-0.002	0.236*
	[0.067]	[0.110]	[0.069]	[0.111]	[0.067]	[0.110]	[0.069]	[0.111]
Personal mismatch	0.052	0.319	-0.205	0.037	0.045	0.313	-0.216	0.027
	[0.155]	[0.245]	[0.163]	[0.252]	[0.155]	[0.246]	[0.163]	[0.253]
Market mismatch	0.321**	0.380*	-0.009	0.034	0.330**	0.405*	-0.001	0.050
	[0.106]	[0.176]	[0.111]	[0.187]	[0.106]	[0.176]	[0.111]	[0.188]
Other mismatch	0.035	-0.098	-0.337	-0.429	0.022	-0.126	-0.349	-0.462
	[0.253]	[0.452]	[0.267]	[0.462]	[0.255]	[0.448]	[0.269]	[0.459]
Preference for security					-0.204**	-0.246**	-0.166**	-0.216**
					[0.028]	[0.051]	[0.029]	[0.051]
Preference for responsibiliy					0.036	0.137**	0.089**	0.147**
					[0.028]	[0.049]	[0.029]	[0.051]
Lnsalary category <10%			0.121	0.639**			0.131	0.649**
			[0.075]	[0.120]			[0.075]	[0.120]
Lnsalary category 10-20%			0.200**	0.345**			0.212**	0.361**
			[0.069]	[0.121]			[0.069]	[0.121]
Lnsalary category 20-30%			0.078	0.247*			0.082	0.253*
			[0.063]	[0.111]			[0.063]	[0.111]
Lnsalary category 30-40%			0.106	0.182			0.107	0.185
			[0.064]	[0.117]			[0.064]	[0.117]
Lnsalary category 40-60%			omitted	omitted			omitted	omitted
Lnsalary category 60-70%			-0.034	0.107			-0.045	0.092
			[0.064]	[0.116]			[0.065]	[0.117]
Lnsalary category 70-80%			0.042	-0.038			0.032	-0.051
			[0.067]	[0.127]			[0.067]	[0.127]
Lnsalary 80-90%			0.160*	0.165			0.136*	0.135
			[0.065]	[0.121]			[0.066]	[0.121]
Lnsalary 90-100%			0.274**	0.458**			0.226**	0.390**
			[0.074]	[0.129]			[0.075]	[0.130]
Job satisfaction			-0.565**	-0.435**			-0.562**	-0.435**
			[0.024]	[0.042]			[0.024]	[0.043]
Non R&D count			0.019	0.093**			0.015	0.086**
			[0.011]	[0.018]			[0.011]	[0.019]
R&D count			0.006	0.035			0.005	0.034
			[0.013]	[0.023]			[0.013]	[0.023]
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Demographic dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
State of employment dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Observations	28310	28310	28310	28310	28310	28310	28310	28310

Notes: Limited sample of cases included in the 2003 SESTAT. Clustered standard errors in brackets. Omitted categories: Job closely related, Lnsalary_40-60%; * Significant at 5%; ** significant at 1%

2.5 Discussion and Conclusion

We analyzed data from over 22,000 scientists and engineers to examine reasons for educational mismatch and the implications of mismatch for work outcomes such as salary, job satisfaction and skill variety, as well as for subsequent transitions into entrepreneurship. Consistent with prior work, we find that educational mismatch is associated with lower salary and job satisfaction. However, distinguishing between different reasons for mismatch, we observe that the consequences of mismatch for those who are mismatched for career reasons are much less negative and in some cases can be positive. Moreover, our results support the notion that an educational mismatch may expose employees to new responsibilities and thus stimulate them to acquire skills outside of their area of education. We also find that those who are mismatched are more likely to enter entrepreneurship in a subsequent period, and this relationship does not simply reflect higher labor mobility per se. While workers who are mismatched for market reasons are more likely to move in general, those who are mismatched for career or personal reasons are more likely to move to entrepreneurship in particular. Examining potential underlying mechanisms, we find evidence that salary, job satisfaction and skill variety play a mediating role.

These insights contribute to a growing stream of entrepreneurship research examining how individuals' experiences in established organizations shape subsequent entrepreneurship (Sorensen, 2007; Agarwal et al., 2009; Elfenbein et al., 2010; Nanda & Sørensen, 2010). We advance this work by considering how work experiences are shaped jointly by both features of the organization and by attributes of the worker, as reflected in educational (mis-)match. We improve upon recent work by Astebro et al. (2011) who

suggest mismatch as an important predictor of entrepreneurship in multiple ways. First, we argue that educational mismatch may not only be due to labor market frictions and we show empirically that at least among scientists and engineers other types of reasons are more prevalent. Mismatches entered for different reasons, in turn, appear to have different implications for work outcomes and subsequent mobility. Second, we consider not only lower opportunity costs (lower wages and job satisfaction) but also increased skill variety as a potential consequence of mismatch, thus drawing on two streams of entrepreneurship literature that have progressed largely independently from each other. Empirically, our data include unique proxies for mismatch as well as financial and non-financial work outcomes, allowing us to explicitly study the relationships among these variables rather than relying on indirect approaches. Finally, we complement prior evidence from a general population sample in Korea with evidence from highly trained knowledge workers in the U.S.

Our results also inform the broader literature on scientific labor markets, human capital, and educational mismatch by providing novel insights into reasons for an educational mismatch using a large and representative sample of scientists and engineers. One key insight is that – at least among highly educated knowledge workers – a mismatch between education and the requirements of the current job may not only result from a lack of adequate positions or labor market imperfections (Bowlus, 1995; Oyer, 2006; Cyranoski et al., 2011) but also because workers voluntarily enter mismatching positions for a variety of other reasons. More importantly, different reasons for mismatch show different relationships with work outcomes such as job satisfaction and salary, suggesting the need to more clearly distinguish different reasons for a mismatch. While

much of the prior work focuses on negative consequences of mismatch in terms of lower wages and job satisfaction, we also examined the possibility that mismatches with respect to formal education may be associated with the acquisition of a broader set of new skills, which in turn may provide individuals with the opportunity to take on new roles and careers paths, including entrepreneurship. While our results do not imply that such a skill development offsets the negative implications of mismatch for salary and job satisfaction, it highlights the need to consider more carefully how mismatch may affect skill development and long-term career trajectories, taking into account the particular kinds of skills individuals have acquired in formal education, as well as the skills required in various types of careers.

As with all studies, ours also faces some important limitations. First, while we control for many variables that may affect a person's career trajectory, there may still be some unobserved heterogeneity that could be associated with being in a mismatch. In particular, we cannot rule out remaining unobserved heterogeneity in ability. Given the robustness of our results to including a broad range of proxies for ability, however, it is unlikely that ability is the key driver of our results. Relatedly, the SESTAT data do not include direct measures of specific types of skills and we rely on measures of work activities as proxies for skills, under the assumption that new skill requirements lead workers to develop the necessary skills through learning by doing. However, we cannot rule out that some of the workers entering an educational mismatch already possess certain non-R&D skills that are required in those positions. In that case, educational mismatch would not be causing an increase in skill variety, but skill variety could still provide an explanation for the observed positive association between educational

mismatch and subsequent entry into entrepreneurship. Finally, while SESTAT provides unique longitudinal data on scientists' and engineers' careers, the time span we are able to observe is relatively short, limiting our ability to examine respondents' earlier career histories or how mismatches develop over time.

Despite these limitations, our results suggest important implications for managers and policy makers. For managers, they highlight the importance of hiring workers that are a good match with respect to their educational background, even if other candidates might be willing to take mismatching positions for personal reasons such as family, location, or a change in career interests. The reason is that employees in an educational mismatch are likely to be less satisfied with their job, which prior research suggests has negative implications for productivity (Judge et al., 2001). Moreover, mismatched employees are more likely to move into new positions at existing firms or to start their own businesses. This higher degree of mobility can have negative consequences for the current employer if it leads to the loss of valuable human capital or if departing employees move to competing employers or start their own competing ventures (Hellmann, 2007; Campbell et al., 2012).

Our results also speak to educational policies and policies designed to encourage technology entrepreneurship. In particular, if it is a goal to encourage entrepreneurship among scientists and engineers, it seems important to consider that this career path has unique requirements regarding the skills individuals need in order to be successful. As such, it may be important to revise and expand curricula to provide students with a broader range of skills, including non-R&D skills that are particularly valuable in entrepreneurship (Agarwal & Sonka, 2010). Relatedly, our results speak to an ongoing

debate on STEM labor market imbalances and potential problems resulting from an oversupply of PhDs (Cyranoski et al., 2011; Austin, 2012; Stephan, 2012). While only a relatively small share of individuals report being in an educational mismatch due to labor market conditions, that share is higher among PhDs than among other degree types. Moreover, the implications of market mismatches for individuals' careers appear to be quite dramatic in terms of both financial income and job satisfaction. While we can only conjecture about potential solutions, it may be important to provide prospective students with better information that allow them to assess labor market conditions and to choose areas of training in light of the demand for certain types of human capital. Given the negative consequences of educational mismatch suggested by our results, students who make the "right" choice when enrolling in a program are likely to have better career outcomes than those who switch into different fields after graduation.

Our study suggests several areas for future research. First, while the SESTAT data offer unique insights into reasons for mismatch, including changes in respondents' career interests, future work could examine more explicitly the degree to which skill acquisition in a mismatch is "accidental" versus an explicit investment made by workers seeking to change careers. Second, future work is needed to determine whether individuals who move out of a mismatched position are able to improve work outcomes such as salary and job satisfaction, and it would be particularly interesting to see whether any existing rate of improvement differs between moves made into entrepreneurship versus a new position at another employer. A finding that transitions into entrepreneurship allow previously mismatched individuals to significantly improve their work outcomes might point towards entrepreneurship as a potential mechanism to mitigate labor market imbalances,

complementing the common emphasis on entrepreneurship's benefits for economic growth (Agarwal et al., 2007; Baumol et al., 2007). A final particularly interesting research opportunity would be to examine whether the performance of entrepreneurial ventures differs depending on whether a founder came from a mismatch and, if so, from what type of mismatch. Our discussion suggests, for example, that new entrepreneurs coming from a career mismatch may have higher performance than those coming from a market mismatch, both because they should pursue only higher value opportunities (due to higher opportunity costs) and because they are likely to possess a broader set of skills that may be beneficial for entrepreneurial success. We hope that our results stimulate future research on these and related questions.

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CHAPTER 3

DOES ENTREPRENEURSHIP PAY OR SATISFY?

3.1 Introduction

With the growing popularity of entrepreneurship as a career path, it is important to understand why people enter and whether it is beneficial to the entrepreneur. There have been mixed results reported on how beneficial entrepreneurship actually is. One stream of research assumes that people enter entrepreneurship because they seek to maximize income and finds that entrepreneurs earn more money than those working in established firms (Berglann et al., 2011; Braguinsky & Ohyama, 2007; Fairlie, 2005; Levine & Rubinstein, 2013; Rosen & Willen, 2002). Conversely**,** there exists a large body of literature that finds that entrepreneurs earn less than their equivalents in wage work (Åstebro & Chen, 2014; Evans & Leighton, 1989; Hamilton, 2000; Moskowitz & Vissing-Jorgensen, 2002; Parker, 2009; Van Praag & Versloot, 2007). This latter finding has lead researchers to question why workers are willing to enter, as well as remain in self-employment despite receiving returns substantially lower than what they might receive if they were employed in wage work. Many authors have suggested that entrepreneurship must offer certain non-pecuniary benefits compared to employment in an established firm that serve as a compensating differential for lower wages (Blanchflower & Oswald, 1998; Hamilton, 2000; Hurst & Pugsley, 2011; Kawaguchi, 2002; Moskowitz & Vissing-Jorgensen, 2002).

One of the problems with the current literature is that a majority of studies use cross sectional data which allows the examination of salary at one point in time, but does not allow for the study of how the wages change over time. Additionally, while many of

these studies argue that there are non-pecuniary benefits to entrepreneurship, they do not have an actual measure to test this theory and merely assume that there must be non-pecuniary benefits to compensate for lower wages in entrepreneurship. The prior literature also implicitly looks at the average entrepreneur as a homogenous group in terms of motivating factors. I argue that whether becoming an entrepreneur changes a worker's wages and non-pecuniary benefits depends on why someone transitioned in the first place. For example, if someone chooses to enter entrepreneurship because they do not feel that they can increase their compensation with their current employer and believe that they could make more money by starting their own business, this motivator may impact an entrepreneurs wages' and non-pecuniary benefits more greatly than someone who lost their job and enters entrepreneurship because they believe that they have no other options in established companies.

In this paper I address the gaps in the literature by using longitudinal SESTAT data on more than 28,000 scientists and engineers to analyze whether there are improvements to wage workers' work outcomes when they enter entrepreneurship. Instead of comparing the average salaries of entrepreneurs to wage workers, as has been often done in the past, I use longitudinal data to answer the call for much needed analysis of the differences in earnings before and after an entrepreneurial transition for a given individual (Åstebro & Chen, 2014). Additionally I perform analyses of non-pecuniary benefits before and after the entrepreneurial transition using job satisfaction as a proxy. I am able to analyze whether non-pecuniary benefits actually increase when someone enters self-employment. I compare the changes in work outcomes of those who transition into entrepreneurship to not only wage workers who do not change employers but also to

those who switch to a new employer in wage work. This allows me to take a more in depth look at the work outcome changes resulting from different mobility patterns of wage workers. Additionally, I use data on worker's reported reasons for why they change employers to take a deeper look into motivations for these different types of labor mobility and the corresponding implications for work outcomes.

3.2 Background

3.2.1 Entrepreneurial Pecuniary and Non-Pecuniary Benefits

Many researchers have found that individuals who are self-employed earn less income than wage workers (Astebro & Thompson, 2011; Evans & Leighton, 1989; Hamilton, 2000; Moskowitz & Vissing-Jorgensen, 2002). Scholars have provided many different explanations as to why this may be the case. Matching models suggest that people have sector specific human capital and they may enter entrepreneurship without knowing their entrepreneurial ability and therefore the earnings differential may reflect those selection effects (MacDonald, 1988). Others have suggested that entrepreneurs are willing to accept lower wages because they may possess personality traits such as unrealistic expectations about the probabilities for success, overconfidence and an appetite for risk (Cooper et al., 1988; De Meza & Southey, 1996; Shane, 2009). Other research suggests that lower wages have been found in the data due to an underreporting of entrepreneurial income (Åstebro & Chen, 2014; Feldman & Slemrod, 2007; Hurst et al., 2014; Pissarides & Weber, 1989; Tedds, 2010). Evans and Leighton (1989) attributed the difference in earnings between wage workers and entrepreneurs to differences in the quality of labor with self-employment often constituting employment of last resort. Hamilton (2000) rejected this conclusion by showing that the differential cannot be

explained solely by the selection of low-ability into self-employment and argued that his results were consistent with the idea that there are non-pecuniary benefits of being one's own boss (Blanchflower & Oswald, 1998). Non-pecuniary benefits appear to be the most widely accepted explanation for lower wages in entrepreneurship.

While a majority of the current literature on entrepreneurial rewards finds that entrepreneurship is associated with lower earnings, empirical findings on earnings in entrepreneurship are mixed. Recent literature has found positive effects of entrepreneurship on salary (Braguinsky & Ohyama, 2007; Fairlie, 2005; Gort & Lee, 2007; Levine & Rubinstein, 2013; Tergiman, 2010). Gort and Lee (2007) find that those at the top of the wage distribution earn more than their counterparts in wage work, while others have found that those who are at the bottom of the wage distribution earn more in entrepreneurship (Holtz-Eakin et al., 2000) and have higher earnings growth in entrepreneurship (Fairlie, 2005). Tergimann (2010) finds that those at the beginning and the end of their careers earn more in entrepreneurship than wage workers. Van der Sluis et al. (2007) find that entrepreneurs with higher education make more money than wage workers, while Braguinsky and Ohyama (2007) have found that entrepreneurs in businesses with job requirements related to the entrepreneurs education have larger earnings than wage workers. Others have found that that the type of entrepreneurship matters; that working in a limited liability firm (Berglann et al., 2011) or in incorporated self-employment (Levine & Rubinstein, 2013) results in larger earnings for the entrepreneur. Even though the results in the prior literature on whether entrepreneurs earn more or less than wage workers are somewhat mixed, the most widely accepted theory in

the literature is still that entrepreneurs earn less than wage workers and accept non-pecuniary benefits as a compensating differential.

