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Predicting Education-Job Mismatch and Its Consequences for A Cohort of American Workers

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Abstract

This paper considers the income and health consequences of education-job mismatch for a cohort of workers. Education-job mismatch is common, but there is little research on how it is related to outcomes for workers. This study uses longitudinal data from the U.S. Panel Study of Income Dynamics (PSID) to examine education-job mismatch over a significant portion of the work life course – early career, between ages 25 and 35, and mid-career. Findings suggest that gender, race/ethnicity, and occupational sector are important predictors of experiencing education-job mismatch. Men, African Americans, and workers in office-administrative occupations were more likely to experience mismatch. Overeducation was associated with poorer health and lower income levels, whereas undereducation was only related to poorer health. The health and income of those who were matched at one time was more like the outcomes of people matched at both time points, suggesting penalties associated with longer periods of mismatch.

Keywords: overeducation, undereducation, education-job mismatch, overqualification, underqualification

Summary for Lay Audience

Most individuals hope to work in a job that utilizes their skills well; however, not everyone is able to achieve this. A recent university graduate may be frustrated after being forced to take a job waiting tables after unsuccessfully applying for jobs that would use their degree. A long-time manual labourer may feel overwhelmed after being promoted to management. Individuals who have a disconnect between their skills are defined as being mismatched between their job and skills. Unfortunately, it is almost impossible to measure every skill a person has so this paper instead uses education to stand in for skills. The experience of having more or less education than one's job requires can be stressful and can negatively affect one's income.

Conceptualizing a person's work life as a pathway, which individuals are most likely to end up on a path that includes being mismatched with their job with respect to their level of education? Is it possible to move from a mismatched path to a matched one and conversely, are matched people at risk of becoming mismatched? What are the effects of mismatch at different points on people's income and health at mid-life? This paper examines data that follows a representative group of the U.S. population to observe individuals at two points in their life to answer these questions.

A person's level of education and the occupational sector they work in are strongly associated with if and when they experience mismatch. African Americans are more likely than white people to start their career matched and then become mismatched. In terms of outcomes, the negative effects of mismatch seem to only appear for those who are mismatched at both times. Having more education than is required at both times or having too much and too little education at different points is associated with lower

income. Having more education than required by the job at both observed time points is also associated with being in good rather than very good or excellent health. Having less than required schooling at both times is associated with being in fair or poor health.

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Chapter 1

Introduction

Education-job mismatch, defined as having too much or too little education for one's job, has received a lot of attention as rates of post-secondary education have increased in both the United States and Canada. Part of the story of education-job mismatch involves the increasing proportion of 18–24-year old's attending post-secondary institutions over time; in the United States, in 2019, 40% of this age group was enrolled compared to 25% in 1970 (National Center for Education Statistics 2020). Canada has also seen a growth in enrolment in post-secondary institutions from 1.35 million to 2.05 million students between 2000 and 2017 (Statistics Canada 2018), compared to fewer than 400,000 Canadians enrolled in post-secondary institutions in 1980 (Association of Universities and Colleges of Canada 2011). This growth in the supply of educated individuals has not been met with an equivalent demand for them in the labour market (Green and Henseke 2016).

Both undereducation and overeducation are often not addressed or appear as an afterthought in studies of the effects of labour force participation on workers; however, overeducation may result in less income than those with the same level of education who are matched, reduced job satisfaction, and adverse health effects. Research has found some evidence of the negative mental health effects of overeducation, but investigations of physical health effects have provided mixed evidence (McKee-Ryan and Harvey 2011). Mismatch can impact health through its role as a stressor, through income, or through job satisfaction. Mismatched workers may also feel like they are not receiving the rewards they deserve based on the effort and investment they put into their education.

At a societal level, economists also point to overeducation as underutilizing human capital; it may also indicate that a society is over-incentivizing education. Even less is known about the impacts of undereducation on workers. Undereducated workers may feel deprived if they earn less than their coworkers, which may have long term impacts on health.

This paper used data from two waves (1997 and 2017) of the Panel Study of Income Dynamics (PSID) to investigate education-job mismatch among a cohort of workers. I investigated mismatch at two points in the work life course – early career, when workers were between ages 25 and 35, and mid-career (20 years later). Workers' mismatch status at both time points was used to capture possible pathways through their careers. Factors associated with patterns of mismatch across the two waves were examined to determine how mismatch is distributed in the population. Next, income and health effects of experiencing mismatch at early, mid-career, or both were considered to determine if the timing of mismatch differently affects income and health at mid-career compared to an ideal, matched path. This study is the first to investigate how the timing of mismatch may lead to unique effects on a person's income and health. The question of whether people remain stuck in mismatch or are able to exit that state is a key feature of the pathways that are identified and analyzed.

Overview of Thesis

This thesis examines education-job mismatch among a cohort of U.S. workers to investigate who is most as risk of mismatch, and how that mismatch may affect their lives. Chapter 2 reviews existing literature on education-job mismatch and some of its consequences. First, definitions and prevalence of mismatch are considered, as well as

theories of why mismatch exists from both economic and sociological literatures. The overrepresentation of certain subgroups of the population in mismatched jobs is a key area of focus. The Life Course perspective is introduced to better understand mismatch in the context of people's lives and as a pathway people may be exposed to. Life course theory has not explicitly been used to examine education-job mismatch, although some studies have touched on relevant concepts. Next, the literature on the potential income effects of mismatch is reviewed, as are theories that predict difference in income based on match status. Finally, the potential ways that mismatch may affect health are reviewed, as well as evidence for this relationship.

Chapter 3 presents the sample and the methodology used in all sections of this thesis, as well as the results of multivariate models addressing my research questions. I first use multivariate multinomial logistic regression to predict the probability of being in each of the 6 possible match/mismatch paths across the two waves. Next, a multivariate ordinary least squares regression is used to examine the relationship between logged income in 2017 and match pathways. Finally, multivariate multinomial logistic regression is used to predict the probability of being in one of three health status groups in 2017 based on match pathways.

Chapter 4 reviews the findings within the context of existing literature and considers how these results fit into the broader societal context. Limitations and directions for further research are also discussed.

Chapter 2

Definition and Prevalence of Education-Job Mismatch

Although a person can be mismatched with their job on many dimensions, including time, geography, earnings, education, and skills (Kalleberg 2007), in this paper I focus on education-job mismatch. Education-job mismatch occurs when an individual works in a job that is in misaligned with their education. This can result from a lack of credentials, a surplus of education, or education in a field unrelated to their current job. The two main kinds of education-job mismatch are vertical and horizontal. Vertical mismatches occur when an individual's level of schooling is either more or less than what is required for their job. In contrast, horizontal mismatches occur when a worker's post-secondary field of study is unrelated to their job. Much of the research on education-job mismatch has focused on overeducation, which is a type of vertical mismatch that occurs when a person is employed in a job that requires less education or experience than the person possesses (Feldman 1996). Overeducation is also considered a type of overskilling, although overskilling is not always due to surplus education and can instead be due to having more work experience than is required by the job (Allen and Weert 2007). There is less research to date on undereducation, which involves workers with less formal education than is required (or is the norm) for the position they hold. This paper will address vertical mismatch in both directions (under and overeducation). Throughout the literature review, different terms will be used to reflect the terminology used in the particular research being referenced, but generally the terms overeducated and undereducated are used to convey the different types of vertical mismatch.

Methods of measurement vary in the literature on education-job mismatch. Broadly speaking, mismatch can be assessed through either objective or subjective measures. *Objective mismatch,* which is sometimes referred to more broadly as *overeducated or overqualified*, is conceptualized as occurring when employment does not fully utilize skills or education, and is often measured by comparing the skills classification of a job to a person's level of education (Hartog 2000). This type of *job analysis* method is costly and time consuming (Hartog 2000). Duties performed by those with the same job title may vary between companies, which further complicates job analysis. Another form of measurement of objective overqualification compares a worker's level of education to either the mean or modal level of education in their field. This method is sometimes referred to as *realized matches* (Hartog 2000). It is perhaps the most common method as it can be done with pre-existing data.

In contrast, *subjective or perceived mismatch* is assessed by asking individual workers whether they feel qualified for their job or whether their job is above or below their level of skill or experience (Maltarich, Reilly, and Nyberg 2011). Alternatively, they may be asked what level of education is typically required to perform their job. While these concepts are different, they are also related. Objective mismatch has been found to predict perceived or subjective mismatch (Arvan et al. 2019). However, some workers who are objectively matched may still feel under or over challenged by their work (Rohrbach-Schmidt and Tiemann 2016). Studies typically only measure either objective or subjective mismatch, they rarely consider both. Overall, variations in measurement across studies makes it difficult to compare the rates of education-job mismatch in the

population, and this is complicated by the fact that the level of education required to get a job is not necessarily the amount of education required to perform the job.

Despite these measurement challenges, the experience of being overeducated or overqualified is widely understood to be common throughout the developed world. Much of the existing research focuses on individuals who complete post-secondary education, as a higher level of schooling allows more opportunity to be overeducated. In North America rates of post-secondary education are high, with graduates making up 32% of the U.S. and 30% of the Canadian labour force (Green and Henseke 2016; Li et al. 2006).

There is a wide range of overeducation across countries, with rates of objective overeducation among university graduates ranging from approximately 10 percent in Finland to almost 50 percent in Japan (Green and Henseke 2016). The United States and Canada fall somewhere in the middle. The U.S. has the seventh highest rate of overeducation, with nearly a third of people with post-secondary education working in a job that did not require it, with Canada ranking third at 37% (Green and Henseke 2016). The phenomenon of overeducation is experienced by people who studied a wide array of subject areas in their post-secondary education. For example, in Canada, those who studied health or science related fields face an overeducation rate of around 20 percent, compared to a rate of 37 percent for commerce and 32 percent for arts and social sciences (Li et al. 2006). There is little research on those who study to enter into the trades or in professional programs that are tied more directly to a career, although there is some indication that programs that are closely tied to particular careers have fewer mismatched employees (Bol et al. 2019) and that members of the trades have lower levels of mismatch due to lower level of education overall (Capsada-Munsech 2017). Additionally,

countries where education is more strictly streamed with established vocational tracks have lower rates of education-job mismatch (Bol et al. 2019; Flisi et al. 2017).

Research suggests that economic downturns also lead to more overeducation (Turmo-Garuz, Bartual-Figueras, and Sierra-Martinez 2019). Under conditions of greater labor market insecurity, individuals may be more willing to take a job for which they are overqualified (Turmo-Garuz et al. 2019). Levels of overeducation also have consequences for the rest of the labour market. When a job does not require post-secondary credentials but people with post-secondary credentials apply, otherwise qualified candidates may not be hired because they appear less qualified (Ghaffarzadegan, Xue, and Larson 2017). This process further incentivizes others to pursue higher education even in light of a shortage of jobs that truly require those skills (Ghaffarzadegan et al. 2017). This perpetuates a cycle that increases educational attainment and overeducation, and in fact, the rates of overeducation in the U.S. have been increasing over time net of economic conditions (Kalleberg 2007; Vaisey 2006). Overqualification increased from 1972-2002 at a rate that was four times greater than the unemployment rate (Vaisey 2006). Over the time period of the study, the average level of education increased by 1.75 years, but the average required amount of schooling only increased by 0.33 years (Vaisey 2006). There is some evidence that jobs have experienced skill upgrades as higher education has expanded (Livingstone 2009), but most of the increase in required post-secondary credentials has occurred in service and industrial sectors (Livingstone and Raykov 2019).

Research on undereducation is harder to find. Some studies of overeducation also include undereducation figures, but not all. Using biannual PSID data from 1976 and

1985, one study found that undereducation became more common by the second time point, with 21% of men and 17% of women undereducated by 1985, up from 16% and 11% in 1976 (Daly, Büchel, and Duncan 2000). However, more recent analysis also using PSID data found that by 2005 only 9% of the sample was undereducated (Tsai 2010). Other data from the U.S. General Social Survey shows an undereducation rate of 7.2% for the period 1993-2002 (Kalleberg 2007). In Canada, 18% of employees were underqualified for the jobs in both 1983 and 2004 (Livingstone and Raykov 2019).

Theories of Job Allocation

To explore the consequences of education-job mismatch, one must first consider theories about why mismatch occurs. Economists are the drivers behind this field of research and suggest four major theories about how people obtain their job. Some of these theories consider education-job mismatch a temporary phenomenon for individuals, while others view it as structural and therefore more permanent. First, *Search and Match* theory asserts that mismatch is a problem of imperfect information (Voon and Miller 2005). Individuals search for jobs they match to, but their inability to know everything about a job may lead them to take a job for which they are overeducated (Hartog 2000). Undereducation occurs when employers think they have found a matched candidate, but their information is also imperfect. Search and Match theory sees mismatch as a temporary state as employees will move, or be forced to move, to new jobs that match their level of education (Voon and Miller 2005). Second, *Human Capital Theory* (Becker 1994) considers education to be only one piece of human capital that may allow someone to get a job. Employees who are mismatched with respect to their education may, in fact, be matched to the job based on other human capital factors such as prior job experience,

on the job training, or intelligence (Voon and Miller 2005). Thus, any actual mismatch between worker ability and job demands will be rectified through adapting job requirements or the individual finding a new position (Hartog 2000; McGuinness 2006).

Other theoretical models consider mismatch to be structurally embedded in the historical conditions of the labour market, rather than a temporary characteristic of individuals. *Job Competition Theory* (Thurow 1975) emphasizes the role of on-the-job training. Since all new employees require training, worker qualifications signal how trainable they are rather than how qualified (McGuinness 2006). The most highly educated people are selected for jobs with the most required training and the availability of workers and jobs determines what level of education is most desirable for an employer (Sicherman 1991). In contrast, *Assignment Theory* (Sattinger 1993) posits that individuals choose a job or sector of employment and then obtaining a job is about an equilibrium point between available jobs and those seeking work (McGuinness 2006). First, the most skilled workers are matched to the most complex jobs in the labour market, then less skilled workers are allocated to jobs with lower requirements (Hartog 2000). There is no specific level of education required to obtain a particular job, rather, the distribution of education in the population is what determines the level of education that will be matched to particular jobs. If the most skilled available worker has an undergraduate degree, they will obtain the most skilled job even if the job would ideally require a graduate degree.

Some sociological theories attempt to explain education-job mismatch through the role of credentials. Rather than split education into different streams that align with particular occupations, as is done in France or Germany, the American educational system is a hierarchy with no defined end, with the value of completing a certain level of

education not found in the knowledge or training gained, but in the access it provides to the next level of education (Collins 1979). This hierarchy was established as higher education expanded and became more sensitive to consumer demands than to public interests (Larabee 1999). Since credentials can be used to gain access to better jobs in the labour market, the desire for social mobility or status maintenance leads to an oversupply of credentials and credential inflation (Larabee 1999). This endless pursuit of labour market advantage combined with structural incentives for educational expansion in educational institutions and labour markets inevitably leads to over-credentialing in the population (Bol et al. 2019; Larabee 1999). Credential theories suggest that there will be growing overeducation at the population level as people seek additional education to obtain advantage in the labour market.

Distribution of Education-Job Mismatch in the Population

Education-job mismatch is not distributed evenly throughout the population and mirrors other labour market inequalities. Capsada-Munsech (2017) proposes that overeducation is another type of labour market stratification, with less privileged individuals more likely to become and remain overeducated. Like other forms of stratification, demographic factors both shape the risk of exposure and the subsequent outcomes. For example, age is associated with the likelihood of being overeducated, with some research suggesting that older workers have a decreased risk of overeducation (Leuven and Oosterbeek 2011). Other research, however, finds that older workers are more likely to be overeducated (Ghignoni and Verashchagina 2014). This discrepancy likely reflects the confounding of age and cohort differences. Today's older workers are from cohorts who saw increases in technology and educational requirements during their

time in the labour market, which likely contributed to higher rates of undereducation (Kalleberg 2007). Other research supports this interpretation, with findings from 1972 data showing younger workers more likely to be mismatched; however, by 2002, age was no longer a significant predictor of match (Vaisey 2006). This relationship also may vary by level of educational attainment, with at least one recent study finding no relationship between age and match for recent university graduates (Boudarbat and Chernoff 2010).

Gender inequalities in the labour market also suggest ongoing differences in the risk of mismatch. Historically, women were less educated than men, but, in the United States, by 2015 a similar percentage of women over 25 held Bachelors degrees as men of the same age, and a higher proportion of women had attended college than men (Ryan and Bauman 2016). Despite the closing of this educational gap, women with children still have less attachment to the labour market and remain more likely than men to leave the labour market either temporarily or permanently (Hynes and Clarkberg 2005). Women's high levels of educational attainment combined with gender differences in childrearing responsibilities may create a greater risk of overeducation for women. And indeed, research suggests that women with young children at home are more likely to be overeducated (Sloane, Battu, and Seaman 1999). In addition, women's labour market participation is influenced by their husband's careers, which also has the potential to lead to a greater risk of overeducation (Feldman 1996). Women may be limited to the same geographic labour market as their husbands or may be limited to part-time work, both of which might affect their ability to find employment that matches levels of educational attainment.

Alternatively, other research suggests that women may be less likely to be overeducated, as they may leave the labour force if they do not find matched employment (Groot 1996). Several studies found no association between rates of overeducation and gender (Boudarbat and Chernoff 2010; Harari, Manapragada, and Viswesvaran 2017; Johnson and Johnson 1996; Li et al. 2006), while another large panel study did find evidence that women are more likely to be overeducated (Verhaest, Sellami, and van der Velden 2017). Research using data from the U.S. GSS suggests that men are more likely to be undereducated (Kalleberg 2007), with marriage increasing the likelihood of being undereducated (Sloane et al. 1999). Overall, the relationship is likely complex and varied according to life stage and stage of career, with research suggesting that women's rates of overeducation only differs from men's at certain points in their careers; women were more likely to be overeducated one year after graduation, but by six years after graduation the gender gap closed (Battu, Belfield, and Sloane 1999).

Research suggests that visible minorities are also more likely to experience both under and overeducation (Kalleberg 2007; McKee-Ryan and Harvey 2011; Sicherman 1991). In addition, there is some evidence that immigrants are much more likely to overeducated (Banerjee, Verma, and Zhang 2019; Capsada-Munsech 2017; Hultin et al. 2016; Li et al. 2006), with employment outside of ethnic enclaves increasing the likelihood of overeducation (Battu and Sloane 2002). Higher rates of overeducation among immigrants and members of visible minority groups may be the result of structural racism and discrimination within the labour market, as well as the devaluing of foreign credentials (Battu and Sloane 2002; Bauder 2003). Indeed, research indicates that foreign credentials are more likely to be devalued when they are possessed by visible

minority immigrants (Li 2008), as is foreign work experience (Oreopoulos 2011).

Research in the European context shows that immigrants have a higher risk of both

overeducation and undereducation based on quality of human capital from their country

of origin, but that the risk of both types of mismatch declines after twenty years in the

host country's labour market (Aleksynska and Tritah 2013). Undereducation is most

common among immigrants who come from countries that are poorer relative to their

destination country and who have less than secondary education (Aleksynska and Tritah

2013). Citizenship, speaking the host country's language at home, and a common

colonial past help decrease the risk of undereducation for immigrants, while higher

unemployment rates in a country increases the risk of undereducation (Aleksynska and

Tritah 2013).

　　　　Likelihood of overeducation and undereducation are also shaped by other factors

such as social class and occupational location. Research suggests that social capital may

play a role in finding work appropriate to one's skill level, with individuals with less

educated parents more likely to end up overeducated (Capsada-Munsech 2017; Turmo-

Garuz et al. 2019) and individuals with high parental SES more likely to become

undereducated (Wiedner and Schaeffer 2020). Also related to social class, research

suggests that program or university quality and level of educational attainment affects the

likelihood of overeducation, with graduates of more prestigious schools less likely to be

overeducated and those holding above a bachelors degree having a greater change of

being matched (Verhaest et al. 2017). In addition, there is some limited research on the

relationship between sector and match, with workers employed in the services sector

more likely to be overeducated than those working in other areas of the labour market

(Congregado et al. 2015; Weststar 2011) and their likelihood of being overeducated is

increasing (Livingstone and Raykov 2019). Professionals are most likely to be matched

with over 60% of this group matched in a 2004 survey (Livingstone and Pankhurst 2019).

Pathways and Duration

Our understanding of the effects of education-job mismatch can also be enhanced

by using concepts from a Life Course perspective. The principles of timing and historical

time and place help determine what questions should be asked to understand the

stratification and experience of education-job mismatch. The principle of timing

highlights that the effect of an event or transition will depend on when it occurs in an

individual's life (Elder, Johnson, and Crosnoe 2007). For example, the age at which an

individual finishes school and begins looking for a job may shape their ability to find

matched work. In addition, the stage of the work life course in which the mismatch

occurs may also affect its subsequent relationship to income and health.

The principle of time and place emphasizes that broader macro-level factors and

their change over time, such as how closely aligned educational systems are with labour

market requirements, shape the likelihood of education-job match. Structural factors,

such as graduating with a degree in a field that is saturated or entering the labour force

during an economic crisis, are more likely to lead to searching for work in other fields

and to taking a job that requires less education than one possesses (Montt 2017). Other

macro-level factors related to country and political context affect the chances of

transitioning out of overeducation. For example, whereas Scandinavian countries do not

appear to have rigid pathways that keep people in positions for which they are

overeducated (Frei and Sousa-Poza 2012; Meroni and Vera-Toscano 2017), other

European countries including Germany, Spain, and Czech Republic have systems that trap people in overeducation (Meroni and Vera-Toscano 2017). Individuals in countries with stronger employment protections are more likely to be undereducated, possibly because these countries offer more on-the-job training or screen for characteristics in addition to education (Aleksynska and Tritah 2013).