According to much of the literature, self-employed workers are considerably more satisfied with their work than individuals in organizations (Benz & Frey, 2004; Blanchflower & Oswald, 1998; Blanchflower, 2000; Hundley, 2001; VandenHeuvel & Wooden, 1997). Benz and Frey (2004) find that self-employed workers are substantially happier with their work than wage workers and that this has nothing to do with differences in outcomes (higher pay or lower working hours) or personality differences but simply that the higher satisfaction comes directly from the non-pecuniary benefits enjoyed in self-employment. Examples of non-pecuniary benefits that have been attributed to self-employment include being one's own boss, skill variety, reduction in job stress, absence of hierarchy in the work environment, task autonomy and taste for variety (Astebro & Thompson, 2011; Benz & Frey, 2003; Benz & Frey, 2004; Frey & Benz, 2003; Griffeth et al., 2000; Hamilton, 2000; Hughes, 2003; Hundley, 2001; Hurst & Pugsley, 2011). These benefits may lead an employee to choose to enter entrepreneurship even though they could possibly be compensated with higher wages if they were to choose wage work.

While most of the prior literature highlights potential non-pecuniary benefits, there may also be negative aspects of entrepreneurship that may lead to lower job satisfaction. Entrepreneurs frequently work longer hours than wage workers (Ajayi-Obe & Parker, 2005; Åstebro & Chen, 2014; Blanchflower, 2004; Hyytinen et al., 2013). They also are known to have greater workloads and job-related demands, as well as high levels of stress from the job responsibilities and from financial uncertainty. Self-

employed people have also been found to sleep less, worry more, have less leisure time, and have spouses that are also stressed by the business (Blanchflower, 2004; Dahl et al., 2010; Harris et al., 1999; Williams, 2003).

One of the problems with the current empirical papers on this topic is that a majority of these studies are cross sectional instead of longitudinal and this is a problem because they only observe one point in time and are unable to observe what happens if someone changes employment, to know if there are benefits for the individual workers in transitioning to self-employment. There are some early longitudinal studies (Åstebro et al., 2013; Braguinsky & Ohyama, 2007; Hartog et al., 2008; Levine & Rubinstein, 2013), but even amongst these studies there is still a mix of findings on what happens to wages when people transition. In addition, these studies only observe what happens to wages, not non-pecuniary benefits. Even though many scholars suggest that entrepreneurs are willing to trade higher salaries for more non-pecuniary benefits, these studies generally only measure financial income, not non-pecuniary measures, so we do not know if non-pecuniary benefits are increasing in entrepreneurship. I address both of these gaps by using longitudinal data to observe what happens to work outcomes when people move, as well as use a proxy measure for non-pecuniary benefits to study what happens to pecuniary benefits and non-pecuniary benefits when individuals transition to self-employment.

Another gap in the literature is that in general, transitions to entrepreneurship and labor mobility in established firms are currently analyzed in distinct studies. This is a problem because most studies focus on entrepreneurship as the only option people have other than remaining in wage work, when in reality they have the option of transitioning

to self-employment and moving to another firm in wage work. To overcome this I jointly study both types of labor mobility in one study and I compare the changes in work outcomes for those who transition to entrepreneurship with the changes in work outcomes for those who move to new employers in wage work. In addition, I compare these with the work outcomes for those who stay with their current employer in wage work. Changes in work outcomes for movers to entrepreneurship to movers in wage work need to be compared to better understand whether there are certain distinct benefits to moving to self-employment over another job in wage work, or if work outcomes change similarly across movers in general. In studies of labor mobility in wage work, researchers have found that people who change employers in wage work move from the top and bottom of the wage distribution in employment (Trevor et al., 1997). They have also found that while longer job tenure is associated with larger wage growth and in general quitters do not increase their wages more than stayers over their lifecycle, young workers are able to increase their salaries when they move (Bartel & Borjas, 1981; Mincer & Jovanovic, 1979; Topel & Ward, 1988). Prior research on labor mobility in wage work has also found that low job satisfaction is an antecedent to employment change (Griffeth et al., 2000; Porter & Steers, 1973; Tett & Meyer, 1993) and that there is a predictable pattern of job satisfaction, specifically that when someone joins a new organization they experience an initial increase in job satisfaction and then a subsequent decline thereafter (Boswell et al., 2005; Boswell et al., 2009).

Many studies have assumed the presence of a compensating differential circumstantially citing the studies listed above as explanations of the entrepreneurial earnings discrepancy. Surprisingly, there have been very few studies on the precise nature

of the compensating differential (Carter, 2011), which is something I plan to account for in this study by analyzing transitioning to entrepreneurship and its relationship with pecuniary and non-pecuniary benefits simultaneously. I will examine the changes in pecuniary and non-pecuniary benefits as people transition to self-employment compared to those who change employers in wage work and those who do not change employers. Per the Hamilton (2000) argument, if non-pecuniary benefits are a compensating differential for salary as often implied in the prior literature, then one would predict that wage workers who enter entrepreneurship may experience a decrease in pecuniary returns but should experience an increase in their non-pecuniary benefits.

3.2.2 Motivations for Employer Change and the Implications for Pecuniary and Non- Pecuniary Benefits

Most prior literature has examined the average salaries of entrepreneurs and assumed entrepreneurs to be homogenous in their motivations. In reality, different people enter entrepreneurship for different reasons and may realize different outcomes as a result. The implications of moving to entrepreneurship may differ among various people depending on why they move. The utility of transitioning to entrepreneurship consists of pecuniary benefits, non-pecuniary job attributes, and non-job benefits. Non-job benefits may consist of things such as the ability to meet more familial obligations or the ability to live in a better location. For different people, different components may be larger or smaller. For example, those who enter entrepreneurship with the goal of increasing their wages may have very different outcomes than those who enter entrepreneurship because they were laid off of a wage work position and have no other options. Bartel and Borjas (1981) found that the nature of a job quit is very important in determining gains to

mobility in established wage work, and I argue that the same should be applicable to transitions to self-employment.

Pecuniary benefits should raise the most for those who transition to self-employment for financial reasons. These are people who would be less likely to trade off pecuniary benefits for non-pecuniary job attributes or non-job benefits. People who move into entrepreneurship purposefully to increase their salary are more likely to be opportunity entrepreneurs who have prepared for entry into self-employment by making purposeful investments into their human and social capital that is necessary to start a business, and also may be more likely to have started a venture in an area of expertise, which should lead to a greater monetary return (Block & Wagner, 2010; Block & Wagner, 2007).

On the other hand, non-pecuniary benefits should improve the most for those who transition into entrepreneurship for non-monetary career reasons. These people are most likely to seek out entrepreneurship for job-related attributes associated with self-employment such as being one's own boss, absence of hierarchy in the work environment, task autonomy, taste for variety, etc. (Astebro & Thompson, 2011; Benz & Frey, 2004; Griffeth et al., 2000; Hamilton, 2000), therefore their job satisfaction should improve. This group of people should be the group most likely to epitomize the Hamilton (2000) theory of people who may be more willing to sacrifice salary for expected job benefit improvements in entrepreneurship.

Other wage workers transition into entrepreneurship for non-job-related reasons. I predict that transitioning to self-employment for personal reasons (such as location or a change in family dynamics, etc.), should increase non-job benefits as it should allow

individuals to improve their quality of life. However, the connections to non-pecuniary benefits are less clear for those who transition to entrepreneurship for personal reasons versus those who transition for career reasons. Personal reasons should have no significant impact on earnings. Others move because they may have little choice and may have gotten fired. I expect that both pecuniary and non-pecuniary benefits will be lowest for those who transition to self-employment for market reasons such as layoff or market frictions. In established wage work, Bartel and Borjas (1981) found that those who obtain a new job after a layoff should experience much lower wages than those who stay in their current jobs. Evans and Leighton (1990) found similar results for those who entered self-employment from previous unemployment. Those who move to entrepreneurship for market reasons such as layoff or due to market frictions are often those who are moving to self-employment as a last resort, often called necessity entrepreneurs (Block & Wagner, 2007). Someone who is forced into entrepreneurship is more likely to be unsuitable for entrepreneurship and less likely to have entrepreneurial traits such as low risk aversion and self-determination. In established firms Bartel and Borjas (1981) found personal reasons and market reasons for job change to have similar impacts on wage growth, an effect that I predict should not be any different in transitions to entrepreneurship.

In the empirical analysis to follow in the next section, I observe what happens to wages and non-pecuniary benefits in the cross-section (to compare my results to those in the prior literature), and then use the longitudinal data to analyze what happens to monetary and non-pecuniary benefits over time as people transition to self-employment and new employment in established wage work. I separate moves to entrepreneurship

from general moves in wage work as moving to a new employer in wage work may have its own implications that differ from moves to self-employment. I will observe whether pecuniary and non-pecuniary job benefits move in the directions suggested in the prior discussion. I will then apply a more nuanced analysis allowing for different types of reasons for job change and observe whether the outcomes differ. I will then perform supplementary analyses to test that my results are robust to inclusion of some of the variables other scholars have found to predict differences in wages between entrepreneurs and wage workers.

3.3 Data and Measures

3.3.1 Data

My empirical analysis uses data from the National Science Foundation's Scientists and Engineers Statistical Data System (SESTAT). SESTAT is an integrated database that includes demographic, employment and educational information about scientists and engineers in the U.S. It is an integration of three surveys: The National Survey of Recent College Graduates (NSRCG), the National Survey of College Graduates (NSCG), and the Survey of Doctoral Recipients (SDR). It was constructed to represent the general population of scientists and engineers in the U.S and includes individuals who have at least a Bachelor's degree. The SESTAT surveys consistently receive high response rates, typically in the range of 70-80%. Complementing prior work using older SESTAT surveys, I employ data collected in the years 2003, 2006, 2008 and 2010. Using recent data from after the technology boom of the early 2000s allows me to gain insights into entrepreneurial entry in the current generation of scientists and engineers.

SESTAT provides a unique opportunity to study entrepreneurial entry. First, SESTAT data sets are longitudinal in nature, allowing me to follow individuals' employment trajectories and to examine the relationship between labor mobility and changes in pecuniary and non-pecuniary benefits over time. Second, the data include a rich set of survey measures for important constructs that are often unobserved, including a measure for non-pecuniary benefits and for respondents' reasons for employer changes. Third, the data offer a unique opportunity to observe the mobility patterns of a highly educated population.

I make several restrictions in order to eliminate unnecessary heterogeneity in the sample. First, I exclude all individuals who were not in the labor force during the observation period as well as those who were unemployed. I exclude individuals under the age of 22 and over the age of 65 to account for potentially different dynamics among those still in training and those close to retirement. I limit the sample to full-time employees (defined as working at least 30 hours per week and 30 weeks per year) working in the U.S. and for a for-profit organization; I exclude individuals who are employed in academia, government, or non-profit organizations, as these sectors are likely characterized by different labor market dynamics. Finally, because I focus on scientists and engineers, I also exclude individuals whose highest degrees are outside of science and engineering, as well as individuals who have a professional degree (e.g., JD, MBA, or MD). As I am analyzing labor mobility across periods, I exclude any individuals who do not appear in the survey in at least two consecutive periods.

My data includes 28,080 individuals and 83,003 observations. 14,480 of these observations are in self-employment and 68,523 are in wage work. The data includes 1,939 transition to self-employment and 7,006 moves to new wage employment.

3.3.2 Variables

3.3.2.1 Main Variables

Salary: Respondents reported their basic annual salary (not including bonuses or overtime pay). The salary for the self-employed reported here includes both nominal salaries and profits and if reported correctly are free of arbitrary partition of salaries and profits. However, this measure of salary may exclude stock options and bonuses. To make this measure comparable across time periods, I adjust it for inflation using a GDP deflator with base year 2009, taken from the US Bureau of Economic Analysis. Given the skewed distribution of salary, I add 1 and use the natural logarithm in the empirical analysis (*lnsalary*).

Job Satisfaction: I use job satisfaction as a proxy measure for non-pecuniary benefits. Respondents rated their overall satisfaction in their primary job using a 4-point scale that ranged from "very dissatisfied," "somewhat dissatisfied," "somewhat satisfied" to "very satisfied." Job satisfaction is a useful proxy for the overall utility employees receive from their job (Cable & Edwards, 2004; Freeman, 1978; Idson, 1990; Wood & LeBold, 1970). Since job satisfaction may reflect both pecuniary and non-pecuniary job attributes, I will control for the current salary of the employee to identify solely the non-pecuniary job attributes associated with job satisfaction.

Employment status: Respondents indicated the type of their primary employer. Individuals who reported that their employer is a for-profit organization are coded as

being employed in *wage work*. Individuals who reported that they are self-employed are coded as working in *self-employment.* The survey also asked respondents whether they had changed employers since the last survey. Given the longitudinal nature of the data, these measures allow me to distinguish for each pair of time periods t and t+1 individuals who stayed with their same employer, individuals who moved to a new employer, and individuals who moved from employment into entrepreneurship. Following prior work (Elfenbein et al., 2010), I coded a *transition to entrepreneurship* when someone reported being self-employed in period t+1 but not in period t and reported either that they had changed employers or had a job tenure of 4 years or less.

Motivations for changing employment: If the respondents changed jobs between the survey periods they were are asked "why did you change your employer or your job?" They could choose "*pay* or promotion opportunities," "*working conditions* (e.g., hours, equipment, working environment)," "job *location," "change in career* or professional interests," "*family*-related reasons (e.g., children, spouse's job moved)," *school-related* reasons (e.g. returned to school, completed a degree)," "*laid off* or job terminated (includes company closings, mergers, buyouts, grant or contract ended)," "*retired*," or "some *other* reason." I aggregate these reasons into five main categories for my analyses. Respondents who indicate that they move for pay-related reasons are coded as *changing employer for pay reasons*. Those who report changing employers for a change in career or professional interests or for working conditions are coded as *change employer for career reasons*, while those who report a change in employers due to a layoff are coded as *change employer for market reasons*. Those who report changing employers for family or location reasons are coded as *changing employer for personal*

reasons. And those who report changing employers for school, retirement or other reasons are coded as *change employer for other reasons*. Respondents can check multiple options for changing employers, although the majority of respondents only choose one. For both movements to new wage work and transitions to self-employment, respondents reported that pay is the number one reason to change jobs and working conditions is the second most reported reason. A potential limitation of these measures is that the reasons for a job change are self-reported after respondents have changed jobs, and experiences the respondents have while working in the new job may potentially influence how they rationalize their change. At the same time, reasons for making certain choices are by their very nature subjective and it would be virtually impossible to ascertain them in a non-experimental setting without asking the individuals themselves.

3.3.2.2 Control Variables

I create proxies to control for ability and the quality of education. In particular, I control for the respondent's *highest degree* type (Bachelor's, Master's or PhD), and the *Carnegie classification* of the degree granting institution (i.e., research I, research II, doctorate granting institution, etc.). I control for labor market experience using the number of years since graduation (*highest degree tenure* and *highest degree tenure squared)* and also control for individuals' tenure in their current job *(job tenure* and *job tenure squared)*. All regressions control for the *field of the highest degree*.

I include demographic controls including *age, age squared, race, marital status, citizenship,* and *gender*. In addition, I include dummies for the state of employment and the survey year.

3.4 Results

3.4.1 Descriptive Results

Table 3.1 shows summary statistics for my main variables, including breakdowns of the means of the main variables by whether people are employed in wage work or self-employment, and also for whether they stay in current wage work, move to a new employer in wage work or if they transition to entrepreneurship. Table 3.2 shows the correlations of the main variables.

Table 3.1: Summary Statistics

	Full sample				Wage work	Self-employment	Wage work (no change)	Change to new wage work	Transition to self-employment
	Mean	SD	Min	Max	Mean	Mean	Mean	Mean	Mean
Real salary	100401	63265	0.00	§	100462	100113	105635	101099	92569
Ln salary	11.34	0.84	0.00	§	11.39	11.14	11.46	11.41	11.12
Job satisfaction	3.35	0.70	1.00	4.00	3.33	3.45	3.34	3.37	3.40
Self-employment	0.17	0.38	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Wage work	0.83	0.38	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Transition to self-employment	0.05	0.21	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Move to new wage work	0.17	0.37	0.00	1.00	0.17	0.00	0.00	1.00	0.00
Age	42.75	10.13	22.00	65.00	42.08	45.90	43.90	41.06	42.64
Male	0.78	0.42	0.00	1.00	0.77	0.78	0.78	0.78	0.75
Married	0.77	0.42	0.00	1.00	0.76	0.78	0.80	0.75	0.77
white	0.73	0.44	0.00	1.00	0.73	0.74	0.74	0.70	0.71
US Citizen	0.89	0.31	0.00	1.00	0.89	0.91	0.91	0.88	0.89
Bachelor's degree	0.51	0.50	0.00	1.00	0.50	0.56	0.49	0.51	0.58
Master's degree	0.21	0.40	0.00	1.00	0.20	0.21	0.20	0.22	0.22
PhD degree	0.29	0.45	0.00	1.00	0.30	0.23	0.31	0.28	0.20
Highest degree tenure	16.00	9.94	0.00	50.00	15.32	19.23	17.24	14.51	16.31
Job tenure	6.77	7.18	0.00	46.00	6.42	8.43	8.08	1.51	1.70
R&D activity count	1.42	1.01	0.00	3.00	1.47	1.20	1.45	1.42	1.27
Non R&D activity count	2.34	1.73	0.00	9.00	2.21	2.94	2.24	2.18	2.72
Change employer for career change	0.09	0.28	0.00	1.00	0.07	0.33	0.00	0.23	0.33
Change employer for pay	0.18	0.38	0.00	1.00	0.16	0.48	0.00	0.54	0.51
Change employer for working conditions	0.12	0.32	0.00	1.00	0.10	0.37	0.00	0.39	0.39
Change employer for layoff	0.12	0.32	0.00	1.00	0.10	0.36	0.00	0.35	0.35
Change employer for family	0.04	0.19	0.00	1.00	0.03	0.13	0.00	0.11	0.13
Change employer for location	0.08	0.27	0.00	1.00	0.07	0.23	0.00	0.28	0.23
Change employer for retirement	0.01	0.07	0.00	1.00	0.00	0.03	0.00	0.01	0.02
Change employer for school	0.01	0.11	0.00	1.00	0.01	0.02	0.00	0.02	0.01
Change employer for other	0.01	0.10	0.00	1.00	0.01	0.03	0.00	0.03	0.02

Note: The sign "§" indicates that a value was omitted to meet an NSF confidentiality requirement.

Table 3.2: Correlations

		1	2	3	4	5	6	7	8	9	10	11	12
1	No employer change	1											
2	Transition to new self-employment	-0.4232*	1										
3	Move to new employer	-0.8603*	-0.0977*	1									
4	Change employer for pay reasons	-0.6912*	0.2322*	0.6304*	1								
5	Change employer for career reasons	-0.6744*	0.2719*	0.5941*	0.5979*	1							
6	Change employer for personal reasons	-0.5138*	0.1636*	0.4727*	0.3932*	0.4218*	1						
7	Change employer for market reasons	-0.5508*	0.1967*	0.4970*	-0.0018	0.0156*	0.0223*	1					
8	Change employer for other reasons	-0.2168*	0.0762*	0.1962*	0.0857*	0.1126*	0.0779*	-0.0123*	1				
9	Real ln salary (t)	0.0691*	-0.1043*	-0.0172*	-0.0244*	-0.0720*	-0.0573*	-0.0584*	-0.0274*	1			
10	Real ln salary (t-1)	0.0600*	-0.0378*	-0.0446*	-0.0773*	-0.0843*	-0.0642*	-0.0091	-0.0179*	0.3791*	1		
11	Job satisfaction (t)	-0.0188*	0.0151*	0.0121*	0.0624*	0.0398*	0.0159*	-0.0585*	0.0082	0.0783*	0.0573*	1	
12	Job satisfaction (t-1)	0.1511*	-0.0460*	-0.1401*	-0.1159*	-0.1476*	-0.0850*	-0.0718*	-0.0340*	0.0827*	0.0777*	0.3660*	1
13	Age	0.1061*	-0.0166*	-0.1072*	-0.1742*	-0.1442*	-0.1271*	0.0347*	-0.0318*	0.1442*	0.1690*	0.0483*	0.0446*
14	Male	0.0074	-0.0142*	-0.0001	-0.0160*	-0.0382*	-0.0369*	0.0205*	-0.0017	0.0991*	0.1049*	0.0095*	0.0023
15	Married	0.0430*	-0.0102*	-0.0415*	-0.0419*	-0.0489*	-0.0188*	-0.0168*	-0.0250*	0.1147*	0.1066*	0.0569*	0.0502*
16	White	0.0392*	-0.0111*	-0.0368*	-0.0239*	-0.0226*	-0.0201*	-0.0135*	-0.0059	0.0044	0.0092*	0.0451*	0.0394*
17	US citizen	0.0345*	-0.0083	-0.0332*	-0.0507*	-0.0417*	-0.0278*	-0.0083	-0.0341*	0.0047	0.0135*	0.0231*	0.0140*
18	Highest degree: Bachelor's	-0.0284*	0.0377*	0.0099*	0.0064	0.0037	0.0147*	-0.0001	-0.0339*	-0.1782*	-0.1806*	-0.0087*	-0.0120*
19	Highest degree: Master's	-0.0144*	0.0076	0.0116*	-0.0090*	-0.0066	0.0083	0.0104*	-0.0198*	0.0119*	0.0117*	0.0121*	0.0048
20	Highest degree: PhD	0.0438*	-0.0480*	-0.0211*	0.0009	0.0018	-0.0232*	-0.0090*	0.0540*	0.1866*	0.1896*	-0.0012	0.0090*
21	Highest degree Tenure	0.1020*	-0.0102*	-0.1063*	-0.1732*	-0.1478*	-0.1221*	0.0146*	-0.0494*	0.1148*	0.1372*	0.0557*	0.0458*
22	Job tenure	0.3821*	-0.1571*	-0.3313*	-0.2813*	-0.2757*	-0.2048*	-0.2195*	-0.0948*	0.0682*	0.0687*	0.0431*	0.0796*

		13	14	15	16	17	18	19	20	21	22
13	Age	1									
14	Male	0.1261*	1								
15	Married	0.2348*	0.1388*	1							
16	White	0.0959*	0.0581*	-0.0146*	1						
17	US citizen	0.1648*	-0.0195*	-0.0324*	0.3182*	1					
18	Highest degree: Bachelor's	-0.1647*	-0.0129*	-0.1069*	0.1663*	0.1845*	1				
19	Highest degree: Master's	-0.0135*	-0.0422*	0.0268*	-0.1125*	-0.1241*	-0.5179*	1			
20	Highest degree: PhD	0.1944*	0.0521*	0.0942*	-0.0834*	-0.0931*	-0.6432*	-0.3218*	1		
21	Highest degree Tenure	0.8582*	0.1289*	0.1992*	0.1435*	0.1990*	0.0928*	-0.0834*	-0.0281*	1	
22	Job tenure	0.4196*	0.0722*	0.0974*	0.0953*	0.1289*	0.0304*	-0.0169*	-0.0185*	0.4432*	1

* Significant at 5%

The key empirical question in this study is how salary and non-pecuniary benefits change when individuals transition to self-employment or to a new employer in wage work versus staying in their current positions. To provide a first impression, Figures 3.1 and 3.2 show the mean of real salary for periods t and t+1 and for mean job satisfaction in t and t+1, respectively, for employees who remain in wage work without changing employers, for those who move to a new employer in wage work and for those who transition to entrepreneurship in t+1. These figures demonstrate my main findings. Based on solely descriptive results, one can see that wage workers who transition to self-employment experience a decline in their salaries when they transition to self-employment but also have a substantial increase in their job satisfaction. Those who transition to a new employer in wage work experience both increases in their salaries and job satisfaction, while those who stay in wage work experience increases in their salary but declines in job satisfaction. As we can see from the figures, people who remain in wage work and do not change employers are those who started with the highest salary and job satisfaction, while those who move to self-employment had the lowest average salaries in the previous period and those who move to new employers in wage work had the lowest average job satisfaction in the previous period. As movers and stayers start from different positions in the wage and job satisfaction distributions, this raises the issue of why people move in the first place, a topic I will discuss in the next section.

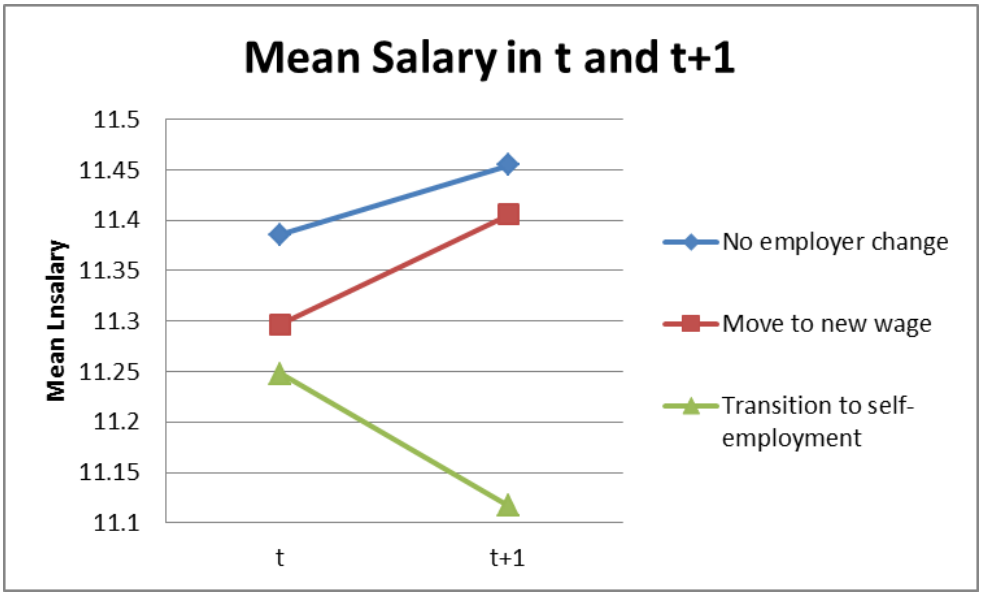

Figure 3.1: Mean Salary

Figure 3.2: Mean Job Satisfaction

3.4.2 Main Regression Results

3.4.2.1 Motivations for Changing Employers

In Table 3.3, I analyze the relationship between characteristics of the employee with the different types of employment change to get a better understanding of who moves. In models 1a and 1b, I use a multinomial logit model to analyze whether certain demographic variables are associated with moves to new employers and to transitions to self-employment compared to those who remain with their same employer in wage work. I find that men are more likely to change employers in wage work, while workers who are married and white are less likely. I also find that those who are more highly educated (Master's or PhD) are less likely to transition to wage work and even less likely to transition to self-employment, compared to staying in wage work. Those who had longer tenures in their previous jobs as wage workers were less likely to move, up until a certain level and then they were slightly more likely to leave.

In models 2a and 2b, I include the variables for salary and job satisfaction in the previous period to observe where people started from in the wage and job satisfaction distributions to be able to better interpret the importance of the change in work outcome variables. Consistent with figures 1 and 2, I find that those who are at the lower end of the earnings distribution are more likely to transition into self-employment and those who are at the lower end of the job satisfaction distribution are more likely to move to either new wage work or self-employment rather than remaining with the current employer. Those who report being the most unsatisfied in previous employment are more likely to move to a new employer in wage work.

In model 3, using only the sample of those who change employers (either to new wage work or to self-employment), I analyze whether certain stated reasons for changing employers are more associated with transitioning to self-employment versus moving to new wage work. I find that those who transition to self-employment are less likely to do so for salary or personal reasons, but are more likely to do so for career reasons compared to those who move to a new employer in wage work. This result shows that movers to self-employment and movers to wage work do have different motivations for moving in the first place and are not a homogenous group. This result also implies that non-pecuniary job benefits, not non-job attributes or pecuniary benefits may be driving movement specifically into self-employment over wage work. Since people are more likely to move to entrepreneurship for career reasons, it is consistent with my expectations that those who move to entrepreneurship should experience a rise in job satisfaction, which is consistent with the graph in Figure 3.2. Since I find that those who move to new employment in wage work are more likely to do so for salary reasons, it is consistent with my expectations that they would increase their salary when they move, which is consistent with the findings in the graph in Figure 3.1. In the next section I will observe whether these expectations are consistent with the main results. I now move to analyzing what happens to wages and job satisfaction when people transition to self-employment.

Table 3.3: Types of Employer Change

	1a Mlogit Move to new employer	1b Mlogit Tran to emself	2a Mlogit Move to new employer	2b Mlogit Tran to emself	3 Logit Tran to emself
Age	-0.026	0.035	-0.031	0.035	0.052
	[0.018]	[0.031]	[0.018]	[0.031]	[0.041]
Age squared	0.000	-0.000	0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Male	0.204**	0.023	0.214**	0.035	-0.111
	[0.036]	[0.059]	[0.036]	[0.060]	[0.080]
Married	-0.084*	-0.024	-0.033	0.022	0.111
	[0.034]	[0.060]	[0.035]	[0.061]	[0.081]
White	-0.125**	-0.179**	-0.101**	-0.156**	0.004
	[0.034]	[0.056]	[0.034]	[0.056]	[0.075]
US citizen	-0.063	-0.136	-0.072	-0.141	-0.044
	[0.049]	[0.086]	[0.050]	[0.086]	[0.113]
Highest degree: Bachelor's	omitted	omitted	omitted	omitted	omitted
Highest degree: Master's	-0.056	-0.185**	-0.038	-0.158*	-0.013
	[0.039]	[0.065]	[0.040]	[0.065]	[0.086]
Highest degree: PhD	-0.188**	-0.735**	-0.174**	-0.699**	-0.433**
	[0.060]	[0.107]	[0.061]	[0.108]	[0.138]
Highest degree tenure	0.010	0.001	0.007	0.001	0.013
	[0.009]	[0.015]	[0.010]	[0.016]	[0.021]
Highest degree tenure squared	-0.001*	-0.000	-0.000	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Job tenure [t-1]	-0.160**	-0.201**	-0.167**	-0.206**	0.020
	[0.007]	[0.011]	[0.007]	[0.011]	[0.015]
Job tenure squared [t-1]	0.004**	0.005**	0.004**	0.005**	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Lnsalary [t-1]			0.007	-0.075*	-0.044
			[0.023]	[0.030]	[0.045]
Job satisfaction [t-1]			-0.550**	-0.432**	0.012
			[0.019]	[0.033]	[0.041]
Change employer for pay reasons					-0.178*
					[0.074]
Change employer for career reasons					0.387**
					[0.077]
Change employer for personal reasons					-0.183*
					[0.073]
Change employer for market reasons					-0.046
					[0.087]
Change employer for other reasons					-0.083
					[0.137]
Observations	42281	42281	42281	42281	8304

Notes: Clustered standard errors in brackets.* Significant at 5%; ** significant at 1%. Control for Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies. The omitted category in model 3 is moving to a new employer in wage work. Model 3 includes only the sample of those who changed employers (either to self-employment, or to a new employer in wage work).

3.4.2.2 Employer Change and Salary

In Table 3.4, I analyze the relationship between labor mobility and salary. In model 1, I use a cross sectional analysis with OLS to compare the wages of working in self-employment versus working in wage work in order to compare my results to prior findings in the literature. I find that self-employment is associated with 19% lower salary than wage work, which is consistent with a majority of the prior findings in the literature using cross sectional analysis (Evans & Leighton, 1989; Hamilton, 2000).

In models 2-4, I switch from using a cross section in model 1 to using the longitudinal data to determine what happens to wages when people transition to self-employment or move to a new employer in wage work versus staying in the current job.

In model 2, I use a change score (change in the log wage between periods), controlling for the prior salary, to analyze the relationship between salary change and labor mobility.

Using ordinary least squares on panel data, I estimate:

$$(LNSALARY_{i(t+1)} - LNSALARY_{it}) = \alpha + \beta\, EMPL_{i(t+1)} + \rho LNSALARY_{it} + \gamma X_i + \delta Z_{it} + \nu_{it} \quad [1]$$

Where $EMPL_{i(t+1)}$ indicates employment status (same employer as in period t, new employer in wage work, or new entry into self-employment), $LNSALARY_{it}$ is the salary in the previous period, the vector X_i is a set of time-invariant individual characteristics such as gender, Z_{it} is a vector of time-variant characteristics such as age, highest degree tenure, and job tenure, and ν_{it} is an error term. I find that transitioning to self-employment is associated with less growth in wages compared to remaining in wage work.

I test multiple methods of measuring salary change to verify that my results are consistent amongst multiple methods. In model 3, I test the relationship between transitions to self-employment and the log of real salary by controlling for salary in previous wage work. This particular method allows me to look at between variations in salary change across different people. Change scores constrain my estimates of the coefficients to one, while this method allows estimates of the coefficient to vary. In model 4, I use OLS regressions with individual fixed effects. Individual fixed effects allow me to examine within person variation and to control for unobserved heterogeneity.

The patterns of the results are consistent across the methods used. While those who are self-employed earn less salary in general compared to those in wage work, they also experience less growth in their salaries when they transition to self-employment compared to those who stay in wage work. On the other hand, those who move to a new employer in wage work do not experience wage changes that are significantly different from the wage changes of those who stay with the same employer in wage work.