The Life Course perspective also pays particular attention to transitions as part of larger employment trajectories. Transitions into and out of mismatch, and the duration of time spent in a particular state, are key for understanding its long-term effects. However, much of the existing literature does not directly address these questions of timing and duration. A key question regarding the association between education-job mismatch and outcomes such as income and health has to do with its role as a part of a larger employment pathway, including whether it represents a transient or permanent phenomenon. There are some clues to the importance of these dimensions from the limited body of existing research that considers the process through which a person become mismatched in their employment and whether the mismatch is reversable.

For example, Canadian research considering mismatch as part of a longer-term employment trajectory shows that 30 percent of workers were overqualified at some point during a six year period, with 20 percent overqualified for the entire period (Li et al. 2006). This study distinguished between the seldom overqualified, who were underemployed for less than 50 percent of the time, and the chronically overqualified who were underemployed between 50 and 99 percent of the time (Li et al. 2006). They also found that older workers were more likely to remain overqualified than younger workers, a finding that likely in part reflects cohort differences discussed earlier (Li et al.

2006). In a different country context, a study from Australia found that over the course of a four-year period, only one in five overskilled workers obtained a job that adequately used their skills, while another one in five individuals who were previously matched obtained a job that did not match their skills (McGuinness and Wooden 2009). Mismatched Australians were twice as likely to be unemployed the following year than matched individuals, but on the flip side, nearly half of the mismatched became matched in the following year (Mavromaras, Sloane, and Wei 2015).

Some research has investigated mismatch from the perspective of both employers and employees to help understand the process through which individuals enter or exit this state. A field experiment and survey by Pedulla (2016) found that among college-educated applicants, being overeducated and horizontally mismatched was as damaging to chances of getting an interview as being currently unemployed. Employers viewed such applicants as less competent and, for male applicants, less committed (Pedulla 2016). In contrast, for those entering the labour market, there may be a preference for overeducated individuals, as their greater education may indicate they are more easily trained (Di Stasio 2017). In interviews with US hiring managers, just over half agreed that on the job experience can substitute for formal educational requirements which would facilitate undereducation (Kulkarni, Lengnick-Hall, and Martinez 2015).

From the perspective of workers, some may intentionally take jobs for which they are overeducated because they are hoping to be promoted more quickly and to learn skills that may be useful for subsequent jobs (Sicherman 1991). Indeed, there is some evidence suggesting that overeducated workers are more likely to be promoted, particularly among people early in their careers (Grunau and Pecoraro 2017). Overeducated individuals may

also see larger wage growth associated with promotions than matched workers (Grunau and Pecoraro 2017). Alternatively, people may choose mismatched jobs because of benefits outside of the work itself, such as allowing greater control over work-life balance (Maltarich, Nyberg, and Reilly 2010). Although one recommendation for avoiding overeducation is to spend more time looking for a job rather than accepting one below one's level of qualification, the ability to do that mirrors other forms of inequality related to race, class and gender, as there are structural differences in the ability to take time out of the labour market to do so (Meroni and Vera-Toscano 2017).

Mismatch and Income

When exploring the relationship between mismatch and income, most theory comes from economists' work on how human capital is rewarded in the labour market. Human Capital theory asserts that a worker is paid relative to their amount of human capital (Becker 1994). This implies that more education should lead to higher wages regardless of the job. Job Competition theory argues the opposite, that wages are determined by the characteristics of the job rather than any characteristic of the individual (McGuinness 2006; Thurow 1975). This would mean that workers with the same job should be paid the same regardless of the amount of education they have. One study found support for both theories but at different ages, with the wages of workers under 35 determined by their level of education, as predicted by Human Capital theory, and the wages of workers over 35 based on the job, as predicted by Job Competition theory (Iriondo and Pérez-Amaral 2016). Assignment theory argues that both individual and job characteristics are considered when wages are determined (McGuinness 2006).

The most immediate impacts of education-job mismatch can be seen in wages and experiences of mismatched workers. Studies find that people who are overeducated face a wage penalty when compared to those with the same level of education (Green and Henseke 2016; Korpi and Tåhlin 2009; Montt 2017; Verhaest and Omey 2006). Overeducated people also face slower wage growth than those with matched levels of education (Büchel and Mertens 2004). Korpi and Tåhlin (2009) found evidence that once overeducated, individuals are not able to make up for this wage penalty throughout their careers. However, not all studies have found support for a wage penalty associated with overeducation. Several studies found that accounting for unobserved heterogeneity of the sample caused wage differences to shrink or to become non-significant (Bauer 2002; Mavromaras et al. 2013; Tsai 2010), while others using panel data found that university-educated women experienced a wage penalty to overeducation net of unobserved heterogeneity (Mavromaras, Sloane, and Wei 2012). Part of this unobserved heterogeneity relates to difference in workers' abilities, and including measures such as mathematical problem solving ability decreased the wage penalty of overeducation, but did not eliminate it (Levels, Van Der Velden, and Allen 2014).

Research also suggests that those who are undereducated earn less than their matched colleagues, but more than their similarly educated peers who are in matched jobs (Alba-Ramirez 1993; Iriondo and Pérez-Amaral 2016; Wiedner 2021). The wage premium associated with being undereducated compared to being matched at a lower level, however, may only appear after some time on the job and grow with tenure (Verhaest and Omey 2012). Overall, data from the PSID show a wage penalty for undereducation even once heterogeneity is accounted for (Tsai 2010), however, the

penalty for being undereducated is smaller than the premium for being overeducated (Hartog 2000). In addition, when undereducated employees are promoted, they experience less wage growth than matched employees who are promoted (Grunau and Pecoraro 2017). Overall there is much inconsistency in the literature, with some research suggesting that mismatched individuals earn less than matched individuals with the same education level, while other studies suggest that the mismatched earn more than others working in the same job who are matched (Erdogan et al. 2019; Green and Henseke 2016; Wiedner 2021).

Mismatch and Health

But how does education-job match relate to individual experiences, such as health and well-being? Research suggests that overeducated individuals fare worse on measures of well-being, exhibiting lower average levels of life satisfaction (Frank and Hou 2018; Wassermann, Fujishiro, and Hoppe 2017). This could be due in part to the relationship between overeducation and job characteristics. Generally, people with higher levels of education are more likely to be employed in jobs that challenge them intellectually and provides greater autonomy (Qiu, Bures, and Shehan 2012). For those who are overeducated, it is possible that they may not receive the benefits of job characteristics more likely to be found in better jobs associated with higher levels of education.

However, both over and undereducation can be thought of as forms of status inconsistency, which is defined as being at different levels in separate social hierarchies. Status inconsistency has also been linked to outcomes such as lower self-rated health (SRH) (Zhang 2008). In the workplace, individuals who occupy different positions across social hierarchies may face conflicting expectations. For example, a manager who is less

educated than their employees may be uncomfortable evaluating an employee's work. Thus, workers exposed to status inconsistently may face conflicting expectations, which leads to stress. Some have theorized that situations involving status inconsistency could lead to self-blame or withdrawal from society (Lenski 1954). Although the early literature on status inconsistency included mixed results and the eventual abandonment of the concept among sociologists, several recent papers have provided evidence for its continued usefulness in understanding social phenomena, including education-job mismatch (Wiedner 2021; Zhang 2008).

Research suggests that individuals experience or notice this inconsistency as a form of relative deprivation. People do not make objective judgements about their circumstances (Erdogan and Bauer 2009) but instead they make comparisons to some real or imagined ideal situation (Feldman, Leana, and Bolino 2002). If a person feels entitled to something, but they are unable to get it, they will have a negative reaction (Gurr 1970 as cited in Erdogan and Bauer 2009). In the case of overeducation, a person may feel they should have a better job because they invested in their education. Relative deprivation theory can be helpful when trying to understand why people are not satisfied with circumstances that seem objectively adequate, as an individual's interpretation of the situation may be more pertinent to how they react to it than objective examinations. Individuals' perceptions of relative deprivation have been found to negatively affect physical and mental health (Mishra and Carleton 2015). In this case, wage differences between mismatched people and their matched colleagues, as well as differences compared to their similarly educated matched peers, may cause feelings of relative

deprivation. Wage differences can also lead to direct effects on health as income is considered a fundamental cause of health (Link and Phelan 1995).

Undereducation has rarely been studied outside of its effects on wages. One of the only studies to examine this type of mismatch is a Swedish study that uses the demand-control model of work stress to conceptualize underqualification as lack of resources to cope with work demands (Stenfors et al. 2013). The demand-control model was developed by Karasek (1979) and proposes that an employee with many responsibilities and little ability to decide how their job is done will experience job strain. Job strain, not work demands alone, is what causes stress and negatively affects health (Karasek 1979). In contrast, when individuals have both the autonomy and resources to manage the demands of their job, they do not experience strain (Karasek 1979). The Swedish study of undereducation finds in both cross-sectional and prospective analyses that perceived underqualification is positively associated with cognitive complaints, defined as self-reported difficulty with focus, memory, decision making, or clarity of thought (Stenfors et al. 2013).

Overall, education-job mismatch may affect people's health through its role as a stressor. Literature on the Stress Process Model provides some insight on its potential long-term effects. While stress will activate processes in the body that can lead to poor health over time, people do not respond to stress in the same way even if they experience identical stressors. These differential responses are conceptualized in both Stress Process theory (Pearlin et al. 1981) and in discussions of allostatic load (McEwen and Stellar 1993). Stress Process theory asserts that a when person experiences a stressor, either acute or chronic, it does not lead directly to ill health. Instead, people use the personal

resources of self-esteem and mastery as well as social support and coping techniques to face stressors (Pearlin et al. 1981). The effect of a stressor will depend on how a person is able to mobilize their resources to respond to it. Allostatic load is the toll taken on the body by the activation of the body's stress response (McEwen and Stellar 1993, p, 2093). Stress causes the body to activate the hypothalamo-pituitary-adrenal (HPA) axis; chronic exposure to stress can lead to improper regulation of the HPA axis and can damage the brain (McEwen and Stellar 1993). The dysregulation of the HPA axis leads to problems in other biological systems which cause physical and mental health problems (Ganster and Rosen 2013).