Table 3.4: Employer Change and Salary

	1 Xtreg Lnsalary (t)	2 Xtreg Lnsalary(t) - Lnsalary (t-1)	3 Xtreg Lnsalary (t)	4 Xtreg w/fe Lnsalary (t)
Wage work	omitted			
Self-employment	-0.187**			
	[0.013]			
No employer change		omitted	omitted	omitted
Move to new wage work		-0.002	-0.002	-0.001
		[0.007]	[0.007]	[0.011]
Transition to self-employment		-0.259**	-0.259**	-0.240**
		[0.032]	[0.032]	[0.046]
Lnsalary (t-1)		-0.970**	0.030	
		[0.018]	[0.018]	
Age	0.030**	0.021**	0.021**	-0.024
	[0.004]	[0.004]	[0.004]	[0.019]
Age squared	-0.000**	-0.000**	-0.000**	0.001**
	[0.000]	[0.000]	[0.000]	[0.000]
Male	0.108**	0.082**	0.082**	0.000
	[0.009]	[0.009]	[0.009]	[0.000]
Married	0.078**	0.067**	0.067**	0.025
	[0.008]	[0.009]	[0.009]	[0.020]
White	0.047**	0.056**	0.056**	0.000
	[0.009]	[0.009]	[0.009]	[0.000]
US Citizen	0.025*	-0.010	-0.010	-0.010
	[0.011]	[0.012]	[0.012]	[0.028]
Highest degree: Bachelor's	omitted	omitted	omitted	omitted
Highest degree: Master's	0.192**	0.188**	0.188**	0.271**
	[0.010]	[0.010]	[0.010]	[0.090]
Highest degree: PhD	0.369**	0.360**	0.360**	0.662**
	[0.014]	[0.017]	[0.017]	[0.255]
Highest degree tenure	0.035**	0.033**	0.033**	0.055**
	[0.002]	[0.003]	[0.003]	[0.010]
Highest degree tenure squared	-0.001**	-0.001**	-0.001**	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]
Job tenure	0.003**	-0.001	-0.001	0.000
	[0.001]	[0.001]	[0.001]	[0.002]
Job tenure squared	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	83003	42281	42281	42281

Notes: OLS regressions include robust standard errors in brackets clustered at the individual level. The regressions with fixed effects include fixed effects at the individual level with robust standard erros in brackets. * Significant at 5%; ** significant at 1%. Control Carnegie Classification dummies, highest degree field dummies, state of employment dummies and year dummies

3.4.2.3 Employer Change and Job Satisfaction

In the previous section, I found that salaries decline when people enter self-employment. Now I analyze what happens to non-pecuniary job benefits when wage workers move to self-employment by using job satisfaction as a proxy measure. In Table 3.5, model 1 and model 5, I use a cross sectional analysis with an ordered probit model to compare the job satisfaction of working in self-employment to working in wage work. In models 5-8, I control for salary in time t+1 in order to assess just the non-financial component of job satisfaction. I find that in the regressions in the cross section, with and without controlling for salary, those who are in self-employment are on average more satisfied with their job than those who work in wage work, which is consistent with previous findings that those who are self-employed have higher job satisfaction and is also consistent with the idea that there may be a trade-off of salary for job satisfaction (Blanchflower & Oswald, 1998; Hamilton, 2000; Kawaguchi, 2002; Moskowitz & Vissing-Jorgensen, 2002).

In models 2 and 6, I use a change score (change in job satisfaction between periods), controlling for the prior job satisfaction, to analyze the relationship between job satisfaction change and labor mobility.

Using an ordered probit model on panel data, I estimate:

$$(JOBSATIS_{i(t+1)} - JOBSATIS_{it}) = \alpha + \beta\, EMPL_{i(t+1)} + \rho JOBSATIS_{it} + \gamma X_i + \delta Z_{it} + \nu_{it} \quad [2]$$

Where $EMPL_{i(t+1)}$ indicates employment status (same employer as in period t, new employer in wage work, or new entry into self-employment), $JOBSATIS_{it}$ is the job satisfaction in the previous period, the vector X_i is a set of time-invariant individual characteristics such as gender, Z_{it} is a vector of time-variant characteristics such as age,

highest degree tenure, and job tenure, and ν_{it} is an error term. In model 6, I include $Lnsalary_{i(t+1)}$ to limit the analysis to the non-pecuniary benefits:

$$(JOBSATIS_{i(t+1)} - JOBSATIS_{it}) = \alpha + \beta\, EMPL_{i(t+1)} + \rho JOBSATIS_{it} + \theta LNSALARY_{i(t+1)} + \gamma X_i + \delta Z_{it} + \nu_{it} \quad [3]$$

I find that while self-employment is associated with an increase in individual job satisfaction (whether controlling for salary or not), moving to wage work is associated with a very similar change in job satisfaction. It appears that those who are unsatisfied in wage work can increase their job satisfaction just by moving, whether it is to a new employer in wage work or to self-employment. I interpret the results as general labor mobility increasing job satisfaction. These results are consistent with the ordered probit model controlling for previous job satisfaction in models 3 and 7. The results are also consistent with the results found in models 4 and 8 using OLS with individual fixed effects. In these models, workers who move to new employers have increases in their job satisfaction higher than those who move to self-employment.

Overall I find that job satisfaction increases for movers in general, for moves to both self-employment and to new employment in wage work. In my main results I do find that wages for those who transition to self-employment have a lower growth rate than the wages of those remaining in wage work, while job satisfaction for those who transition to self-employment has a higher growth rate than the job satisfaction of those remaining in wage work. These results are consistent with the expectations that workers may be willing to trade salary for non-pecuniary benefits in self-employment. However, while this may be true for some, it does not have to be true for everyone. In the next

section, I will examine whether experiences differ between people who transition for different reasons.

Table 3.5: Employer Change and Job Satisfaction

	1 Oprobit Job satisfaction (t)	2 Oprobit Job satisfaction(t)-job satisfaction(t-1)	3 Oprobit Job satisfaction (t)	4 Xtreg w/fe Job satisfaction (t)	5 Oprobit Job satisfaction (t)	6 Oprobit Job satisfaction(t)-job satisfaction (t-1)	7 Oprobit Job satisfaction (t)	8 Xtreg w/fe Job satisfaction (t)
Wage work	omitted				omitted			
Self-employment	0.170**				0.200**			
	[0.013]				[0.013]			
No employer change		omitted	omitted	omitted		omitted	omitted	omitted
Move to new wage work		0.242**	0.236**	0.112**		0.241**	0.235**	0.112**
		[0.016]	[0.017]	[0.014]		[0.016]	[0.017]	[0.014]
Transition to self-employment		0.243**	0.248**	0.106**		0.271**	0.277**	0.110**
		[0.029]	[0.030]	[0.031]		[0.029]	[0.031]	[0.031]
Job satisfaction (t-1)		-1.152**	0.626**			-1.163**	0.619**	
		[0.012]	[0.010]			[0.012]	[0.010]	
Lnsalary (t)					0.117**	0.107**	0.106**	0.017
					[0.007]	[0.013]	[0.012]	[0.009]
Age	-0.029**	-0.006	-0.007	0.028	-0.032**	-0.009	-0.01	0.029
	[0.006]	[0.007]	[0.007]	[0.021]	[0.006]	[0.007]	[0.007]	[0.021]
Age squared	0.000**	0.000	0.000	-0.000*	0.000**	0.000	0.000	-0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Male	0.015	0.021	0.023	0.000	0.004	0.012	0.015	0.000
	[0.013]	[0.014]	[0.015]	[0.000]	[0.013]	[0.014]	[0.015]	[0.000]
Married	0.158**	0.140**	0.136**	-0.006	0.148**	0.132**	0.129**	-0.007
	[0.012]	[0.015]	[0.015]	[0.024]	[0.012]	[0.015]	[0.015]	[0.024]
White	0.107**	0.065**	0.084**	0.000	0.102**	0.059**	0.078**	0.000
	[0.012]	[0.013]	[0.014]	[0.000]	[0.012]	[0.013]	[0.014]	[0.000]
US Citizen	0.021	0.016	0.016	-0.041	0.019	0.017	0.017	-0.041
	[0.017]	[0.021]	[0.021]	[0.030]	[0.017]	[0.021]	[0.021]	[0.030]
Highest degree: Bachelor's	omitted	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Highest degree: Master's	0.075**	0.043**	0.044**	-0.018	0.053**	0.023	0.024	-0.022
	[0.015]	[0.016]	[0.017]	[0.156]	[0.015]	[0.016]	[0.017]	[0.156]
Highest degree: PhD	0.081**	0.023	0.019	-0.009	0.038	-0.017	-0.021	-0.02
	[0.022]	[0.024]	[0.025]	[0.424]	[0.022]	[0.024]	[0.025]	[0.424]
Highest degree tenure	0.001	-0.002	-0.003	-0.016	-0.003	-0.005	-0.006	-0.017
	[0.003]	[0.004]	[0.004]	[0.012]	[0.003]	[0.004]	[0.004]	[0.012]
Highest degree tenure squared	0.000	0.000*	0.000*	0.001*	0.000**	0.000**	0.000**	0.001*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Job tenure	-0.002	0.008**	0.007**	-0.022**	-0.002	0.009**	0.008**	-0.022**
	[0.002]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]
Job tenure squared	0.000**	0.000	0.000	0.001**	0.000**	0.000	0.000	0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	83003	42281	42281	42281	83003	42281	42281	42281

Notes: OLS regressions include robust standard errors in brackets clustered at the individual level. The regressions with fixed effects include fixed effects at the individual level with robust standard errors in brackets. * Significant at 5%; ** significant at 1%. Control for Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies. Models 5-8 control for real lnsalary to analyze the non-pecuniary portion of job satisfaction.

3.2.4 Motivations for Employer Change, and Work Outcomes

I argue that the changes in wages and job satisfaction will not be the same for all people, and that the degree to which salary and job satisfaction change is based on the reasons for changing employers in the first place. I now regress salary and job satisfaction changes on the interactions of the reasons for labor mobility with whether the worker transitioned to self-employment or moved to new employment in wage work.

When I regress changes in salary and job satisfaction on different reasons for employer change interacted with the type of employer change, I find that the work outcome patterns remain similar amongst those who transition to self-employment and those who change employers in wage work, depending on the reasons for the employer change. In Table 3.6, I find that those who had an employer change for pay reasons (regardless of whether the employer change is to self-employment or to a new employer) were able to increase both their salary and their job satisfaction. I do not, however, find significant coefficients for the relationship between transitioning to self-employment for pay reasons and wage changes as I do for those who move to new employment in wage work for pay reasons. Thus, people who move into entrepreneurship for pay reasons experience a salary increase, but that is similar to the increase amongst those who remain with their current employer. In contrast, those who move to a new employer in wage work increase wages more strongly than for those who remain with their current employer. On the other hand, those who underwent an employer change (whether to self-employment or a new employer) for career reasons had less growth in their salary and higher growth in their job satisfaction. Transitioning to self-employment for personal reasons did not have significant effects on work outcomes. And those who changed

employers for market reasons had declines in their salary when they moved to both new wage work and to self-employment (though the results were significantly worse for those who transitioned to self-employment for market reasons) and did not have significant effects on job satisfaction.

To summarize, I find that different people experience different changes in their work outcomes when they transition to self-employment depending on their reason for moving in the first place. I find that people who move for salary do improve their salary and those who move for career reasons gain more job satisfaction, and seem to get what they were hoping for. On the other hand those who move for personal reasons do not seem to have any significant changes in their work outcomes and those who move for market reasons experience a significant decline in their wages when they transition to self-employment. This is important because this means that entrepreneurship is not a single uniform experience and we need to consider different groups of people and their motivations when analyzing work outcomes.

Table 3.6: Motivations for Different Types of Employer Change and Work Outcomes

	1 Xtreg Lnsalary (t)-Lnsalary (t-1)	2 Xtreg w/fe Lnsalary (t)	3 Oprobit Job satisfaction (t)- Job satisfaction (t-1)	4 Xtreg w/fe Job satisfaction (t)	5 Oprobit Job satisfaction (t)-Job satisfaction (t-1)	6 Xtreg w/fe Job satisfaction (t)
Transition to emself for pay reasons	0.135	0.15	0.298**	0.09	0.283**	0.088
	[0.079]	[0.094]	[0.063]	[0.068]	[0.064]	[0.068]
Transition to emself for career reasons	-0.317**	-0.423**	0.294**	0.273**	0.325**	0.280**
	[0.084]	[0.136]	[0.066]	[0.079]	[0.067]	[0.078]
Transition to emself for personal reasons	0.049	0.107	0.1	0.034	0.096	0.033
	[0.078]	[0.136]	[0.073]	[0.097]	[0.073]	[0.097]
Transition to emself for market reasons	-0.449**	-0.481**	0.033	0.001	0.077	0.009
	[0.084]	[0.119]	[0.059]	[0.059]	[0.059]	[0.059]
Transition to emself for other reasons	-0.002	0.214*	0.031	0.414*	0.031	0.410*
	[0.120]	[0.097]	[0.145]	[0.201]	[0.142]	[0.201]
Move to new employer for pay reasons	0.091**	0.051**	0.352**	0.120**	0.340**	0.119**
	[0.011]	[0.013]	[0.029]	[0.022]	[0.029]	[0.022]
Move to new employer for career reasons	-0.022*	-0.012	0.150**	0.107**	0.152**	0.107**
	[0.011]	[0.014]	[0.031]	[0.024]	[0.031]	[0.024]
Move to new employer for personal reasons	-0.021*	-0.009	-0.042	-0.017	-0.04	-0.016
	[0.010]	[0.014]	[0.031]	[0.024]	[0.031]	[0.024]
Move to new employer for market reasons	-0.067**	-0.042**	-0.015	0.004	-0.007	0.005
	[0.013]	[0.016]	[0.025]	[0.020]	[0.025]	[0.020]
Move to new employer for other reasons	-0.044	-0.008	0.002	0.035	0.007	0.035
	[0.024]	[0.034]	[0.060]	[0.053]	[0.059]	[0.053]
Lnsalary (t-1)	-0.959**					
	[0.018]					
Job satisfaction (t-1)			-1.153**		-1.164**	
			[0.012]		[0.012]	
Lnsalary					0.105**	0.016
					[0.013]	[0.009]
Observations	41640	41640	41640	41640	41640	41640

Note. Fixed effects are at the individual level with robust standard errors in brackets. * Significant at 5%; ** significant at 1%. Control for age, age squared, gender, marital status, race, citizenship, highest degree type, highest degree tenure, highest degree tenure squared, job tenure, job tenure squared, Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies. Models 5-6 control for real lnsalary to analyze the non-pecuniary portion of job satisfaction.

3.4.3 Supplementary Analyses

It is likely that those who transition to self-employment will have to put in more effort on the job as they may have to take on more individual work responsibility (Ajayi-Obe & Parker, 2005; Åstebro & Chen, 2014; Blanchflower, 2004; Hyytinen et al., 2013). It is also conceivable that the amount of effort someone puts into a job will affect their work outcomes. To examine this issue I control for current on the job effort by creating proxy measures via variables for the number of hours worked per week and the number of weeks worked per year. I create a dummy for above regular number of hours worked if someone works more than 40 hours a week and a dummy for whether they work the standard 52 weeks a year to account for a change in effort between the two periods. These measures allow for meaningful break points between regular and non-regular work effort. I analyze whether the number of hours worked or the number of weeks worked change the relationships between the mobility variables and the main work outcome variables. I find that people who have increases in their hours worked from normal to above normal hours worked, experience higher growth in their wages, but I find no significant effect on job satisfaction change, while working a standard work year has significant implications for job satisfaction change. Regardless, controlling for hours and weeks worked does not significantly impact the main relationship between transitions to self-employment and changes in salary or job satisfaction.

Table 3.7: Controls for Effort

	1 Xtreg w/fe Lnsalary (t)	2 Xtreg w/fe Lnsalary (t)	3 Xtreg w/fe Job satisfaction (t)	4 Xtreg w/fe Job satisfaction (t)	5 Xtreg w/fe Job satisfaction (t)	6 Xtreg w/fe Job satisfaction (t)
No employer change	omitted	omitted	omitted	omitted	omitted	omitted
Move to new wage work	-0.001	0	0.112**	0.113**	0.112**	0.113**
	[0.011]	[0.011]	[0.014]	[0.014]	[0.014]	[0.014]
Transition to self-employment	-0.240**	-0.236**	0.106**	0.110**	0.110**	0.113**
	[0.046]	[0.045]	[0.031]	[0.031]	[0.031]	[0.031]
Work >40 hours per week		0.043**		0.02		0.019
		[0.011]		[0.012]		[0.012]
Work 52 weeks per year		0.119		0.126*		0.124*
		[0.076]		[0.057]		[0.056]
Lnsalary (t)					0.017	0.016
					[0.009]	[0.009]
Observations	42281	42281	42281	42281	42281	42281

Note. Fixed effects are at the individual level with robust standard errors in brackets. * Significant at 5%; ** significant at 1%. Control for age, age squared, gender, marital status, race, citizenship, highest degree type, highest degree tenure, highest degree tenure squared, job tenure, job tenure squared, Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies. Models 5 and 6 control for real lnsalary to analyze the non-pecuniary portion of job satisfaction.

Table 3.8: Incorporated vs. Unincorporated Self-Employment

	1 Xtreg Lnsalary (t) - Lnsalary (t-1)	2 Xtreg w/fe Lnsalary (t)	3 Oprobit Job satisfaction (t)- job satisfaction (t-1)	4 Xtreg w/fe Job satisfaction (t)	5 Oprobit Job satisfaction (t)- job satisfaction (t-1)	6 Xtreg w/fe Job satisfaction (t)
No employer change	omitted	omitted	omitted	omitted	omitted	omitted
Move to new wage work	-0.001	-0.003	0.244**	0.112**	0.242**	0.112**
	[0.007]	[0.011]	[0.016]	[0.014]	[0.016]	[0.014]
Transition to incorporated self-employment	-0.214**	-0.259**	0.372**	0.218**	0.394**	0.214**
	[0.044]	[0.074]	[0.043]	[0.049]	[0.043]	[0.050]
Transition to unincorporated self-employment	-0.714**	-0.767**	0.410**	0.176	0.492**	0.174
	[0.137]	[0.217]	[0.071]	[0.094]	[0.071]	[0.093]
Lnsalary (t-1)	-0.959**					
	[0.018]					
Job satisfaction (t-1)			-1.151**		-1.163**	
			[0.012]		[0.012]	
Lnsalary (t)					0.115**	0.019*
					[0.013]	[0.009]
Observations	41452	41452	41452	41452	41452	41452

Note. Fixed effects are at the individual level with robust standard errors in brackets. * Significant at 5%; ** significant at 1%. Control for age, age squared, gender, marital status, race, citizenship, highest degree type, highest degree tenure, highest degree tenure squared, job tenure, job tenure squared, Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies. Models 5 and 6 control for real lnsalary to analyze the non-pecuniary portion of job satisfaction.

Levine and Rubinstein (2013) suggest that wage differences can be explained by the type of entrepreneurship that workers enter into. They find that those who work in incorporated self-employment earn much more than those who work in unincorporated self-employment and wage work. In Table 3.8, I create separate variables for those who are in incorporated self-employment and for those in unincorporated self-employment to analyze if there is a difference in outcomes based on the type of self-employment. 77 percent of my sample of self-employed workers is working in incorporated firms, whereas in Levine and Rubinstein's study 65 percent of their sample of self-employed is working in unincorporated self-employment. In model 1, I find that even transitioning into incorporated self-employment is still associated with less wage growth than remaining in wage work, although those who are in unincorporated self-employment do experience much larger declines in their salary. When I examine job satisfaction, I still find that any kind of labor mobility is associated with an increase in job satisfaction. I find that while those who transition to unincorporated self-employment have the smallest growth in their salary, they also have the largest growth in their job satisfaction. Even dividing the self-employed into unincorporated and incorporated self-employment to analyze heterogeneity amongst people in certain types of self-employment, my main results hold true, that wages have less growth and job satisfaction have higher growth.

In the final set of analyses I see if the match between an employee's education and the type of business they start has an effect on work outcomes. Braguinsky and Ohyama (2007) use SESTAT data from 1993-1997 and they suggest that income in entrepreneurship may depend on the degree to which entrepreneurial activities draw on the stock/types of individuals' knowledge. They claim that it is the type of entrepreneurship that people enter, as far as how closely the firm they start uses their technical knowledge that affects the earnings distribution. They find that those who work in self-employment in an educated-related business will make more than wage workers, while those in an education unrelated business will make less. To examine whether this has an impact on my main results I will use 2003-2010 SESTAT data. Whereas Braguinsky and Ohyama compare those who move to self-employment to anyone who does not move into self-employment (regardless of the mismatch type in other employment), I compare people who are mismatched in self-employment, with those who are mismatched in wage work and with their new employer in wage work. In Table 3.9, models 1-6, I limit the sample to those in an education-related position (those who self-reported that their principal job was "closely related" to their highest degree) and in models 7-12, I limit the sample to those in an education-unrelated position (those who self-reported that their principal job was "not related" to their highest degree). I find that while moving to education related self-employment still has negative implications for wage growth (compared to staying in an education related position or moving to new employment in an education related position), moving to education unrelated self-employment has worse negative consequences for wages (compared to staying in an education unrelated position or moving to new employment in an educated unrelated

position). Both types of self-employed (education related and unrelated) experience increases in their job satisfaction when they move. Even controlling for the type of self-employment as it relates to the entrepreneur's human capital and finding for support for Braguinsky and Ohyama's point that the degree of the match in skills does affect work outcomes, it still does not alter the pattern of my main findings that those who transition into self-employment experience less growth in their wages but a larger growth in their job satisfaction than those who do not change employers.

Table 3.9: Education Related and Unrelated Self-Employment

	1	2	3	4	5	6
	Xtreg	Xtreg w/fe	Oprobit	Xtreg w/fe	Oprobit	Xtreg w/fe
	Education-related business					
	Lnsalary (t)- Lnsalary (t-1)	Lnsalary (t)	Job satisfaction (t) - job satisfaction (t-1)	Job satisfaction (t)	Job satisfaction (t) -job satisfaction (t-1)	Job satisfaction (t)
No employer change	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Move to new wage work	0.004	0.011	0.244**	0.102**	0.243**	0.102**
	[0.010]	[0.018]	[0.022]	[0.019]	[0.022]	[0.019]
Transition to self-employment	-0.144**	-0.166**	0.225**	0.073	0.236**	0.075
	[0.036]	[0.063]	[0.039]	[0.047]	[0.039]	[0.047]
Lnsalary (t-1)	-0.965**					
	[0.020]					
Job satisfaction (t-1)			-1.279**		-1.285**	
			[0.018]		[0.018]	
Lnsalary (t)					0.078**	0.016
					[0.018]	[0.013]
Observations	23931	23931	23931	23931	23931	23931

Table 3.9 (continued)

	7	8	9	10	11	12
	Xtreg	Xtreg w/fe	Oprobit	Xtreg w/fe	Oprobit	Xtreg w/fe
	Education-unrelated business					
	Lnsalary (t) - Lnsalary (t-1)	Lnsalary (t)	Job satisfaction (t) - job satisfaction (t-1)	Job satisfaction (t)	Job satisfaction (t) - job satisfaction (t-1)	Job satisfaction (t)
No employer change	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Move to new wage work	-0.045	-0.017	0.186**	0.102	0.190**	0.102
	[0.026]	[0.033]	[0.048]	[0.054]	[0.048]	[0.054]
Transition to self-employment	-0.535**	-0.334*	0.353**	0.018	0.424**	0.022
	[0.098]	[0.165]	[0.067]	[0.117]	[0.069]	[0.118]
Lnsalary (t-1)	-0.978**					
	[0.086]					
Job satisfaction (t-1)			-0.969**		-0.989**	
			[0.029]		[0.029]	
Lnsalary (t)					0.121**	0.012
					[0.031]	[0.028]
Observations	4463	4463	4463	4463	4463	4463

Note. Fixed effects are at the individual level with robust standard errors in brackets. * Significant at 5%; ** significant at 1%. Control for age, age squared, gender, marital status, race, citizenship, highest degree type, highest degree tenure, highest degree tenure squared, job tenure, job tenure squared, Carnegie classification dummies, highest degree field dummies, state of employment dummies, and year dummies Models 1-6 include a sample of only those in education related position, and models 7-12 included only those in an education unrelated position. Models 5-6 and 11-12 control for real lnsalary to analyze the non-pecuniary portion of job satisfaction.

3.5 Discussion and Conclusion

I use SESTAT data on over 28,000 scientists and engineers to analyze the effects of changing employers (either to a new employer in wage work or to self-employment) on pecuniary and non-pecuniary benefits. The current work in the rewards to entrepreneurship literature has mixed results on how working in self-employment affects wages; some find positive effects while others find negative. Those who find negative effects of self-employment on wages assume that non-pecuniary benefits must be present to compensate for lower wages, yet do not test whether there are actual improvements to job satisfaction upon entering self-employment. I study how salary and job satisfaction change for a given individual when they transition to self-employment. I also compare the changes in work outcomes when someone enters self-employment to the change in work outcomes when someone changes employment in wage work or stays with their current employer in an established firm. I do this in order to analyze whether there are benefits or consequences that are specific to transitions to entrepreneurship and not just mobility in general.

I find that on average, workers who transition to self-employment experience less growth in their wages and more growth in job satisfaction upon transitioning. I also find that these results differ depending on the reason someone transitioned to self-employment in the first place. I suggest that previous literature that treated entrepreneurs as a homogenous group in their motivations were not accounting for significant heterogeneity which has important consequences for work outcomes. I find that those who move to self-employment with the intention of increasing their wages are able to do so, just not as significantly as those who moved to a new employer in wage work. Those who moved to

self-employment because they wanted to improve their career benefits were able to improve their job satisfaction. In general when transitioning to self-employment, former wage workers were able to improve the work outcomes that they intended to improve. However, I also found that those who entered self-employment for reasons such as market or personal reasons saw no significant improvements in either their wages or job satisfaction.

While my results are consistent with theory that people who enter self-employment may be willing to take a reduction in salary for an increase in non-pecuniary benefits, I also find that those who change employers in wage work also experience a very similar increase in their job satisfaction. Job satisfaction seems to improve for movers in general, not just those who transition into entrepreneurship. I suggest two possible explanations for these results. First, it may be the case that the labor market is not frictionless and the worker could not have moved to a different employment situation than the one that they ultimately chose. Therefore, it is possible that someone did not choose to accept lower wages from ~~s~~self-employment over moving to wage work, but instead just did not have the same employment choices as another who moved to a new employer in wage work. Second, an alternate explanation is simply that those who entered self-employment may have been overly optimistic about how successful their business would be and thought that they would earn higher wages in self-employment than they did as wage workers. Many studies have found that entrepreneurs are inherently optimistic and often overconfident about the potential success of their business (Åstebro et al., 2014; Cooper et al., 1988; De Meza & Southey, 1996). Shane (2009) finds that entrepreneurs are 5 times more likely to report that they will have at least ten million

dollars in sales than is actually found in the Global Entrepreneurship Monitor. While I am not able to directly test for overconfidence, I do find mild support for this argument in that I find that those who move to self-employment for pay reasons do not significantly increase their wages as much as other types of employment. This is a topic that is worthy of further analysis in future research.

My findings contribute to a growing literature on rewards to entrepreneurship. First, I advance this work by using longitudinal data to analyze what actually happens to work outcomes on average when someone transitions to self-employment, instead of just using cross sectional data to compare entrepreneurs to non-entrepreneurs as is often done in the prior literature. Second, in addition to studying what happens to wages when workers transitions to self-employment, I also use job satisfaction as a proxy measure for non-pecuniary benefits to analyze if workers are able to improve their job satisfaction when they transition to self-employment. Even though a common argument for why workers enter entrepreneurship despite typically having lower wages than wage workers is that non-pecuniary benefits offer a compensating differential for salary, very few previous studies have analyzed both pecuniary and non-pecuniary measures in the same study. This is mostly due to the lack of data with a good measure for non-pecuniary job benefits, something this study is able to overcome using the SESTAT data. Third, in addition to comparing those who transition to self-employment with just those who remain with the same employer in wage work, I am able to disentangle those who stay in wage work and do not change employers and those who move to new employment in wage work. This allows me to distinguish the effect of mobility in wage work versus mobility to entrepreneurship specifically. Finally, I use the reasons people report for

making the initial entrance into entrepreneurship to show that entrepreneurship is not a uniform experience. Different people with different motivations for entry have different work outcomes, both pecuniary and non-pecuniary. This finding suggests that future research should consider motivations for entry when analyzing work outcomes in entrepreneurship.

The findings in this study provide important implications for wage workers and entrepreneurs. While entering self-employment may not allow all wage workers to increase their wages as much as other types of employment, some can improve their wages (although they may have been able to increase their wages more if they had moved in wage work). While transitioning to entrepreneurship may not be as beneficial in terms of increasing salary, it is still beneficial in terms of increasing job satisfaction. I find that those who want to improve their current working conditions are generally able to achieve that goal in self-employment. However if someone is suffering from low job satisfaction with their current employer and income maximization is a priority for them, switching to a new employer in wage work may be the most beneficial in enabling someone to largely increase not only their salary but also their job satisfaction.

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CHAPTER 4

ENTREPRENEURIAL EXIT

4.1 Introduction

There exists a large body of research on which mechanisms predict entrepreneurial entry, yet the amount of research conducted on which mechanisms drive entrepreneurial exit is considerably less. A number of studies suggest that small businesses are highly likely to fail and to fail quickly (Amit et al., 1995; Mata & Portugal, 1994; Shane, 2009). Yet others have suggested that entrepreneurship is a fairly transitory state between periods of employment and that a majority of entrepreneurial spells are terminated voluntarily for a move to alternative work in wage work (Taylor, 1999). Therefore, this study plans to contribute to a greater understanding of what factors attribute to individuals leaving entrepreneurship and returning to wage work.

Prior literature assumes that the firms that performed the best were the most likely to survive (Penrose, 1952; Taylor, 1999), and these studies indicate that those who produce low financial returns simply fail altogether and exit entrepreneurship. Other research has found that the determinants of performance and survival may differ (DeTienne et al., 2008; Gimeno et al., 1997; Kalleberg & Leicht, 1991). They claim that many entrepreneurs persist in entrepreneurship for long periods of time without making large financial returns and without any intention of growing (Hurst & Pugsley, 2011). This finding implies that producing only low wages does not mean an entrepreneur is necessarily going to leave entrepreneurship; they may choose to remain in self-employment for the non-pecuniary benefits of entrepreneurship.

A model is needed that combines both the impacts of financial and non-financial benefits. The goal of this paper is to demonstrate that studies that do not include a measure of non-pecuniary benefits with research on transitions in and out of entrepreneurship are missing out on a fundamental component. I argue that even those studies that include factors other than performance variables, such as human capital variables, are not documenting the full picture as entrepreneurial human capital is associated with both the pecuniary and non-pecuniary benefits of self-employment. This opens the question asking who exactly is exiting entrepreneurship. Is it those who are unsatisfied in it, since non-pecuniary benefits are a main motivator into entrepreneurship (Hamilton, 2000), or is it those who are not earning high salaries in entrepreneurship? I argue that it is a combination of both mechanisms that influences entrepreneurial exit and that this relationship is largely dependent on the entrepreneur's human capital.

One of the problems with the current literature is that while studies claim that people may remain in entrepreneurship for the non-pecuniary benefits of entrepreneurship regardless of financial performance, there is little empirical evidence examining the relationship between non-pecuniary benefits and entrepreneurial exit. Additionally, the literature has begun to acknowledge that human capital and traits of the individual entrepreneur influence financial performance in entrepreneurship, yet there has still been little work done on the relationship between entrepreneurial human capital and non-pecuniary benefits.

I argue that people enter entrepreneurship for a variety of different reasons and with varied skills sets. Those people then experience different outcomes in entrepreneurship, with some attaining high entrepreneurial salaries, some experiencing

high degrees of non-pecuniary benefits, some experience a mix of both, and some having neither. Additionally, individual entrepreneurs inherently possess different opportunity costs. Thus, exit decisions may reflect both financial and non-financial benefits and how those financial opportunities compare to outside options. This in turn, depends on the individual's skills and how valuable those skills are in self-employment versus employment.

Using a longitudinal sample of over 8,000 highly educated entrepreneurs in science and engineering, I use proxy measures for both non-pecuniary benefits and skill variety to better analyze the relationship between entrepreneurial human capital, the non-pecuniary benefits of entrepreneurship and entrepreneurial exit. I then study what happens to entrepreneurs' work outcomes once they exit entrepreneurship and return to wage work. I find that there is a positive but non-linear relationship between salary and entrepreneurial exit and a significant negative relationship between job satisfaction and entrepreneurial exit. I find that those with lower job satisfaction are more likely to exit entrepreneurship, regardless of salary. Those with greater R&D skill sets are those who are more likely to report lower job satisfaction but higher salaries in entrepreneurship compared to other entrepreneurs. They are the most likely to exit entrepreneurship, with their greater opportunity costs to remaining in self-employment and the marketability of their specialized skill set in wage work, compared to those with a more generalized skill set.

I add to the understanding of entrepreneurial exit in three important ways. First, I highlight that decisions made by individuals to exit entrepreneurship and return to wage work are largely influenced by not only their salary but also the non-financial benefits

they derive from entrepreneurship. Second, I speak to the emerging literature on human capital and entrepreneurial exit by highlighting the importance of human capital in entrepreneurial exit decisions. While prior work in this domain has considered how the entrepreneur's human capital relates to the financial performance of the firm which influences exit (Gimeno et al., 1997), I expand this to consider how the entrepreneur's human capital relates to the non-financial benefits an individual gains from entrepreneurship, which may influence exit. Finally, I use longitudinal data to analyze the changes in financial and non-financial outcomes for those who re-enter wage work.

4.2 Background

4.2.1 Predictors of Entrepreneurial Exit

Prior research has established that there is a strong relationship between performance and exit. Jovanovic (1982) suggests that there is entrepreneurial learning that happens in entrepreneurship with regards to initially unknown entrepreneurial abilities. People are uncertain of their expected returns in entrepreneurship and enter on chance. Based on constantly arriving new information, entrepreneurs adjust their beliefs regarding their own entrepreneurial human capital. Able entrepreneurs survive and grow while the less able exit. More precisely, those who are able as entrepreneurs remain, while those less able return to wage work after a short time in entrepreneurship (Åstebro & Chen, 2014; MacDonald, 1988).