The mental health toll associated with the stress of education-job mismatch has been documented. Overeducation has been linked to higher levels of depressive symptoms (Bracke, Pattyn, and Von dem Knesebeck 2013; Dudal and Bracke 2019; Wassermann and Hoppe 2019). It has also been linked to psychological distress (Johnson and Johnson 1996). Research on the relationship between physical health and overeducation also suggests that it is important. Studies have linked overeducation to poorer self-rated health (Hultin et al. 2016), an increased risk for decline in self-rated health (Smith and Frank 2005), increased risk of ischemic heart disease and other chronic diseases (Friedland and Price 2003; Peter, Gässler, and Geyer 2007), stroke (Honjo et al. 2014), and increased risk of work-related injuries (Premji and Smith 2013). One study also finds excess mortality among consistently overeducated Swedish workers (Garcy 2015). However, not all results are consistent, with other research finding no association between overeducation and other health indicators, such as all-cause mortality or mortality from cardiovascular diseases (Smith et al. 2012).

Research suggests that the association between undereducation and health is dependent on level of education, with the health of undereducated workers more similar to the health of people doing the same job rather than individuals with the same level of schooling who are matched with their job (Korpi and Tåhlin 2009). Undereducation was associated with an increased risk of poorer SRH at follow-up in a Swedish panel study, but being matched in the same occupational class had a similar increased risk; the authors theorize that health risks associated with low-skilled occupations are not shaped by an individual's education level (Hultin et al. 2016). Having low levels of education in a high status occupation almost doubled the risk of cardiovascular disease among men in a German study (Braig et al. 2011). In contrast, other studies of undereducation suggest it may be protective of health in certain contexts. For example, a Canadian study found reduced mortality from cardiovascular diseases (Smith et al. 2012) associated with undereducation, and a Swedish study found a reduced risk of all cause mortality (Garcy 2015), but the mechanisms behind these relationships are not clear.

While there is indication from previous research that a mismatch between education and employment has effects on both income and health, findings are often not consistent or in the same direction. Mixed results could be due to factors such as the timing and duration of the mismatch, and at what life stage both match and outcomes are measured. Incorporating this context is therefore a key motivation of the present study.

Research Questions

Previous studies have not explicitly considered the issue of education-job mismatch as part of an individual's employment pathway across the work life course - or how the timing or duration of mismatch may change the association between

experiencing a mismatch and mid-career outcomes, such as health and income. In this analysis, match status at two time points is used to construct six different match profiles that capture the intersection of timing (early vs mid-career) and duration (ranging from matched at both waves to mismatched at both waves). First, I examine what type of workers are more likely to experience the various match profiles, and then I use the profiles as independent variables predicting income and health. I ask the following questions.

1) To what extent is education-job mismatch stratified in the population, and what demographic factors are associated with the timing and persistence of mismatch? Based on what we know about educational differences and labour market participation, I expect that women, visible minorities, and immigrants will be more likely to be mismatched. We do not know, however, if there are differences in timing (early-career, mid-career) or duration (persistence) of this status. Based on the influence of childrearing on women's labour force participation, I expect to find that women are more likely to be matched later in their careers, during the life stage when they are less likely to have childcare responsibilities limiting their employment. I expect visible minorities to be more likely to remain unmatched across the period if their mismatch is due to discrimination, and immigrants to be more likely to be matched later in their career once they have had more time to integrate into the host country's labour market.

2) How does mismatch experienced in early and/or mid-career affect mid-career earnings? Previous research suggests that overeducation has a negative effect on income, but less is known about how issues related to the timing and duration of overeducation or undereducation set the context for earnings later in the work life course. Based on

existing literature, I expect that mismatched individuals will have lower income at mid-career, and that mismatch experienced mid-career will be particularly harmful. I also suspect that persistent mismatch will be more detrimental to earnings than being mismatched at only one wave.

3) Finally, I ask how does the timing and duration of mismatch relate to self-rated health? Is long-term mismatch experienced at both waves more damaging than mismatch experienced in early career? Previous research suggests overeducation might be associated with poorer health, thus I expect that being mismatched at both the first and second observation points will more strongly impact SRH than only being mismatched only at time one.

Chapter 3

Methodology

Data and Sample

This analysis used data from the U.S. Panel Study of Income Dynamics (PSID), a publicly available longitudinal data set that began in 1968 with a nationally representative sample of approximately 4,800 households interviewed annually until a biannual design was introduced in 1997 (PSID 2019). The survey extended governmental efforts to assess poverty and therefore oversampled low-income families. Children from households in the original sample formed a new PSID household when they moved out. Those households were included in the sample and by 2017, over nine thousand families were interviewed (PSID 2019). Because it is a household survey, data on employment and other variables are available for the head of household and spouse (if applicable). From the beginning of the survey, men were assumed to be the head of household in heterosexual couples; a

woman was only the head of household if she was unmarried. In 2017, this was changed to reflect changes in family structures, with the interviewee denoted as the reference person and the gender of their spouse gathered (if applicable).

Because new units of analysis were only created by a sample member leaving to begin their own household, immigrants were not automatically captured by the survey design. To address this, immigrant families were added to the sample at two time points, with approximately 500 immigrant families added to the sample in 1997 and another 615 added in 2017 (only 452 gave interviews) (PSID 2019). These additions allow the survey to remain representative of the American population.

The PSID was chosen for its longitudinal design and richness of its employment and health data. Its initial over-sampling of lower income households may be beneficial as overeducation may be more common for people whose parents had less education (Capsada-Munsech 2017; Turmo-Garuz, Bartual-Figueras, and Sierra-Martinez 2019; PSID 2019). Its inclusion of immigrants is also valuable as they are more likely to face education-job mismatch (Capsada-Munsech 2017; Hultin et al. 2016; Li et al. 2006).

The analysis focused on a cohort of employed individuals between the ages of 25 and 35 in the 1997 survey wave. This time frame was chosen to capture the beginning and early stages of individuals' careers and to allow for the completion of educational attainment for most. The second time point, 2017, was chosen to capture this cohort of workers when they were between the ages of 45 and 55, a point in their work-lives when they were mid-career. Beginning with the 1997 survey wave allowed for the inclusion of the immigrant sample, and 2017 was the most recent publicly available data release at the start of this analysis.

Retrieving data from the PSID website for both survey waves yielded a sample of 10,601 people who were either a head of household or spouse in either survey wave. Restricting the sample to those present in both 1997 and 2017 produced a sample of 5,611 adults. Attrition is part of what led to individuals not being present in both waves of the survey; however, new household formation, or inclusion in the case of the 2017 immigrant refresher sample, also contributed to the number of cases present only in one wage. Excluding cases with missing data on education, occupation, or health measures in either wave reduced the sample to 5,318 individuals. The sample was further restricted to the age cohort of interest (N=1,545) and to employed individuals, resulting in a final analytic sample of 1,118 individuals. All analyses were performed on data weighted to reflect oversampling.

The PSID averaged a response rate of 92% during the period between 1997 and 2017. Response rates in 2015 and 2017 dropped below 90% (to 89.1% and 88.8% respectively) for the first time and were slightly lower among the immigrant subsample (with an average response rate of 83% for the same period). From my analysis of attrition of my sample between the 1997 and 2017 waves, I found that individuals lost to follow up were more likely to identify as American Indian, Asian or Pacific Islander, Latino or other. Because of their lower response rate, immigrants were also less likely to have remained in the analytic sample, as were men. Those who remained in the sample had a slightly lower average income than those only present in 1997 and were slightly more educated than those who were lost to follow up. In terms of the health measure, those who remained in the sample by 2017 rated their health lower in 1997 than those not in the survey in 2017.

Analytic Strategy

The creation of a match variable incorporating timing and duration allowed for an examination of match in both survey waves without needing to model both times separately or use pooled techniques. The presence and timing of matches variable was first used as the dependent variable in multinomial logistic regression models and then became a key independent variable in subsequent multivariate models examining income and health. All models made use of nested models to build from a bivariate relationship to the fully articulated model. Some intermediate steps are omitted in the tables for parsimony but were run to ensure no unexpected relationships appeared while staging in variables.

Presence and timing of matches and health are nominal and ordinal categorical variables respectively so when they were independent variables, a multinomial logistic regression was used. Rather than reporting log odds, as is the default in multinomial logistic regression, relative risk ratios (RRR) are reported instead. This was done by instructing Stata to report RRR for each of the multinomial models. Relative risk ratios transform log odds such that the risk for the reference group is equal to 1 and a coefficient greater than 1 indicates a greater likelihood of experiencing the outcome than the reference group. If the RRR is less than one, that group is less likely to be in the outcome category than the reference group. Income was logged in order to resemble a normal distribution and was modelled using OLS regression.

Dependent Variables

Education –Occupation Match

The main independent variable of interest was the match of an individual's level of education to level of education typical for their occupation. Ideally, the level of

education required for the specific job a person is employed in would be used; however, employment information only provided the detailed occupation code. Literature often refers to this as education-job mismatch despite perhaps being more-accurately called education-occupation mismatch. This paper used the term education-occupation mismatch when referring to the variable created here and education-job mismatch when referencing literature. Consistent with previous research (Garcy 2015; Rubb 2013; Tsai 2010), the modal level of education for each occupational code was determined (using the methodology described below) and an individual's level of education was compared with this modal level. Individuals were considered matched if the difference was zero. They were considered undereducated if the difference was positive and overeducated if the difference was negative. The modal level of education was used because it was not affected by skewness of the distribution of years of education across occupations. The mode was also a good measure considering that theories of relative deprivation suggest that individuals do not compare themselves to the average, but rather to the most common level of education among their colleagues. This choice was not without its limitations – for example, the mode was not able to capture variations in the distribution of years of schooling across occupations.

Respondents and their spouses were asked about their occupation, or what sort of work they do, in both 1997 and 2017. Their answers were then matched to occupations as listed in the census, which groups jobs and assigns occupational codes based on similarities in job duties and education or training required (Cosca and Emmel 2010). From 2000 onward these groupings were based on the Standard Occupational Classification (SOC) system which is updated approximately every ten years to keep up

with changes in jobs (Cosca and Emmel 2010). In 1997, the PSID used occupation codes from the 1970 census. In 2017, the occupation codes came from the 2010 census and were based on the 2010 SOC (United States Census Bureau 2021).

Match was determined at two time points, 1997 and 2017, using the detailed occupational codes available in each of these study waves of the PSID. An occupation classification needed to have at least ten observations for a modal education level to be determined from the sample. The modal level of education for each occupation was determined separately for 1997 and 2017 by cross tabulating the years of schooling and occupation for the full, nationally representative sample (N=10,601 individuals). In each wave, the most common value for years of schooling for every occupation with at least ten people was noted. Consistent with previous research (Tsai 2010), to obtain modal education levels for those occupations with less than ten individuals, data from the Current Population Survey (CPS) was used.

This process was straightforward for the 2017 wave, as the PSID used the same occupational classifications as the CPS in that year. Data was obtained from the CPS Social and Economic (March) Supplement from the census website. Since the CPS lists the highest level of education completed rather than years of schooling, modal levels from the CPS were converted to years of schooling based on a high school diploma being equal to 12 years, a bachelor's degree to 16 years, an associates degree to 14 years, "some college" to 14 years (splitting the difference between 13 and 15 years that it likely captures), and a professional degree to 17 years (the maximum years of schooling possible in the PSID).