I argue that salary is not the only mechanism affecting entrepreneurial exit. Whether someone exits entrepreneurship should be dependent on their overall utility and whether entrepreneurship is benefiting them. Benefits to engaging in entrepreneurship may be both financial and non-financial. I claim that entrepreneurs will switch

employment options if the net gain, including their financial and non-financial benefits, from their current employment position becomes negative when compared to their set of alternatives in wage work.

Gimeno et al. (1997) is one of the first to suggest that there is a relationship between non-financial factors and entrepreneurial exit. They find that the more psychic income one has from entrepreneurship, the less likely they will be to exit entrepreneurship. Their measure of psychic income is measured by whether the entrepreneurs' parents owned a business, and by the small business owner's intrinsic motivation (whether the entrepreneur reported entering to do the kind of work they wanted to do or to not have to work with others, versus entering to make money or to build a successful organization.) To build on this finding that non-financial objectives matter, other recent studies have emphasized the importance of other non-financial factors that might impact entrepreneurial exit such as reputation of the owner, and the entrepreneur's competence and commitment, as well as extrinsic motivators such as environmental munificence, personal investment, and efficacy (DeTienne et al., 2008; McCann & Vroom, 2013; Sørensen & Phillips, 2011). These studies all highlight the idea that non-pecuniary benefits in entrepreneurship may create a disconnect between exit and performance causing entrepreneurs to remain in their firms despite a lack of profitability, though none of these studies directly empirically test the relationship between non-financial measures and entrepreneurial exit. In my analysis I am able to empirically study the presence of non-financial objectives (using a measure of job satisfaction) and analyze whether the relationship between performance and exit are changed by the inclusion of non-pecuniary factors.

While the findings above from Gimeno et al. (1997) highlight the importance of non-financial factors in studies of exit, their measures focus on motivators for entrepreneurship pre entry, and not whether an entrepreneur actually experienced non-financial benefits while in entrepreneurship. This is an important distinction, because even though someone may be more likely to enter for the non-financial benefits of entrepreneurship, it does not necessarily mean that they will experience them. In addition to the non-financial benefits that are often associated with entrepreneurship, such as being one's own boss, increased freedom and flexibility, less hierarchy, and greater autonomy (Benz & Frey, 2003, 2004, 2008; Frey & Benz, 2003; Griffeth et al., 2000; Hundley, 2001), there are also negative non-financial factors that have been associated with entrepreneurship such as less sleep, long work hours and less leisure time, increased stress, and increased spousal stress (Ajayi-Obe & Parker, 2005; Blanchflower, 2004; Dahl et al., 2010; Harris et al., 1999; Williams, 2003).

Policy makers and the media often emphasize the benefits of small business ownership and underestimate the struggles of entrepreneurs. Lessons from behavioral economics on projection bias would suggest that those making predictions expect future changes to affect their well-being more than they should and underestimate their ability to adapt (Brickman et al., 1978; Dolan & Kahneman, 2008). So while an entrepreneur may enter entrepreneurship expecting greater non-pecuniary benefits, they may find that they preferred wage work in an established company where they may not have had to carry as much job responsibility or pressure to succeed. These entrepreneurs may be less accepting of the non-pecuniary costs of entrepreneurship and less committed to their business, even if the business is financially successful. An individual who runs a

financially successful business may also have more outside opportunities for employment, therefore if they are not experiencing large non-pecuniary benefits from entrepreneurship, then the opportunity costs of remaining in entrepreneurship may be larger, which could increase the likelihood of that person choosing to exit entrepreneurship and return to wage work.

4.2.2 Entrepreneurial Human Capital

After introducing the importance of both financial and non-financial attributes in predicting entrepreneurial exit in the previous section, I now discuss the factors that might impact where someone is positioned in the salary and job satisfaction distributions, centering my discussion around the human capital of entrepreneurs. While pay and non-pecuniary benefits will drive exit, these in turn reflect underlying skills and how valuable these skills are for entrepreneurship versus outside options in wage work.

While there is a growing body of work that examines how human capital, in terms of the comparative advantage of their skill set, affects entrepreneurial entry (Astebro & Thompson, 2011; Elfenbein et al., 2010; Hyytinen & Ilmakunnas, 2007; Lazear, 2005; Lechmann & Schnabel, 2014; Sell & Sauermann, 2014; Silva, 2007; Wagner, 2003; Wagner, 2006), there is only a very small body of literature that uses an entrepreneur's skill set as a mechanism that predicts entrepreneurial exit (Gimeno et al., 1997; Oberschachtsiek, 2012). Gimeno et al.'s discussion of entrepreneurial human capital in terms of skills focuses on the amount of applicable previous work experience an entrepreneur has in the same industry. I, however, argue that is important to observe the skill set of an entrepreneur in terms of the entrepreneurial activities in which they participate to gain a better understanding of their entrepreneurial abilities, as

entrepreneurs' do not know their entrepreneurial abilities pre-entry. The prior studies do not link entrepreneurial skill variety to non-financial benefits. Gimeno et al.'s (1997) model asserts that human capital in terms of levels of education and skill prior to entering self-employment should have no relationship with their non-financial mechanism of psychic income. I argue that human capital of entrepreneurs should be directly related to their levels of financial and non-financial benefits in wage work, which should impact entrepreneurial exit.

Those who were in the bottom of the wage distribution in wage work and who have lower human capital in terms of education and entrepreneurial skill set are more likely to have low salary and job satisfaction in entrepreneurship. Wage workers who enter entrepreneurship from the bottom of the salary distribution in wage work are generally those with lower wage work abilities and who are typically forced into entrepreneurship because they have no other options and have low opportunity costs to entering. These necessity entrepreneurs are often those who have been "pushed" into self-employment because they have become unemployed and have no other options in wage work (Blau, 1987; Evans & Leighton, 1989; Taylor, 1996; Thurik et al., 2008). Because necessity entrepreneurs are often forced into entrepreneurship, they tend to not have made the human capital and social capital investments that may be necessary for high entrepreneurial performance (Block & Wagner, 2007). Therefore, these necessity entrepreneurs tend to be lower quality (Thompson, 2011), and attain lower earnings (Bates, 1990; Evans & Leighton, 1990) than opportunity entrepreneurs who have been "pulled" into entrepreneurship to exploit a specific opportunity in their own firm. These entrepreneurs also tend to be less satisfied in entrepreneurship (Benz & Frey, 2004; Block

& Koellinger, 2009; Block & Wagner, 2007; Kautonen & Palmroos, 2010) since entrepreneurship was forced upon them, and not chosen above other opportunities. These necessity entrepreneurs are more likely to experience lower utility than those who desired and chose a career in self-employment instead of having it forced upon them as the only option. While this group experiences less non-pecuniary benefits and salary should be the least likely to remain in entrepreneurship (Amit et al., 1995; Block & Sandner, 2009; Pfeiffer & Reize, 2000), they may also be locked into self-employment (Bruce & Schuetze, 2004; Hyytinen et al., 2013; Hyytinen & Rouvinen, 2008) due to relatively poor outside options in alternative employment (Amit et al., 1995).

Those with greater skill variety should be best equipped for entrepreneurship and should therefore achieve the greatest salary and non-pecuniary benefits from entrepreneurship. Previous research has found that those who are generalists in terms of their skill set, or a jack of all trades, are more likely to be financially successful in entrepreneurship since working in entrepreneurship requires one to be able to manage a variety of different activities (Lazear, 2005; Silva, 2007; Wagner, 2003; Wagner, 2006). Astebro and Thompson (2011) on the other hand find that variety is actually a job preference as some people prefer to job hop and in the process happen to acquire more skills. Combing both perspectives I argue that someone who has a more balanced skill set should be more likely to be financially successful and be more satisfied with the non-pecuniary benefits of entrepreneurship.

Those with a more specialized skill set and greater human capital in terms of education should be more likely to be financially successful in entrepreneurship but not necessarily satisfied. This group should be highly capable wage workers who were

successful in wage work and may also have high opportunity costs from remaining in self-employment. They may have entered entrepreneurship because they overestimated their returns (financial and non-financial) to entrepreneurship. They may have good human capital for wage work but not necessarily for entrepreneurship, and they may have underestimated what skills are necessary to succeed in self-employment. In my sample of scientists and engineers having specialized R&D skills should have a greater comparative advantage for wage work in science and engineering, than in entrepreneurship which should require a greater mix of technical and business skills. On the other hand those with a more generalized skill set may experience high non-pecuniary benefits but low wages in self-employment. This group will be more likely to persist in entrepreneurship for a long period of time, because they not only derive utility from entrepreneurship in terms of non-pecuniary benefits, but they also will have less outside options to re-enter wage work.

4.2.3 Returns to Re-entering Wage Work

Many researchers have claimed that entrepreneurs experience large non-pecuniary benefits to remaining in entrepreneurship, as they find that these entrepreneurs could earn more if they switched back to wage work (Bernhardt, 1994; Evans & Leighton, 1989; Hamilton, 2000; Williams, 2000). Other studies have found the returns in wage work to be negative (Ferber & Waldfogel, 1998; Hyytinen & Rouvinen, 2008) and that there is a lack of viable employers for entrepreneurs to return to after a spell in self-employment and therefore those individuals often have to take part time positions or become unemployed (Bruce & Schuetze, 2004).

Entrepreneurs may lack the specific skill set that can be gained in wage employment, particularly in larger companies, especially as formal training is more frequently offered in large firms (Koellinger et al., 2015). In a field experiment Koellinger et al. (2015) found that former entrepreneurs will be disadvantaged in the labor market if employers have the alternative to hire someone who has the specific human capital that the entrepreneur lacks. Time spent working in self-employment may inherently alter the subsequent opportunities that are available to an entrepreneur if they were to return to wage work. Time working as an entrepreneur may lead to a depreciation of the specialized human capital previously gained in wage work (Failla et al., 2014). These authors have found that entrepreneurship acts as a treatment that leads employers in wage work to value entrepreneurship experience less than wage work experience and consequently offer former entrepreneurs wages below their reservation wages. Therefore I argue that those who have a diversified skill set and work as jacks of all trades in entrepreneurship by working in non-technical and management activities in entrepreneurship and who have allowed their specialized skill set to depreciate, may experience more disadvantages by returning to wage work with a generalized skill set.

However, I argue that this will not always be the case. Those who have not lost specialization in their skill set should be able to return to wage work and not be at a disadvantage. Some entrepreneurs continue to focus on specialized technical skills and work in teams or hire others to do non R&D activities, and therefore their skill set should not depreciate. Those who continue to work in specialized skills in entrepreneurship should be more likely to be in the group of entrepreneurs who have high salary but possibly lower levels of non-financial benefits. This group should have more employment

opportunities available to them outside of self-employment and therefore should be able to improve their salary when they exit. They may enter entrepreneurship thinking that they are going to be very satisfied and be willing to trade salary for improvements in their non-financial benefits. But then if they end up not being as satisfied as they expected due to increased job stress, greater job responsibility etc., they may choose to return to wage work. After time spent not earning as much money as they may have in wage work, they may choose to focus on improving their salary, and may be willing to sacrifice those non-financial benefits to do so. Therefore they should experience increases in their financial benefits but not necessarily their non-financial benefits upon returning to wage work.

Many have found that certain personal characteristics and preferences work better in startup employment than in regular employment (Markman & Baron, 2003; Zhao et al., 2010). Some of the qualities that may be beneficial in entrepreneurship such as higher propensity for risk taking, wanting to be in control, and independence, are not necessarily conducive to working for traditional companies (Koellinger et al., 2015), therefore those who return to wage work after being in self-employment may see a decline in their non-financial benefits due to these characteristics. I suggest that leaving entrepreneurship should result in a decline in non-pecuniary benefits compared to remaining in entrepreneurship.

4.3 Data and Measures

4.3.1 Data

My empirical analysis uses data from the National Science Foundation's Scientists and Engineers Statistical Data System (SESTAT). SESTAT is an integrated database that includes demographic, employment and educational information about scientists and engineers in the U.S. It is an integration of three surveys: The National Survey of Recent College Graduates (NSRCG), the National Survey of College Graduates (NSCG), and the Survey of Doctoral Recipients (SDR). It was constructed to represent the general population of scientists and engineers in the U.S and includes individuals who have at least a Bachelor's degree. The SESTAT surveys consistently receive high response rates, typically in the range of 70-80%. Complementing prior work using older SESTAT surveys, we employ data collected in the years 2003, 2006, 2008 and 2010. Using recent data from after the technology boom of the early 2000s allows me to gain insights into entrepreneurial careers in the current generation of scientists and engineers.

SESTAT provides a unique opportunity to study entrepreneurship and those who exit and return to wage work. First, the SESTAT data are longitudinal in nature, allowing me to follow individuals' employment trajectories over time and to examine the relationships between work outcomes in entrepreneurship and subsequent exit. Second, the data include a rich set of measures for important constructs that are often unobserved, including job satisfaction, and skill variety. Third, SESTAT includes data on a large number of highly educated scientists and engineers in entrepreneurship, allowing me to complement prior work using general population samples.

I make several restrictions to eliminate unnecessary heterogeneity. First, I exclude individuals who were not in the labor force during the observation period as well as those who were unemployed. I exclude individuals under the age of 22 and over the age of 65 to account for potentially different dynamics among those still in training or close to retirement. I limit my sample to full-time employees (defined as working at least 30 hours per week and 30 weeks per year) working in the U.S. and in a for-profit organization; I exclude individuals who are employed in academia, government, or non-profit organizations, as these sectors are likely characterized by different labor market dynamics. Because I focus on entrepreneurial careers among scientists and engineers, I also exclude individuals whose highest degrees are outside of science and engineering, as well as individuals who have a professional degree (e.g., JD, MBA, or MD). Finally, because I am focusing on entrepreneurs and those who exit entrepreneurship and return to wage work, I limit the sample to only those who were entrepreneurs in time period t. My final sample of entrepreneurs includes 8513 entrepreneurs and 14480 observations.

4.3.2 Variables

4.3.2.1 Main Variables

Exit/Employment status: Respondents indicated the type of their primary employer. Individuals who reported that their employer is a for-profit organization are coded as employed. Individuals who reported that they are self-employed are coded as self-employed. The survey also asked respondents whether they had changed employers since the last survey. Given the longitudinal nature of the data, these measures allow me to distinguish for each pair of time periods t and t+1 individuals who stayed in entrepreneurship, and those individuals who left entrepreneurship and moved to a new

employer in wage work. I coded an *exit* when someone reported being self-employed in period t but not in period t+1 and reported either that they had changed employers or had job tenure of less than 3 years. My sample includes 1,413 people who transition out of entrepreneurship.

Salary: Respondents reported their basic annual salary (not including bonuses or overtime pay). For the self-employed this measure captures their income including both nominal salaries and profits and if reported correctly are free of arbitrary partition of salaries and profits. However, this measure of salary may exclude stock options and bonuses. To make this measure comparable across time periods, I adjust it for inflation using a GDP deflator with base year 2009, taken from the US Bureau of Economic Analysis. Given the skewed distribution of salary, I add 1 and use the natural logarithm in the empirical analysis (*lnsalary*).

Job Satisfaction: To proxy for non-financial benefits I use a measure of *job satisfaction*. Respondents rated their overall satisfaction in their primary job using a 4-point scale that ranged from "very dissatisfied," "somewhat dissatisfied," "somewhat satisfied" to "very satisfied."

Salary/Satisfaction Categories: I create categories based on what part of the salary and job satisfaction distributions someone is in in entrepreneurship. I code someone as having low salary if they have less than the average real log salary in entrepreneurship, 11.144, and code them as having high salary if they report a salary greater than or equal to 11.144. I code someone as having low job satisfaction if they have less than the average job satisfaction in entrepreneurship, 3.45, and high job satisfaction if they have a job satisfaction greater than 3.45 (the highest job satisfaction

rating of 4). I then create categories of job satisfaction and salary depending on where they are in both distributions in entrepreneurship, including *low salary/low job satisfaction*, *low salary/high job satisfaction*, *high salary/low job satisfaction*, and *high salary/high job satisfaction*.

Skill Variety: One way in which I account for human capital is via proxies for skill variety. The surveys asked respondents which of a list of work activities occupied more than 10% of their time during a typical work week. R&D related activities in this list include "Basic research-study directed toward gaining scientific knowledge primarily for its own sake," "Applied research-study directed toward gaining scientific knowledge to meet a recognized need," "Development-using knowledge gained from research for the production of materials, devices," "Design of equipment, processes, structures and models," and "Computer applications, programming, systems development." The count of R&D activities that occupy at least 10% each of respondents' time forms my variable *R&D count*. Non-R&D activities included "Accounting, finance, contracts," "Employee relations-including recruiting, personnel development, internal training," "Managing or supervising people or projects," "Production, operations, maintenance," "Professional services," "Sales, purchasing, marketing, customer service, public relations," "Quality or productivity management," "Teaching," and "Other." The number of non-R&D activities that occupy at least 10% each of respondents' time is my variable *non-R&D count*. I suggest that these measures of work activities can serve as useful proxies for the skills respondents have during their employment. These may be skills that entrepreneurs already had before entering entrepreneurship and be one of the reasons they entered, or they could be skills that the entrepreneurs acquired during entrepreneurship. In particular,

given that all of my respondents have a science and engineering educational background, engaging in non-R&D activities is likely to broaden their skills and experience through on the job training, increasing their skill variety. On the other hand, respondents who focus on R&D activities may deepen their skills in the R&D domain but will overall have a narrower skill base than those who also engage in non-R&D activities (Ganco, 2014).

4.3.2.2 Control Variables

I control for the respondent's highest degree (*Bachelor's, Master's* or *PhD*). I also control for the *field of the highest degree*, including computers, biology, physical sciences, engineering and S&E related fields. I control for the *Carnegie classification* of the degree granting institution (i.e., research I, research II, doctorate granting institution, etc.). I control for professional tenure using the number of years since graduation (*highest degree tenure* and *highest degree tenure squared)* and I also control for individuals' tenure in their current job *(job tenure* and *job tenure squared).* Additionally, I include demographic controls including *age, gender, race, marital status, and citizenship.* I also include fixed effects for the *state* of employment and the *year* of the survey.

4.4 Results

4.4.1 Empirical Approach

In my first main set of analyses I examine the relationship between work outcomes in entrepreneurship and exit. Using OLS regression, I estimate:

$$EXIT_{i(t+1)} = \alpha + \beta WORKOUTCOMES_{it} + \gamma \mathbf{X}_i + \delta \mathbf{Z}_{it} + \theta \mathbf{A}_{it} + \nu_{it} \quad [1]$$

Where $EXIT_{i(t+1)}$ indicates whether someone exited entrepreneurship and returned to wage work after self-employment, where $WORKOUTCOMES_{it}$ indicates individual i's work outcomes (such as salary and job satisfaction) in period t. The vector $\mathbf{X}_i$ is a set of

time-invariant individual characteristics such as gender. $\mathbf{Z}_{it}$ is a vector of time-variant characteristics such as age, highest degree tenure, and job tenure, and ν_{it} is an error term. $\mathbf{A}_{it}$ is a vector of human capital (R&D and non-R&D work activity counts, highest degree type, highest degree field). To focus on transitions from entrepreneurship, these models are estimated using only those individuals who are entrepreneurs in period t. I then replace individual work outcomes of salary and job satisfaction, with four categories that combine the levels of both entrepreneurial salary and job satisfaction to understand whether a combination of the two has a relationship with exit. Standard errors are clustered at the level of the individual.

I seek to gain a deeper understanding of different measures of human capital and their relationship with direct work outcomes in entrepreneurship. For this analysis I utilize only the sample of respondents who are entrepreneurs in a given time period. I estimate models using different work outcomes including salary, job satisfaction, as well as the combination categories of salary and job satisfaction as dependent variables. I estimate:

$$WORKOUTCOMES_{it} = \alpha + \beta HUMANCAPITAL_{it} + \gamma \mathbf{X}_i + \delta \mathbf{Z}_{it} + \nu_{it} \quad [2]$$

Where $HUMANCAPITAL_{it}$ indicates individual i's level of human capital based on their skill variety in period t, the vector $\mathbf{X}_i$ is a set of time-invariant individual characteristics such as gender, $\mathbf{Z}_{it}$ is a vector of time-variant characteristics such as age, highest degree tenure, and job tenure, and ν_{it} is an error term. Standard errors are clustered at the level of the individual.

I then use a change score analysis (log of the change in wages between periods), controlling for the prior salary, to analyze the relationship between exit and subsequent change in salary. Using ordinary least squares on panel data, I estimate:

$$(LNSALARY_{i(t+1)} - LNSALARY_{it}) = \alpha + \beta\, EXIT_{i(t+1)} + \rho LNSALARY_{it} + \gamma X_i + \delta Z_{it} + \nu_{it} \quad [3]$$

Where $EXIT_{i(t+1)}$ indicates whether someone exited entrepreneurship and returned to wage work, $LNSALARY_{i(t)}$ is the salary in time t, the vector X_i is a set of time-invariant individual characteristics such as gender, Z_{it} is a vector of time-variant characteristics such as age, highest degree tenure, and job tenure, and ν_{it} is an error term. I then perform the same analyses but using job satisfaction in the place of salary ($JOBSATIS_{it}$), and controlling for current salary ($LNSALARY_{i(t+1)}$) to limit my analysis to only the non-financial aspects of job satisfaction:

$$(JOBSATIS_{i(t+1)} - JOBSATIS_{it}) = \alpha + \beta\, EXIT_{i(t+1)} + \rho JOBSATIS_{it} + \theta LNSALARY_{i(t+1)} + \gamma X_i + \delta Z_{it} + \nu_{it} \quad [4]$$

4.4.2 Descriptive Results

Table 4.1 shows summary statistics for my main variables in the full sample of entrepreneurs, including breakdowns by whether someone exits entrepreneurship or not. Descriptively, those who return to wage work are those who in general are younger, who have lower salaries, lower job satisfaction, a higher R&D count, a lower non R&D count, and shorter job tenure in entrepreneurship.

Table 4.1: Summary Statistics

	Full Sample				Remain in Self-employment	Return to Wage Work
Variable	Mean	Std. Dev.	Min	Max	Mean	Mean
Lnsalary	11.14	1.36	0.00	§	11.16	11.07
Job satisfaction	3.45	0.68	1.00	4.00	3.59	3.22
R&D count	1.81	1.49	0.00	5.00	1.64	2.13
Non R&D count	2.94	1.87	0.00	9.00	3.29	2.49
Highest degree: Bachelor's	0.56	0.50	0.00	1.00	0.53	0.61
Highest degree: Master's	0.21	0.41	0.00	1.00	0.20	0.22
Highest degree: PhD	0.23	0.42	0.00	1.00	0.26	0.17
Age	45.90	10.43	22.00	65.00	47.35	40.47
Male	0.78	0.41	0.00	1.00	0.81	0.76
Married	0.78	0.41	0.00	1.00	0.81	0.72
White	0.74	0.44	0.00	1.00	0.78	0.71
US Citizen	0.91	0.29	0.00	1.00	0.93	0.86
HD tenure	19.23	10.56	0.00	47.00	20.79	13.99
Job tenure	8.43	8.23	0.00	46.00	9.76	3.90

Note: The sign "§" indicates that a value was omitted to meet an NSF confidentiality requirement.

Table 4.2 shows the correlations between my main variables. Solely on a descriptive basis, salary and job satisfaction in entrepreneurship are each negatively associated with entrepreneurial exit in the subsequent period. Additionally, those with high salary and high job satisfaction in entrepreneurship, and those with low salary and high job satisfaction in entrepreneurship are less likely to exit in the subsequent period. While those with low salary and low job satisfaction, and high salary and low job satisfaction in entrepreneurship are more likely to exit in the subsequent period. Having high salary and low job satisfaction in entrepreneurship is the category most correlated with entrepreneurial exit in the subsequent period. Additionally having a higher R&D count is positively correlated with exit, while having a higher non R&D count is

negatively correlated with exit. In addition having a higher R&D activity count is highly correlated with being in a category with higher salary, particularly the category with high salary and low job satisfaction. On the other hand, participating in more non R&D activities is correlated with being in categories with higher job satisfaction.

Table 4.2: Correlations

	1	2	3	4	5	6	7	8	9
1 Exit	1								
2 Ln Salary	-0.0269*	1							
3 Job satisfaction	-0.2359*	0.1113*	1						
4 Low salary, low job satisfaction	0.1083*	-0.3194*	-0.5189*	1					
5 Low salary, high job satisfaction	-0.0996*	-0.3050*	0.3764*	-0.2364*	1				
6 High salary, low job satisfaction	0.1586*	0.1926*	-0.5244*	-0.2976*	-0.2704*	1			
7 High salary, high job satisfaction	-0.1401*	0.3365*	0.6129*	-0.3848*	-0.3497*	-0.4403*	1		
8 R&D count	0.1404*	0.0251*	-0.0123	-0.0653*	-0.0565*	0.0983*	0.0109	1	
9 Non R&D count	-0.1772*	0.0085	0.1107*	-0.0325*	0.0517*	-0.1014*	0.0782*	-0.0255*	1
10 Highest degree: Bachelor's	0.0664*	-0.1048*	-0.0523*	0.1447*	0.0958*	-0.0795*	-0.1258*	-0.0582*	0.0867*
11 Highest degree: Master's	0.0194	0.0018	-0.0028	-0.0376*	-0.0255*	0.0515*	0.0053	0.0580*	-0.0449*
12 Highest degree: PhD	-0.0954*	0.1214*	0.0641*	-0.1337*	-0.0879*	0.0438*	0.1427*	0.0125	-0.0587*
13 Age	-0.2853*	0.0436*	0.0923*	-0.1174*	-0.0372*	-0.0029	0.1310*	-0.1476*	0.0712*
14 Male	-0.0494*	0.0815*	0.0091	-0.0750*	-0.0981*	0.0592*	0.0873*	0.0994*	0.0122
15 Married	-0.0887*	0.0854*	0.0680*	-0.1287*	-0.0473*	0.0488*	0.1017*	-0.0202*	0.0391*
16 White	-0.0610*	-0.0124	0.0833*	-0.0103	0.0539*	-0.1020*	0.0583*	-0.0987*	0.0883*
17 US citizen	-0.0932*	-0.0056	0.0639*	-0.0041	0.0360*	-0.0830*	0.0501*	-0.1028*	0.1206*
18 Highest degree tenure	-0.2769*	0.0249*	0.0931*	-0.0931*	-0.0170*	-0.0246*	0.1142*	-0.1671*	0.1074*
19 Job tenure	-0.2952*	0.0704*	0.0825*	-0.0806*	-0.0220*	-0.0171*	0.1008*	-0.0997*	0.1178*

	10	11	12	13	14	15	16	17	18	19
10 Highest degree: Bachelor's	1									
11 Highest degree: Master's	-0.5779*	1								
12 Highest degree: PhD	-0.6177*	-0.2848*	1							
13 Age	-0.1887*	-0.0065	0.2279*	1						
14 Male	0.0042	-0.0513*	0.0445*	0.1252*	1					
15 Married	-0.0757*	0.0230*	0.0667*	0.2039*	0.1364*	1				
16 White	0.1195*	-0.1158*	-0.0288*	0.1024*	0.0443*	-0.0259*	1			
17 US citizen	0.1222*	-0.1234*	-0.0246*	0.1522*	-0.0229*	-0.0159	0.2989*	1		
18 Highest degree tenure	0.0683*	-0.0959*	0.0122	0.8580*	0.1386*	0.1820*	0.1410*	0.1646*	1	
19 Job tenure	0.0188*	-0.0078	-0.0146	0.4636*	0.0805*	0.0878*	0.1145*	0.1344*	0.4941*	1

Note: *Significant at 5%

4.4.3 Main Regression Results

4.4.3.1 Work Outcomes and Exit

Table 4.3 shows the relationship between the entrepreneurial work outcome variables and entrepreneurial exit. In model 1, there is a slightly positive and significant relationship between salary and entrepreneurial exit. However, when I include job satisfaction (model 2), job satisfaction is negative and significant. Adding job satisfaction strengthens the relationship between salary and exit. This is consistent with other research that has found that people persist in entrepreneurship for long periods of time even without high salaries (Hurst & Pugsley, 2011). The addition of job satisfaction unsuppressed the relationship where salary is now more strongly correlated with exit and the two predictors together explain more of the variance in the model than might have been expected from examination of zero-order relationships. When I analyze correlations, salary is negatively correlated with exit, but when I examine the correlation between salary and exit when only looking at the population with low job satisfaction, I find that salary is positively correlated with exit. However, when I limit the sample to only the population with high job satisfaction, I find that salary is negatively correlated with entrepreneurial exit in the subsequent period. Yet when I examine the correlation between exit and job satisfaction, I find that job satisfaction has a negative and significant relationship with exit. And whether I use only the sample with low salary, or only the sample with high salary in entrepreneurship, I find that job satisfaction is negatively and significantly correlated with entrepreneurial exit in the next period. This makes it easier to understand why taking into account job satisfaction clarifies and enhances the relationship between salary and entrepreneurial exit. While job satisfaction is negatively

and significantly associated with exit no matter which variables are added to the analysis, the relationship between salary and exit is not as obvious and is dependent on other factors such as job satisfaction.

I find that those who are male, older and who have been in entrepreneurship longer (job tenure) are less likely to exit. This is consistent with prior work on labor mobility that finds that those who are older are less likely to job hop compared to those who are young, and the longer the job tenure in any type of employment is, the less likely someone is to be mobile (Bartel & Borjas, 1981; Lin et al., 2000; Mincer & Jovanovic, 1979; Topel & Ward, 1988).

I find that those who participated in more R&D activities in self-employment are more likely to exit self-employment, while those who participate in more non R&D activities in self-employment, my proxy for skill variety, are less likely to exit self-employment. However, other variables associated with human capital, such as level of education, appear to be uncorrelated with entrepreneurial exit, which is consistent with prior research (Asoni, 2011; Evans & Leighton, 1989)

To allow for nonlinear effects of salary, I include a set of dummy variables for different salary percentiles, omitting the 40-60% category (models 3-4). Model 3 shows an inverted U-shape pattern between entrepreneurial salary and exit, suggesting that those who remain in self-employment are those at the top and bottom of the entrepreneurial wage distribution. Prior work has shown that those who leave wage work to enter self-employment are more likely to leave from the tails of the salary distribution in wage work (Astebro et al., 2011; Elfenbein et al., 2010), and I find that those who are in the tails of the entrepreneurial wage distribution are more likely to remain in self-

employment. This seems to imply that entrepreneurship is more attractive to those at the tails of the salary distribution. When job satisfaction is added (model 4), I find that while those who are at the top of the wage distribution are still negatively associated with entrepreneurial exit, the coefficient is smaller with the addition of job satisfaction. Overall I find that those who are in the top and bottom of the wage distribution are more likely to exit and that job satisfaction has a negative and linear relationship with entrepreneurial exit.

I now analyze how salary and job satisfaction are jointly associated with entrepreneurial exit. In Table 4.3 (model 5) I analyze the relationship between entrepreneurial exit and categories for where entrepreneurs are in the distribution for both entrepreneurial salary and job satisfaction. I find that compared to those who have low salary and low job satisfaction, those who have low salary and high job satisfaction are the least likely to exit. Those in the high salary and high job satisfaction are also less likely to exit. This result implies that someone will remain in entrepreneurship if they have high job satisfaction, regardless of where they are in the entrepreneurial salary distribution. Therefore even if someone is not performing as well as others in entrepreneurship in regard to financial outcomes, as long as they are satisfied, they are more likely to remain in self-employment. However, compared to those who have low salary and low job satisfaction in entrepreneurship, those who have high salary and low job satisfaction are the most likely to exit entrepreneurship. Even though someone is financially successful in self-employment compared to others, if they are unsatisfied in entrepreneurship they are more likely to return to wage work. This result implies that previous studies that did not account for job satisfaction were not getting the full story.

Entrepreneurial salary alone does not predict exit, it also depends on where the entrepreneur falls in the job satisfaction distribution

Table 4.3: Work Outcomes and Exit

	1 Xtreg Exit (t+1)	2 Xtreg Exit (t+1)	3 Xtreg Exit (t+1)	4 Xtreg Exit (t+1)	5 Xtreg Exit (t+1)
Lnsalary (t)	0.008*	0.013**			
	[0.004]	[0.004]			
Job satisfaction (t)		-0.112**			
		[0.008]			
Lnsalary category <10% (t)			-0.066**	-0.091**	
			[0.019]	[0.019]	
Lnsalary category 10-20% (t)			-0.066**	-0.083**	
			[0.019]	[0.019]	
Lnsalary category 20-30% (t)			-0.050**	-0.061**	
			[0.019]	[0.019]	
Lnsalary category 30-40% (t)			-0.02	-0.025	
			[0.020]	[0.020]	
Lnsalary category 40-60% (t)			omitted	omitted	
Lnsalary category 60-70% (t)			0.001	0.001	
			[0.020]	[0.020]	
Lnsalary category 70-80% (t)			0.02	0.029	
			[0.021]	[0.021]	
Lnsalary category 80-90% (t)			0.007	0.016	
			[0.020]	[0.019]	
Lnsalary category 90-100% (t)			-0.060**	-0.038*	
			[0.017]	[0.017]	
Very dissatisfied (t)				omitted	
Somewhat dissatisfied (t)				-0.134*	
				[0.053]	
Somewhat satisfied (t)				-0.236**	
				[0.049]	
Very satisfied (t)				-0.354**	
				[0.049]	
Low salary/ low satisfaction (t)					omitted
Low salary/ high satisfaction (t)					-0.135**
					[0.015]
High salary/ low satisfaction (t)					0.071**
					[0.017]
High salary/ high satisfaction (t)					-0.072**
					[0.015]
R&D count (t)	0.020**	0.020**	0.018**	0.018**	0.018**
	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]
Non R&D count (t)	-0.027**	-0.024**	-0.027**	-0.023**	-0.024**
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Highes degree: Bachelor's (t)	omitted	omitted	omitted	omitted	omitted
Highest degree: Master's (t)	-0.021	-0.017	-0.024	-0.022	-0.025
Highest degree: PhD (t)	-0.031	-0.026	-0.036	-0.038	-0.043
Age (t)	-0.018**	-0.019**	-0.021**	-0.022**	-0.023**
Age squared (t)	0.000*	0.000**	0.000**	0.000**	0.000**
Male (t)	-0.036**	-0.042**	-0.036**	-0.045**	-0.046**
Married (t)	0.001	0.009	-0.001	0.006	0.007
White (t)	0.000	0.011	0.001	0.012	0.01
US citizen (t)	-0.007	-0.001	-0.003	0.003	0.003
Highest degree tenure (t)	-0.007	-0.005	-0.006	-0.005	-0.005
Highest degree tenure squared (t)	0.000	0.000	0.000	0.000	0.000
Job tenure (t)	-0.029**	-0.029**	-0.029**	-0.029**	-0.029**
Job tenure squared (t)	0.001**	0.001**	0.001**	0.001**	0.001**
Observations	6315	6315	6315	6315	6315

Note: Clustered standard errors in brackets. * Significant at 5%; ** significant at 1%. Includes Carnegie classification dummies, highest degree field dummies, state of employment and year dummies.