The process for supplementing data from the 1997 wave was more complicated. Data was taken from the 1997 March CPS in most cases. A small number of occupations had no observations in the March CPS, so the 1997 July CPS was also used. The 1997 CPS used occupational classification from the 1990 census whereas the PSID was still using classifications from the 1970 census. The occupational classifications changed significantly from 1970 to 1990, which made comparing data from the PSID to the CPS difficult. The 1990 classifications (which are used by the CPS in 1997) often split what was previously one category in the 1970 classification system into many categories, and some occupations are omitted as they become obsolete or are grouped with others. Job titles from the 1970 classification were compared to those in the 1990 classification. When job titles were comparable, the matching was simple, and the modal level of education was taken from that category. If a job category was spilt into several categories, the average of those new categories was taken as the modal level of education for the 1970 category. For jobs that were absent from the 1990 classification, additional steps were taken to determine how to best fit previous titles to the new system. A guide to converting from the 1980 classification system was consulted and research was done on the job duties performed for the 1970 job titles or the level of education needed to obtain the jobs as listed in the 1970 classification. For all but one occupation (union officers), a suitable match was found in the 1990 occupational classifications and modal education levels were obtained. See Appendix A for a table of matched job titles. As with the 2017 wave, the 1997 CPS presents the highest level of education obtained. These were converted to years to schooling to align with the information from the PSID. These steps allowed every employed individual to be classified as matched or over/undereducated.

Presence and Timing of Match Variables

To examine the effect of presence, timing, and duration of education-occupation mismatch, variables were created to indicate the status of individual's occupation and education match at both time points. An individual could be undereducated, overeducated, or matched at each time point and creating categories for all configurations of those statuses across the two waves yielded nine groups. However, due to the small sample size of some groups, these nine categories were collapsed into six. The categories are *undereducated at both waves, overeducated at both waves, matched at both waves, matched in 1997 only, matched in 2017 only, and undereducated and overeducated (or vice versa)*. The first three groups were made of individuals who had the same education-occupation relationship in both 1997 and 2017. The matched in 1997 group was matched in that year but either under or overeducated in 2017. Similarly, the matched in 2017 group was under or overeducated in 1997 but was matched in 2017. The overeducated and undereducated category captured those who went from undereducated to overeducated and the reverse. This group experienced the most dramatic changes in their job-education match. These variables were simplified versions of potential paths through individuals' work lives.

Income

Logged income in 2017 was the dependent variable of interest in the second portion of the analysis. Income in 1997 was also used as a control variable in models predicting 2017 income. Income was constructed by the PSID as the sum of wages/salaries, bonuses, overtime, tips, commissions, professional practice or trade, market gardening, miscellaneous labour income, and extra job income. Farm income and the labour portion of business income were not included. The reference person was also

asked to report their spouse's labour income if applicable. While everyone was employed during the survey year (unemployed individuals were excluded from the analytic sample), income from the previous year may be zero if the individual was previously unemployed or their income came from sources not included in this variable. This was the case for 50 individuals in 2017 and 53 individuals in 1997. If income was zero, data was imputed from the same question in the prior survey wave, where available. If income data was not available in the previous survey wave, then data from the next survey wave was used. If all three waves had zero income, then income was set to 1 (in 2017 this was 13 people and in 1997 it was 9 people). Income from 1997 was converted into 2017 dollars using information on inflation from the US Census Bureau. Because of the skewed nature of income distributions, the natural log was taken of the income value for each person.

Self-Rated Health

Self-rated health in 2017 was also a main dependent variable of interest. While the PSID contains an array of health information, self-rated health (SRH) was chosen for its strength as an indicator of health status. SRH has been shown to be a valid predictor of mortality (Schnittker and Bacak 2014; Woo and Zajacova 2017). Self-rated health has also been used in previous studies that investigated the link between education-job mismatch and health (Hultin et al. 2016; Smith and Frank 2005). In the PSID interviews, only the reference person was interviewed, so information on the health status of their spouse was from the perspective of the reference person. Spouse-rated health has been shown to be associated with mortality (Ayalon and Covinsky 2009). Studies have shown high correlation between an individual's rating of their health and a proxy's rating, particularly when the proxy lives with the individual as is the case here (Epstein et al. 1989). For simplicity, the term self-rated health will be used in this paper. Respondents

were asked to rate their health (or their spouse's health) in general, with options including: excellent, very good, good, fair, or poor. Consistent with previous literature, categories were collapsed into three distinct categories and analyzed using multinomial logistic regression models comparing excellent/very good, good, and fair/poor health. SRH in 1997 was also included as a binary variable in models of 2017 health (fair/poor versus good/very good/excellent) in order to control for the potential of reverse causality, with poor health experienced early in life affecting mismatch rather than the other way around.

Independent Variables

Education

Education was measured using several variables to capture different dimensions, including years of education, a binary measure of attaining a college degree, and a measure of additional education acquired between the waves. Years of education was a continuous measure ranging from 0-17. Because 17 was the highest answer that can be given, information on years of post-graduate and professional schooling is limited. Attainment of a college degree was useful in separating those who attended some college from those who obtained a credential. Both variables were included in the model to give a more complete picture of a person's educational attainment and to test the value of a credential in obtaining matched employment. To examine if individuals went back to school between the two waves, an individual's years of education in 1997 was subtracted from their years of schooling in 2017. When the difference was positive, the person was assigned a 1 on a dummy variable that indicated they obtained additional years of education between 1997 and 2017.

Occupational Sector

A measure of occupational sector in 2017 was created based on the 11 major occupation group recodes of the 2010 Occupational Classification used by the CPS (management, business, and financial occupations; professional and related occupations; service occupations; sales and related occupations; office and administrative support occupations; farming, fishing, and forestry occupations; construction and extraction occupations; installation, maintenance, and repair occupations; production occupations; transportation and material moving occupations; and Armed Forces) (United States Census Bureau 2017). Several of these groups had small sample sizes in the PSID and were collapsed based on similarities in title. Occupational sector was grouped as management and professionals, sales and services, office administration, and trades and manufacturing. All individuals were sorted into these groups following the guidance on condensing occupational codes provided in the documentation from the CPS using 2010 Occupational Classifications (see Appendix B).

Race/Ethnicity and Immigrant Status

Respondents were asked to chose from a set of options, including White, Black, American Indian, Aleut, Eskimo, Asian, Pacific Islander, Latino origin or descent, and other. Although respondents could indicate more than one choice, in this analysis only the race first mentioned was used. Because of small sample sizes in some groups, some categories were combined resulting in a *race/ethnicity* variable consisting of four categories: White, Black, Latino, and Other. *Immigrant status* was determined from a question that asked individuals if they were born in the United States. All those who answered no were coded as immigrants in this sample.

Marital Status and Gender

The reference person was asked their marital status in 2017. The options were married, never married, widowed, divorced, or separated. If a romantic partner was living in the household for more than a year, they were treated as a spouse. Because of small sample sizes for some responses, this variable was collapsed into married/partnered or not married. Gender of respondent was based on response to the question about sex of the head of household question found in the 1997 wave.

Age

Individuals were asked for their age and their spouse's age (if applicable). This information was used to restrict the analytic sample to respondents who were between the ages of 25 and 35 in 1997. Age was also used as a control in the models to control for age-related differences in health and income within the cohort.

Results

Results addressing my three research questions regarding who was more at risk of exposure to pathways that involve education-occupation mismatch and what the consequences of those pathways might be are presented below. Tables 1 and 2 provide information on the demographic characteristics of the sample and the bivariate relationships between the categorical dependent variables and the independent variables. Tables 3-5 show the results of multivariate regressions models predicant match, income, and self-rated health respectively. Figures 1-3 provide visual representations of key findings.

Table 1: Demographics of Analytic Sample, N=1,118

Demographic Characteristic	Number of Cases	Percentage of Sample
Gender		
Male	552.5	49.4
Female	565.5	50.6
Race		
White	844.7	75.6
Black	120.9	10.8
Hispanic	96.9	8.7
Other	55.4	5.0
Immigrant Status		
US born	1030.6	92.2
Foreign born	87.4	7.8
College Degree in 1997		
None	733.3	65.6
Associates or Bachelors	384.7	34.4
Change in Educational Attainment		
No additional since 1997	758.3	67.8
More years of education since 1997	359.7	32.2
Occupational Sector		
Management and Professionals	473.6	42.4
Sales and Services	246.9	22.1
Office Admin	150.5	13.5
Trades and Manufacturing	246.8	22.1
Marital Status in 2017		
Divorced, widowed, or never married	343.7	30.7
Married or common law	774.3	69.3
In Fair or poor health in 1997		
Yes	37.1	3.3
No	1080.9	96.7
Self-Rated Health in 2017		
Excellent or Very Good	658.1	58.9
Good	348.0	31.1
Fair or Poor	111.9	10.0

	Mean	Standard Deviation
Age in 1997	30.4	3.2
Years of Schooling in 1997	13.5	2.5

Years of Schooling in 2017	14.2	2.3
Income in 1997 in 2017 dollars	43046.71	37036.53
Income in 2017	71990.18	116404.50

Notes: N=1118. Weighted estimates.

Characteristics of the sample

Table 1 shows the characteristics of the analytic sample based on weighted estimates. The sample was slightly more female than male and approximately three quarters were white. A small percentage of the sample (7.8%) were immigrants. The mean age in 1997 was 30.4 years. Just shy of 70% of the sample was married in 2017. The percent of the sample in fair or poor health was 3.3% in 1997 but grew to 10% by 2017. Over half of the sample rated their health as excellent or very good in 2017 when the sample was aged 45 to 55.

In terms of employment-related variables, respondents were equally employed in sales and services and trades and manufacturing (42.4% and 42.1%). Only 13.5% were employed in office administration, and 42% were in management and professional occupations. Just over 34% of the sample had a college degree in 1997, and 32% of the sample obtained more education between 1997 and 2017. The sample had an average of 13.5 years of education in 1997 but this rose slightly to 14.2 years in 2017 because of the portion of the sample that attained additional education. The average income of the sample was US$ 43,047 in 1997 (converted to 2017 dollars) and grew to $71,990 in 2017 with the standard deviation also growing.

Figure 1: Sankey Diagram Showing Match Pathways
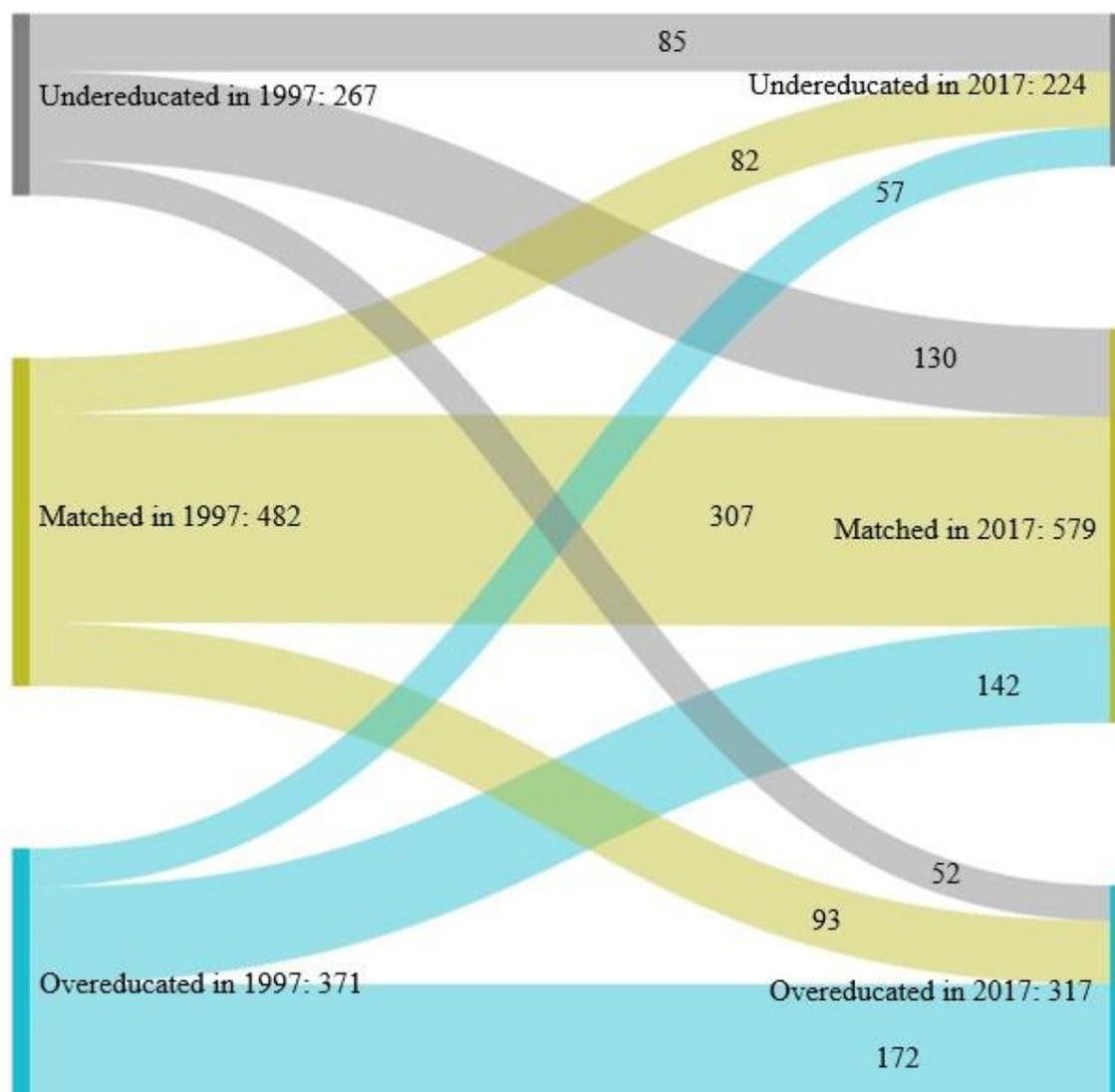
Bivariate relationship with presence and timing of matches

  The first stage of the analysis was aimed at addressing my first research question

regarding the stratification of education-occupation matching. Figure 1 is a Sankey

diagram which illustrates the movement between match categories from 1997 to 2017. In

1997, 267 people or 23.9% of the sample were undereducated, 482 people or 43.1% of

the sample were matched, and 371 people or 33.2% of the sample were overeducated. In

2017, the over and undereducated categories were smaller than in 1997. When this cohort

was mid-career, 224 people or 20.0% of the sample was undereducated, 579 people or

51.8% of the sample were matched, and 317 people or 28.4% of the sample were

overeducated. It was most common for individuals to remain in the match category they

started in, but the presence of movement between categories demonstrates that for this

cohort, mismatch was not always a permanent phenomenon. The least common

transitions were those from overeducation to undereducation in both directions indicating

that fewer people experienced such a drastic shift in status. For subsequent analysis some

pathways were grouped due to small sample sizes.

Table 2: Bivariate Relationship between Characteristics of Timing of Match by Demographic, N=1,118

	Undereducated at both	Overeducated at both	Matched at both	Matched in 1997 only	Matched in 2017 only	Both under and overeducated
	N=85	N=172	N=307	N=175	N=271	N=109
Gender						
Male	7.7	12.2	28.6	15.9	24.2	11.5
Female	7.4	18.6	26.3	15.3	24.4	8.0
Race**						
White	6.5	15.5	28.4	15.8	23.9	10.0
Black	5.2	15.2	22.5	23.3	18.1	15.8
Hispanic	24.3	15.0	24.5	9.0	19.7	7.5
Other	4.0	14.3	25.6	12.8	39.6	3.8
Immigrant Status**						
US born	6.7	15.3	27.8	15.8	24.3	10.0
Foreign born	17.3	16.0	22.8	13.2	24.2	6.5
Degree in 97**						
No degree	10.2	11.3	28.9	16.8	22.1	10.7
Associates or Bachelors	2.9	22.7	24.7	13.5	28.3	8.0
More Education**						
No additional years	7.5	18.9	35.8	13.2	17.1	7.5

More years since 97	7.8	7.8	9.8	20.7	39.5	14.5
Occupational Sector**						
Management and Professionals	7.5	9.2	23.1	15.9	34.5	9.9
Sales and Services	7.9	18.8	24.6	16.5	20.0	12.3
Office Admin	2.3	32.3	25.1	14.9	14.6	10.9
Trades and Manufacturing	10.7	13.4	40.0	14.8	14.7	6.4
Poor or Fair Health in 97						
Yes	17.7	12.2	17.8	15.7	26.1	10.4
No	7.3	15.4	27.7	15.6	24.2	9.7
SRH in 2017**						
Excellent or very good	5.1	14.9	26.9	15.5	28.3	9.4
Good	8.8	18.2	26.0	17.6	19.2	10.3
Fair or Poor	18.2	9.5	34.9	10.5	16.4	10.4
Income 1997* in 2017$	33715.39 (18899.21)	42264.69 (43590.88)	47305.14 (37289.98)	42822.66 (35385.08)	46871.47 (38121.04)	42816.73 (32452.77)
Income 2017	48520.71 (39076.99)	65851.56 (90127.83)	74444.79 (152222.00)	82228.4 (163464.4)	79079.52 (75320.02)	58996.22 (49340.46)

Age	30.5 (2.9)	30.1 (3.2)	30.7 (3.2)	30.4 (3.2)	30.2 (3.2)	30.4 (3.4)
Years of school 1997**	10.4 (3.2)	15.1 (1.2)	13.5 (2.0)	13.2 (2.2)	14.1 (2.4)	13.6 (2.2)
Years of School 2017	11.5 (3.2)	15.1 (1.5)	13.7 (2.1)	13.9 (2.2)	14.8 (2.1)	14.7 (1.5)

Notes: N=1118. Weighted. Standard deviations in parentheses for continuous variables. Numbers displayed are percentages of the subgroup.
* denotes significance at p<0.1 level and ** denotes significance at p<0.05

Table 2 presents the weighted bivariate relationships between the first dependent variable, which is the presence and timing of matches, and the other variables used in subsequent analyses, including demographic factors, several education variables, income at both time points, and two health variables. For categorical variables, the number displayed in each cell is the percent of that subgroup in each timing category with rows adding to 100%. For continuous variables the number displayed is the mean for that match group with the standard deviation in parentheses. The asterisks indicate statistically significant relationships, determined using chi-square tests for the categorical variables and ANOVA tables for the continuous variables.

Although white respondents were more likely to be matched (28.4%) in both 1997 and 2017, overall, there was not much variation across race/ethnic groups, as close to ¼ of every group was matched at both time points. The pattern is similar for overeducation as well, with roughly 15% of all race/ethnic groups overeducated in both 1997 and 2017. There was more variation across the other categories. Hispanic individuals were much more likely to be undereducated at both times (24.3%) – a proportion that was nearly the same as those matched at both time points. In sharp contrast, for the other three groups only 4% and 6.5% fell into this category. For the category matched in 1997 but not in 2017 there was no discernable pattern, however, Black respondents were more likely to be in this group (23.3%) which perhaps suggests greater vulnerability to losing matched status than other groups. Respondents who were of other race/ethnicities were overrepresented in matched only in 2017 category (39.6%), while Black respondents were overrepresented in the transient category (overeducated in 1997/undereducated in 2017 or undereducated in 1997/overeducated in 2017) - 15.8% of Black respondents,

compared to only 10.0% of whites, 7.5% of Hispanics, and 3.8% of those in the other race category were in this group.

Looking at immigrant status, the largest difference was in the percentage of people undereducated in both 1997 and 2017. Of those born in the United States, only 6.7% were in this group compared to 17.3% of immigrants. This may be due to different educational expectations or norms in home countries compared to the United States. Immigrants were slightly less likely to be matched at both time points than US born (22.8% vs. 27.8%). The percent of each of these groups in the overeducated at both time points category was almost identical (15.3% for U.S. born compared to 16.0% for immigrants) which was unexpected, as immigrants' foreign credentials are often devalued. In addition, there was a smaller percent of immigrants compared to non-immigrants in the matched in 1997 category (13.2% vs. 15.8%), which fits with expectations around immigrants' integration into the labour market. Immigrants were less likely to be in the transient category (6.5% vs. 10.0%), but there was no difference in the matched in 2017 only group.

In terms of education, respondents who were undereducated at both points had on average almost five fewer years of schooling in 1997 as those who were overeducated at both points (10.4 years and 15.1 years respectively). The average years of schooling for the other categories were all very similar and sat between the overeducated at both and undereducated at both averages. For years of education in 2017, those who were undereducated at both times had an average 11.5 years of schooling compared to 15.1 years for those who were overeducated at both times. Average years of schooling rose from 1997 to 2017 for all groups excepted those who were overeducated at both times.

Individuals without a college degree were almost five times more likely to be in the

undereducated at both time points category (10.2% vs. 2.9%) and conversely, those with

a college degree were much more likely to be overeducated at both time points than

individuals without a degree (22.7% and 11.3% respectively). The percentage of people

matched at both times was relatively similar between those with and without a degree in

1997 although those without were slightly more likely to be in this group. This may be

due to their longer time in the labour market compared to those with higher levels of

education. The longer time in the labour market for those without a degree may also be

why those with a degree were less likely than those without to be matched only in 1997

but more likely to be matched in only 2017 as they have had more time to find a matched

job. People with degrees were slightly less likely to be in the transient category (8.0% vs.