4.4.3.2 Predictors of Work Outcomes

In Table 4.4, I regress the different work outcomes on human capital and demographic variables in entrepreneurship to gain a better understanding of the factors that predict which part of the entrepreneurial salary and job satisfaction distribution someone will be in. These regressions use the full sample of entrepreneurs. I find that participating in a greater number of R&D activities in entrepreneurship is not significantly associated with salary or job satisfaction separately (models 1 and 2). Participating in more non R&D activities on the other hand is significantly associated with more job satisfaction. This is consistent with the taste for variety theory by Astebro and Thompson (2011) that skill variety is a preference among entrepreneurs. Entrepreneurs attain a benefit from participating in more different activities, but it seems to be via their satisfaction with their job in self-employment and not necessarily with their salary in self-employment, as predicted by Lazear (2005). Entrepreneurial success is not necessarily defined as making the most money, but also is achieved by those who are satisfied in their employment. I find that human capital in terms of higher education is associated with greater salary and job satisfaction in entrepreneurship. This differs from Gimeno et al. (1997) model that human capital (as measured in terms of level of education) should be positively related to entrepreneurial salary but unrelated to psychic income. I find that human capital is associated with job satisfaction, even when controlling for salary (model 3). This allows me to analyze only the non-financial portion of job satisfaction. Even when controlling for current salary I still find that different forms of human capital are still positively and significantly related to job satisfaction.

In model 4 (columns 4a to 4d) using a multinomial logit model, I analyze how skill variety is associated with being in the different salary and job satisfaction categories. I find that those who have a higher R&D count are more likely to be in any category other than the low salary and low satisfaction category. While there is not a significant relationship between R&D count and work outcome variables separately, when accounted for together, having a high R&D count is most associated with being in the high salary and low job satisfaction category (the category that is also most likely to exit self-employment). Those who participate in more R&D activities in entrepreneurship are the least likely to be in the low salary and low job satisfaction category. On the other hand those who participate in more non R&D activities in entrepreneurship are the least likely to be in the high salary and low job satisfaction category. Having a greater skill variety is positively and significantly associated with being in the categories with high job satisfaction, regardless of salary.

When I analyze the relationship between human capital in terms of level of education and the different categories of salary and job satisfaction, I find that the higher the education, the more likely someone is to be in any category besides the low salary and low job satisfaction category. Those with a PhD are more likely to be in the category with high salary but low job satisfaction in entrepreneurship. My findings show those with more specialized human capital, those who participate in more R&D work activities and those with PhDs, are more likely to be in the category with high salary and low job satisfaction in entrepreneurship (the category most likely to exit entrepreneurship). Additionally, I find that those who have had longer job tenure in self-employment are more likely to be in the high salary and high job satisfaction category, than in the low

salary and low job satisfaction category. This result implies that there is some sorting out that is happening; that those who are mismatched in terms of salary and job satisfaction in entrepreneurship eventually leave and those who are most satisfied and make the most money remain in entrepreneurship, and is consistent with my findings that those with higher salary and job satisfaction are less likely to exit entrepreneurship in the subsequent period.

Table 4.4: Correlates of Entrepreneurial Work Outcomes

	1 OLS Lnsalary	2 Ologit Job Satisfaction	3 Ologit Job Satisfaction	4a Mlogit Low salary/ low satisfaction	4b Mlogit Low salary/ high satisfaction	4c Mlogit High salary/ low satisfaction	4d Mlogit High salary/ high satisfaction
Lnsalary			.132**				
			[0.018]				
R&D count	0.01	0.017	0.015	omitted	0.056*	0.170**	0.123**
	[0.010]	[0.013]	[0.013]		[0.022]	[0.021]	[0.021]
Non R&D count	0.006	0.101**	0.100**	omitted	0.074**	-0.050**	0.074**
	[0.007]	[0.011]	[0.011]		[0.017]	[0.016]	[0.016]
Highest Degree: Bachelor's	omitted	omitted	omitted	omitted	omitted	omitted	omitted
Highest Degree: Master's	0.154**	0.203**	0.181**		0.193*	0.631**	0.703**
	[0.041]	[0.055]	[0.055]	omitted	[0.092]	[0.087]	[0.088]
Highest Degree: PhD	0.475**	0.336**	0.278**		0.342*	1.839**	1.815**
	[0.059]	[0.091]	[0.091]	omitted	[0.157]	[0.153]	[0.153]
Age	0.019	-0.082**	-0.086**		-0.110**	0.206**	0.115**
	[0.014]	[0.023]	[0.023]	omitted	[0.034]	[0.035]	[0.034]
Age squared	-0.000*	0.001**	0.001**		0.001**	-0.002**	-0.002**
	[0.000]	[0.000]	[0.000]	omitted	[0.000]	[0.000]	[0.000]
Male	0.192**	-0.042	-0.067		-0.225**	0.298**	0.344**
	[0.037]	[0.050]	[0.050]	omitted	[0.074]	[0.077]	[0.076]
Married	0.194**	0.271**	0.0247**		0.290**	0.427**	0.574**
	[0.037]	[0.049]	[0.049]	omitted	[0.073]	[0.075]	[0.074]
White	-0.016	0.297**	0.302**		0.239**	-0.156*	0.225**
	[0.033]	[0.049]	[0.049]	omitted	[0.083]	[0.075]	[0.078]
US citizen	0.000	0.155*	0.154*		0.095	-0.135	0.121
	[0.044]	[0.072]	[0.072]	omitted	[0.133]	[0.111]	[0.119]
Highest degree tenure	0.023**	0.044**	0.041**		0.032	0.035*	0.076**
	[0.007]	[0.011]	[.011]	omitted	[0.018]	[0.017]	[0.017]
Highest degree tenure squared	-0.000*	-0.001*	-0.001*		-0.001	-0.000	-0.001*
	[0.000]	[0.000]	[0.000]	omitted	[0.000]	[0.000]	[0.000]
Job tenure	0.029**	0.021**	0.018*		0.011	0.020	0.041**
	[0.005]	[0.007]	[0.007]	omitted	[0.012]	[0.011]	[0.011]
Job tenure squared	-0.001**	0.000	-0.000		-0.000	-0.000	-0.001
	[0.000]	[0.000]	[0.000]	omitted	[0.000]	[0.000]	[0.000]
Carnegie classification dummies	incl.	incl.	incl.		incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	omitted	incl.	incl.	incl.
State of employment and year dummies	incl.	incl.	incl.	omitted	incl.	incl.	incl.
Observations	14480	14480	14480	14480	14480	14480	14480

Note: Clustered standard errors in brackets. * Significant at 5%; ** significant at 1%

4.4.3.3 Returns to Re-entry to Wage Work

In Table 4.5, I analyze whether there are changes to salary and job satisfaction when people re-enter wage work after time spent in self-employment. I find that those who exit self-employment on average experience an increase in their salary (models 1 and 2), even when controlling for their position in the salary distribution in entrepreneurship (model 1). However when someone re-enters wage work after time in self-employment, I find that there is a negative but insignificant change in job satisfaction (models 3 and 4) compared to staying in self-employment, even when controlling for job satisfaction in entrepreneurship (model 3). The results still hold even when controlling for the salary in time t+1 to account for the non-financial component of job satisfaction (models 5 and 6). While job satisfaction seems to influence the decision to exit entrepreneurship, when those individuals do return to wage work they take a job that focuses on improving their salary and not their job satisfaction. After trying entrepreneurship and realizing it is not as satisfying as they hoped, they may return to wage work with the intent of focusing on finding a better match in terms of wages and improving their salary, rather than focusing on improving job satisfaction.

Table 4.5: Returns to Re-entry to Wage Work

	1 Xtreg Lnsalary (t+1)- lnsalary (t)	2 Xtreg Lnsalary (t+1)- lnsalary (t)	3 Ologit Job satisfaction (t+1)- job satisfaction (t)	4 Ologit Job satisfaction (t+1)- job satisfaction (t)	5 Ologit Job satisfaction (t+1)- job satisfaction (t)	6 Ologit Job satisfaction (t+1)- job satisfaction (t)
Exit (t+1)	0.213**	0.204**	-0.109	-0.015	-0.150	-0.039
	[0.035]	[0.052]	[0.081]	[0.079]	[0.082]	[0.079]
Lnsalary (t+1)					0.134**	0.112**
					[0.028]	[0.027]
Lnsalary (t)	-0.697**					
	[0.038]					
Job satisfaction (t)			-2.393**		-2.426**	
			[0.083]		[0.083]	
Low salary/ low satisfaction (t)		omitted		omitted		omitted
Low salary/ high satisfaction (t)		0.122		-2.858**		-2.871**
		[0.078]		[0.111]		[0.111]
High salary/ low satisfaction (t)		-0.568**		-0.003		-0.084
		[0.066]		[0.098]		[0.099]
High salary/ high satisfaction (t)		-0.479**		-2.619**		-2.732**
		[0.063]		[0.106]		[0.107]
R&D count (t)	0.008	0.018	-0.013	-0.018	-0.013	-0.016
	[0.012]	[0.013]	[0.019]	[0.019]	[0.019]	[0.019]
Non R&D count (t)	0.009	-0.004	0.028	0.021	0.026	0.02
	[0.009]	[0.010]	[0.015]	[0.014]	[0.015]	[0.014]
Highest degree: Bachelor's (t)	omitted	omitted	omitted	omitted	omitted	omitted
Highest degree: Master's (t)	0.066	0.031	0.188*	0.134	0.172*	0.131
	[0.048]	[0.051]	[0.073]	[0.071]	[0.074]	[0.071]
Highest degree: PhD (t)	0.311**	0.130	0.196	0.120	0.134	0.100
	[0.077]	[0.092]	[0.149]	[0.140]	[0.150]	[0.140]
Demographic dummies	incl.	incl.	incl.	incl.	incl.	incl.
Carnegie classification dummies	incl.	incl.	incl.	incl.	incl.	incl.
Highest degree field dummies	incl.	incl.	incl.	incl.	incl.	incl.
HD tenure and Job tenure (t-1)	incl.	incl.	incl.	incl.	incl.	incl.
State of employment and year dummies	incl.	incl.	incl.	incl.	incl.	incl.
Observations	6315	6315	6315	6315	6315	6315

Note: Clustered standard errors in brackets. * Significant at 5%; ** significant at 1%

4.5 Discussion and Conclusion

In this study I focus on the mechanisms that predict entrepreneurial exit in the subsequent period, with a particular focus on the influence of entrepreneurial salary, job satisfaction and human capital. I use SESTAT data on over 8,000 scientists and engineers who are entrepreneurs to analyze transitions out of entrepreneurship. I find that there is a positive relationship between salary and exit, which is enhanced when including a measure for job satisfaction, while I find that there is a negative relationship between job satisfaction in entrepreneurship and entrepreneurial exit. In addition to testing average salary, I analyze the salary distribution in wage work and find an inverted u-shaped relationship between salary and exit, with those at the top and bottom of the salary distribution being those who were less likely to exit entrepreneurship in the subsequent period. On the other hand, job satisfaction and exit have a linear relationship with those having the lowest job satisfaction being the most likely to exit. When I dig deeper to gain a better understanding of how the measures of salary and job satisfaction together influence entrepreneurial exit, I find that those who are the highest performers in terms of salary and job satisfaction in entrepreneurship are less likely to exit than the underperformers who suffer both low salary and job satisfaction in entrepreneurship. The group that I find who are most likely to remain in entrepreneurship are those with high salary and low job satisfaction, while those who are most likely to exit are those with high salary and low job satisfaction. For those who exit entrepreneurship and return to wage work, I find that they are able to signficantly increase their salary but not their job satisfaction, compared to remaining in self-employment.

These insights contribute to a growing stream of research focusing on entrepreneurial exit. There is some current work in the literature that finds that underperforming firms are the ones most likely to remain in entrepreneurship, and these studies conclude that that they do so for non-pecuniary benefits. Yet these studies do not test a measure of non-pecuniary benefits and the relationship with entrepreneurial exit. I advance this work by using a measure of job satisfaction as a proxy for non-pecuniary benefits to empirically test the relationship between job satisfaction and entrepreneurial exit in the subsequent period. My findings show some support for the argument of the survival of underperforming firms for non-pecuniary benefits, in that I find that people are less likely to exit the more job satisfaction they enjoy, regardless of their salary. Second, I contribute to the literature by not only analyzing the relationships of salary and job satisfaction separately with entrepreneurial exit, but I also test them together by creating categories of whether an entrepreneur is in the top or the bottom of the wage distribution in entrepreneurship and whether they are in the top or bottom of the job satisfaction distribution in entrepreneurship. I find that it is not merely a typical fail story showing that those with low salary (and low job satisfaction) exit. It is also not a case of solely underperforming firms surviving where those with low salary (and low job satisfaction) remain in entrepreneurship and those with high salary (and high job satisfaction) exit. I find instead that those who are the most likely to exit, are those with low job satisfaction, regardless of salary. Therefore, I argue the importance of job satisfaction in predicting entrepreneurial exit.

My results also inform the literature on human capital and entrepreneurship. I argue for the importance of human capital in determining where people are positioned in

terms of not only the entrepreneurial salary distribution but also in the entrepreneurial job satisfaction distribution. Those with greater human capital as far as levels of education and R&D skills, are more likely to be in the categories with high salary in entrepreneurship. In particular those with higher R&D skills are more likley to have high salary but low job satisfaction in entrepreneurship. On the other hand, those with a higher number of non R&D skills, and who have the skill variety that Lazear (2005) says is necessary for success in entrepreneurship are more likely to be in the categories with high job satisfaction. I contibute to the skill variety literature and entrepreneurial human capital literature by finding evidence for Astebro and Thompson's (2011) hypothesis that skill variety is beneficial in entrepreneurship as a contributor to job satisfaction, rather than a direct contributor to financial success. And lastly, I reason that those who return to wage work are those who are making a decision to focus on salary, rather than job satisfaction. I argue that there is great opportunity cost to remaining in entrepreneurship if those who have specialized skills can make more money in wage work and are not gaining large non-pecuniary benefits from self-employment. This may prompt them to exit entrepreneurship to a job with higher wages, even if they are not able to increase their job satisfaction.

There are limitations to this study. First this sample focuses on the scientists and engineers, those who are highly educated and does not focus on the general population, where the exit patterns may differ. Second, my study only follows those who return to wage work and does not account for those who become unemployed after time spent in self-employment.

Even with its limitations, it is the first paper I know of to show empirically how the mix of both financial and non-financial benefits predict exit from entrepreneurhsip. This study has implications for future research, in that future studies that focus on entrepreneurial exit should account for not only finanical but also non-financial performance. Studies focusing only on entrepreneurship in terms of finanical factors and do not include non-financial components are overlooking a large piece of the puzzle.

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VITA

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Briana Sell attended the University of Georgia, where she graduated in 2009 with a B.A. in Economics. Following graduation, Briana served as an intern for the Council for Quality Growth where she worked on economic development for the Metro Atlanta Region while pursuing a Master's in Public Policy, with a focus on Economic Development at the Georgia Institute of Technology. In the summer of 2010 she interned for the U.S. Department of State at the U.S. Embassy in Athens, Greece in the Economics Section before joining the Strategic Management PhD program.

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When she is not working on her research Briana enjoys swing dancing, travelling, and spending time with friends and family.