10.7%), switching from undereducated to overeducated or vice versa.

Acquiring additional years of education may help people find jobs that were a

better match. This can be seen in the data, as a larger percentage of those who did not

obtain additional education between the waves were matched at both time points (35.9%)

compared to those who completed more education (9.8%). Conversely, those who

completed additional education were more likely to be matched only at the second wave

(39.5% compared to 17.1%). Around 20% of people who acquired more education were

matched only at the first wave, which perhaps suggests they did not realize returns to

their additional education. The percent of those with and without additional education

who were undereducated at both time points was very similar. Those who did not

complete additional education were more likely to be already overeducated in both time

points (18.9% compared to 7.8% of those who obtained more education between the

waves). The final transient category represents a larger proportion of those who obtained additional education (14.5%) compared to those who did not (7.5%).

Occupational sector has a strong association with the presence and timing of matches. Among those employed in management and professional positions, more than 70% were matched in at least one year. In contrast, those in office administration had the highest percentage of respondents who were overeducated at both time points (32.3%). People employed in trades and manufacturing were the most likely to be matched at both time points with 40% of people in this category. The trades and manufacturing group also had the highest proportion in the undereducated at both times category (10.7%). Those employed in sales and services were more likely to be overeducated at both times than those in management and professional jobs. Just under ¼ of people in this sector were matched at both times. This group has the largest percent of people in the transient category (12.3%) and the smallest percentage in the undereducated at both times category (2%).

Self-rated health (SRH) in 2017 shows the potential relationship with education-job match and how match pathways may reflect broader interlocking systems of inequality. Among those who rated their health as fair or poor, 18.2% were undereducated at both times, which is more than twice the percentage of any other group. Those who rated their health as good were more likely to be overeducated at both times than those who rated their health as either better or worse (18.2% compared to 14.9% and 9.5%). Those who rated their health as very good or excellent were less likely to be consistently undereducated (5.1%) compared to those who rated their health as fair or

poor (18.2%) and more likely than both other groups to be matched in 2017 (28.3%

compared to 19.2% and 16.4%).

Finally, income also shows some associations with matching. Most striking is the

relationship between income in 2017 and matched status although the averages for each

category were not significantly different from one another. The average income in 1997

for each timing of match category was significantly different from one another. Those

who were matched at both times had the highest income in 1997, perhaps indicating that

they started on a better pathway than those in other groups. In contrast, those who were

undereducated at both times were making over $13,000 less on average than those who

were matched at both times, demonstrating their disadvantage in the labour market. The

differences among the other presence and timing of matches categories were quite small.

Table 3: Multivariate multinomial logit model predicting timing of match (Relative Risk Ratios), N=1,118

	Model 1					Model 2				
	Under at both N=85	Over at both N=172	Matched in 1997 N=175	Matched in 2017 N=271	Under and over N=109	Under at both	Over at both	Matched in 1997	Matched in 2017	Under and over
Race Black	1.497 (0.58)	1.274 (0.43)	2.184** (0.74)	0.906 (0.30)	2.550** (0.92)	1.243 (0.54)	1.486 (0.57)	2.082** (0.78)	1.062 (0.34)	2.490** (0.92)
Hispanic	2.912* (1.83)	0.504 (0.33)	0.359 (0.26)	0.597 (0.36)	0.555 (0.50)	1.072 (0.84)	1.196 (0.88)	0.358 (0.31)	1.259 (0.85)	0.885 (0.78)
Other	0.816 (0.98)	0.631 (0.42)	0.804 (0.47)	1.322 (0.69)	0.610 (0.45)	0.995 (1.21)	0.946 (0.73)	0.968 (0.59)	1.225 (0.68)	0.596 (0.49)
Male	0.864 (0.24)	0.565** (0.14)	0.956 (0.23)	0.837 (0.18)	1.140 (0.30)	0.757 (0.26)	0.751 (0.22)	1.280 (0.33)	1.162 (0.28)	1.758** (0.50)
Immigrant	2.834 (2.04)	3.379 (2.54)	3.058 (2.44)	1.987 (1.36)	2.179 (2.06)	1.088 (1.05)	2.139 (1.83)	2.684 (2.39)	1.972 (1.41)	2.420 (2.21)
Age	0.968 (0.04)	0.938* (0.03)	0.971 (0.04)	0.966 (0.03)	0.967 (0.04)	0.977 (0.04)	0.960 (0.04)	0.968 (0.04)	0.971 (0.3)	0.974 (0.04)
Education Years of Ed (97)						0.520** (0.06)	2.948** (0.36)	0.888 (0.08)	1.217* (0.13)	1.282 (0.20)
College Degree (97)						1.944 (1.33)	0.183** (0.09)	1.580 (0.55)	0.857 (0.35)	0.380 (0.24)

More Ed (since 97)	1.367 (0.51)	2.698** (0.93)	4.693** (1.42)	7.614** (2.06)	6.821** (2.17)
Occupational Sector					
Sales & Services	0.390** (0.17)	6.087** (2.19)	1.151 (0.44)	0.881 (0.26)	1.506 (0.61)
Office Administration	0.111** (0.08)	15.520** (6.48)	0.963 (0.44)	0.734 (0.29)	1.789 (0.84)
Trades & Manufacturing	0.232** (0.10)	6.832** (3.27)	0.553 (0.23)	0.368** (0.13)	0.423* (0.20)

Notes: N=1,118. ** indicates significant at p<0.05, * significant at p<0.1. weighted. Timing of match reference category is matched at both times. Race reference category is white. Occupational sector reference category is management and professional.

Which workers are more likely to experience mismatch and when?

Table 3 presents the results of multivariate multinomial logistic regression models predicting the presence and timing of matches based on demographic, education, and occupational variables. The numbers presented in the table are relative risk ratios, with a value greater than 1 indicating a higher probability of being in that match category compared to the reference group. Model 1 predicts membership in the presence and timing of matches categories based on key demographic variables. Black individuals were about 2.5 times as likely to be in the transient category, moving from over to undereducated in either direction and were twice as likely to be matched in only 1997 compared to white individuals. Hispanic individuals were 2.9 times as likely to be undereducated at both times compared to white individuals. Men were less likely to be consistently overeducated compared to women; men have about half the risk of being in the category. Age had a significant relationship with being overeducated, at both times with each additional year of age associated with a lower risk of being in this category relative to matched at both times.

Model 2 introduced education and occupational sector variables. Several associations from Model 1 remained significant, including the greater risk for Black respondents of experiencing mismatch, providing support for research suggesting visible minorities are more prone to mismatch (Battu and Sloane 2002). Black individuals were twice as likely as white individuals to be matched in only 1997 and in the transient category. Hispanic individuals were no longer at a greater risk of being consistently undereducated net of education and occupation. Similarly, the relationships between age and gender and overeducation were no longer significant. However, other interesting

findings emerged. All of the education variables were significant for at least one of match categories relative to consistently matched. Each additional year of education, measured in 1997, was associated with an individual being half as likely (0.52) to be undereducated at both times and three times (2.95) more likely to be overeducated at both times. Each additional year of education also increased the likelihood of being matched in only 2017 by 1.22 times compared to being matched at both times. Having a college degree in 1997 was also associated with a much smaller risk (82% less likely) of being overeducated in both waves relative to matched at both times compared to those without a college degree. Obtaining more education between the waves was also significant, increasing the risk of being overeducated at both time points by 2.7 times, and the risk of being matched only in 1997 by 4.6 times, compared to being matched at both times. Those who obtained additional years of education were also more than seven times as likely to be matched only in 2017. Both findings suggest that controlling for level of education and credentials, additional education may not always translate into matched employment.

Net of education, occupational sector also had many significant associations with presence of and timing of matches. Being employed in sales and services (compared to the reference category of management and professional occupations) decreased the risk of being undereducated at both times (compared to matched at both times) by 61% and increased the risk of being overeducated in both waves sixfold (6.09). Office administration employees were fifteen times (15.52) as likely to be overeducated at both times compared to managers and professionals. Employees in trades and manufacturing were also 77% less likely (0.23) to be undereducated at both times and almost 7 times (6.83) more likely to be overeducated at both times (compared to matched in both waves)

than the reference group. Trades and manufacturing employees were about 64% less likely to be partially matched (in 2017 only) than managers and professional occupations.

To further illuminate some of the more interesting findings from these multivariate models, Figure 2 presents the predicted probabilities for being in each presence and timing of matches category for those without a college degree in 1997, comparing those who obtained more education between 1997 and 2017 to those who did not. For this illustration, all other variables were set to their mean values. The predicted probabilities were restricted to those without a college degree in 1997 because college graduates are near the top of the range of years of education measured in the PSID and additional education would be more difficult to accurately capture for this group. Among people without a college degree in 1997, those who acquired more education were much more likely to be in groups that transitioned between match statuses. They were less likely to be undereducated, overeducated, or matched, at both waves. Interestingly, they were also more likely to move into a matched job by mid-career (2017) than those without further education. This does suggest that additional education may be pursued by mismatched individuals as an attempt to improve their match status.

Figure 2: Predicted Probabilities of Presence and Timing of Matches for Those Who Did and Did Not Complete Additional Education, other values at means
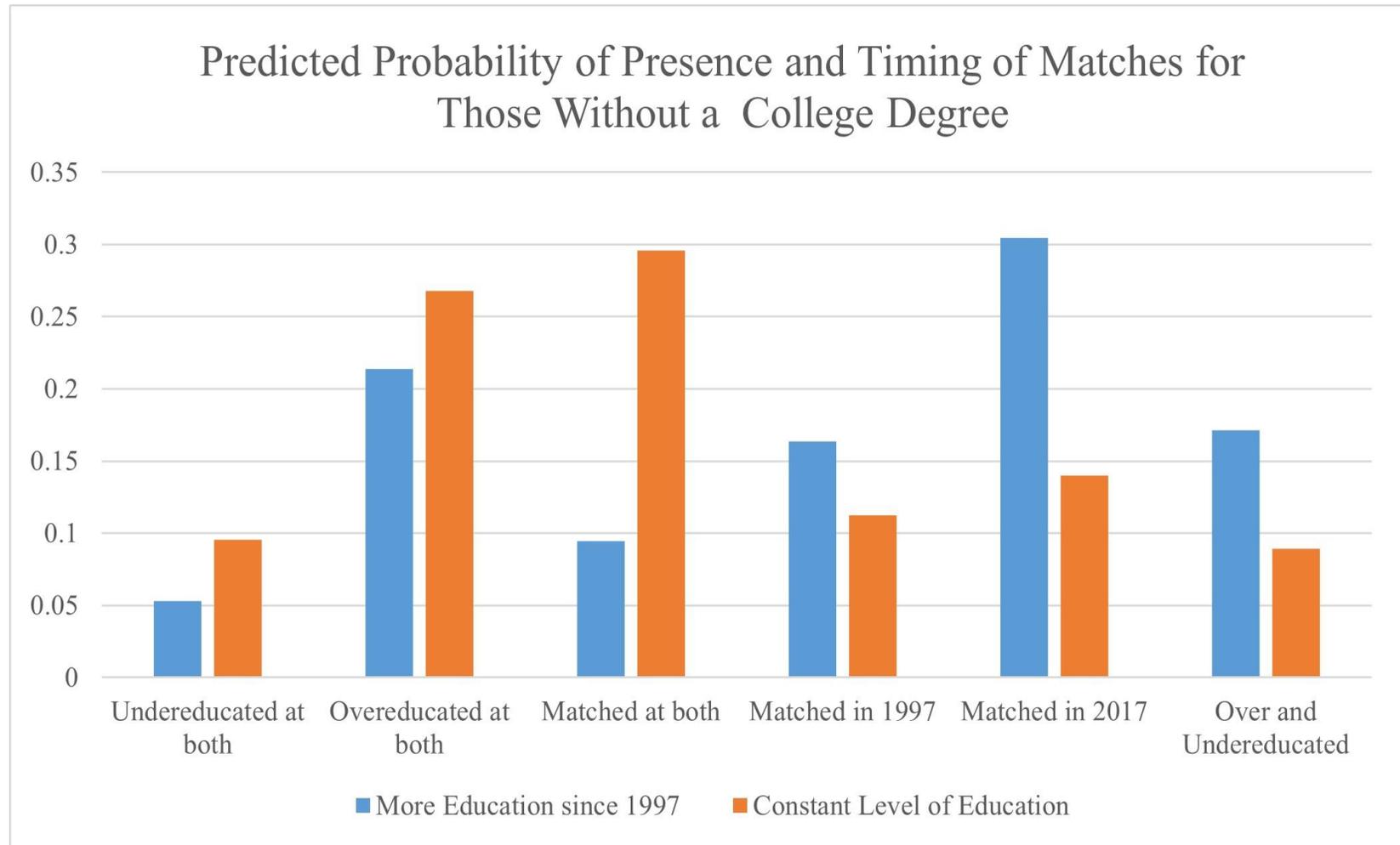
Table 4: OLS of Effects of Timing of Match on 2017 income, N=1,118

	Model 1	Model 2	Model 3	Model 4
Undereducated at both times	-0.322** (0.16)	0.077 (0.18)	0.059 (0.17)	-0.015 (0.16)
Overeducated at both times	-0.347* (0.19)	-0.579** (0.21)	-0.584** (0.21)	-0.300* (0.16)
Matched in 1997	-0.121 (0.21)	-0.141 (0.20)	-0.132 (0.20)	-0.035 (0.20)
Matched in 2017	0.171 (0.15)	-0.066 (0.14)	-0.088 (0.04)	0.001 (0.14)
Undereducated and Overeducated	-0.406 (0.25)	-0.457* (0.24)	-0.519** (0.24)	-0.357* (0.21)
Education				
Years of Ed (97)		0.106** (0.03)	0.119** (0.04)	0.068** (0.03)
Degree 97		0.370** (0.15)	0.318** (0.15)	0.196 (0.14)
Additional Ed		0.204 (0.15)	0.241 (0.15)	0.147 (0.14)
Occupational Sector				
Sales and services		-0.459** (0.19)	-0.405** (0.19)	-0.466** (0.17)
Office Admin		-0.001 (0.17)	0.103 (0.16)	-0.035 (0.12)
Trades and manufacturing		-0.167 (0.21)	-0.204 (0.22)	-0.241 (0.20)
Race				
Black			0.074 (0.27)	0.124 (0.26)
Hispanic			0.051 (0.19)	0.050 (0.21)

Other	0.466** (0.15)	0.395** (0.14)
Male	0.248** (0.13)	0.064 (0.13)
Immigrant	0.247 (0.17)	0.275 (0.18)
Age	-0.013 (0.02)	-0.020 (0.02)
Married in 2017	0.191 (0.12)	0.190 (0.12)
Self-Rated Health in 2017	0.012 (0.09)	0.005 (0.08)
Logged 1997 Income (2017 dollars)		0.432** (0.11)

Notes: N=1118. An * indicates significance at p<0.1 and ** indicates significance at p<0.05. weighted. Timing of match reference category is matched at both times. Race reference category is white. Occupational sector reference category is management and professionals.

Mismatch and Mid-career Income

Table 4 displays the results of nested models from OLS regression with logged (natural log) 2017 income as the dependent variable and presence and timing of matches as the main independent variable of interest. Matched in both 1997 and 2017 is the reference category. The bivariate relationships presented earlier showed a significant negative relationship between being undereducated at both time points and income mid-career. In these multivariate models, if the coefficient is exponentiated, the income penalty associated with the various match categories can be compared to the reference group. Model 1 of Table 4 shows that being undereducated at both time points was associated with earnings that were only 72.5% of the earnings of those matched at both times. Similarly, being overeducated at both times was associated with 70.1% of the earnings of those matched at both times. Both suggest a significant earnings penalty associated with education-occupation mismatch.

Model 2 introduces controls for education and occupational sector. These additions do not change the relationship between overeducation and income and in fact, the magnitude of this effect increased, with those who were overeducated at both points only earning 56.0% of the earnings of those matched at both times. Being undereducated in both waves was no longer significantly associated with logged income in Model 2. Moving from over to undereducation also had a significant negative relationship with logged income, with this group earning 63.3% of the income of those matched at both times. As expected, education was positively associated with income, with a college degree associated with 44.8% higher income compared to those without a degree. Each additional year of education was also associated with a 11.2% increase in income. Being

employed in sales and services had a significant, negative effect on income in all models where it was included. Those in this occupational group make 37% less than those in management and professional occupations.

Model 3 adds demographic factors, which do not change the patterning of the earlier results. Being in the other racial category had a large, positive coefficient with members of this group earning 59.4% more than white individuals. Due to the heterogeneity of this group this finding is hard to interpret. As expected, men earned 28.1% more in 2017 than women.

The final model, Model 4, introduced logged 1997 income, in 2017 dollars. This control for earlier income allowed for a closer examination of the change in income between 1997 and 2017 or between early and mid-career. The associations with presence and timing of matches variables that were present before this inclusion decrease in magnitude and significance level. Years of education remain significant, but its magnitude decreased as well to yield 7.0% more income for each additional year. Having a college degree in 1997 was no longer significant which may indicate that this credential is more important early in a career for determining starting wages but does not help increase wage growth. The negative effects of sales and services on wages remain significant. Those employed in this sector experienced slower wage growth than those in management and professional occupations.

Table 5: Multivariate multinomial logistic regression Timing of match on SRH in 2017, Relative Risk Ratios, N=1,118

	Model 1		Model 2		Model 3	
	Fair or Poor N= 112	Good N=348	Fair or Poor	Good	Fair or Poor	Good
Match Under at both	6.105** (2.75)	2.937** (0.99)	2.177 (1.13)	1.697 (0.65)	2.479* (1.34)	1.751 (0.66)
Over at both	1.143 (0.59)	1.798** (0.48)	1.432 (0.76)	1.983** (0.58)	1.246 (0.69)	2.039** (0.60)
Matched at both	1.747 (0.58)	1.425 (0.34)	1.273 (0.57)	1.237 (0.31)	1.450 (0.70)	1.254 (0.32)
Matched in 1997	1.176 (0.58)	1.695* (0.46)	0.854 (0.45)	1.448 (0.41)	0.796 (0.40)	1.318 (0.37)
Under and over	1.925 (0.96)	1.650* (0.49)	1.583 (0.82)	1.533 (0.46)	1.656 (0.87)	1.562 (0.48)
Education Years of Ed (97)			0.778** (0.07)	0.837** (0.06)	0.832** (0.08)	0.814** (0.06)
Degree (97)			0.483 (0.25)	1.205 (0.34)	0.478 (0.25)	1.360 (0.40)
More ed (since 97)			0.792 (0.26)	0.916 (0.17)	0.771 (0.26)	0.878 (0.17)

Occupational Sector Sales and Services	1.315 (0.50)	1.116 (0.25)	1.047 (0.42)	1.037 (0.24)
Office Admin	1.153 (0.54)	1.041 (0.29)	1.228 (0.62)	0.990 (0.28)
Trades and Manufacturing	1.020 (0.44)	1.023 (0.26)	0.791 (0.33)	0.948 (0.25)
Race Black			1.338 (0.47)	1.781** (0.47)
Hispanic			1.332 (1.00)	0.996 (0.50)
Other			0.341 (0.29)	0.665 (0.34)
Male			1.366 (0.40)	1.034 (0.19)
Age			1.098** (0.05)	1.001 (0.03)
Immigrant			1.444 (1.12)	0.765 (0.45)
Married (17)			0.516** (0.16)	0.664** (0.13)
Poor Health (97)			7.222** (3.95)	1.604 (0.81)

	0.957	1.048
Logged Income (17)	(0.05)	(0.06)

Notes: an * indicates significance at p<0.1 and ** at p<0.05. Health reference category is very good or excellent health. Timing of match reference category is matched in 2017. Race reference category is white. Occupational sector reference category is management and professionals. Weighted.

Mismatch and Mid-career Health

Table 5 shows the results of the multivariate multinomial logistic regression models of the relationship between SRH in 2017 and presence and timing of matches as well as other independent variables. Multinomial logistic regression was used instead of ordered logistic regression or OLS as there is ongoing debate in the health literature regarding whether it is appropriate to impose an order and/or assume equal distances across SRH response categories. The reference category for health in these models is very good/excellent health and the reference category for presence and timing of matches is matched in only 2017. The reference category was changed so that those matched in 1997 only could be more easily compared to those matched in 2017 only. The coefficients displayed are in the form of relative risk ratios.

Model 1 reports the bivariate relationship between SRH and presence and timing of matches. Being undereducated at both times more than doubled (2.94) the risk of reporting health as good rather than very good or excellent. In addition, those undereducated at both times were 6.1 times more likely to rate their health as fair or poor than as very good or excellent. Those who were overeducated in 1997 and 2017 were 1.8 times more likely to rate their health as good rather than excellent compared to those matched in 2017 only. Those who were matched in 1997 only and those who experienced transient over and undereducation were about 1.6 times more likely to rate their health as good rather than very good or excellent. To summarize these various relationships, those who were matched in 2017 or at both time points are the groups most likely to report excellent health.

Model 2 introduced education and occupation variables. Differences in education explained much of the relationships seen in Model 1. For example, the increased risk of fair or poor health among those who were undereducated at both times became non-significant. Those overeducated at both times, however, remained almost twice as likely to rate their health as good rather than as very good or excellent. Years of education reduced the risk of less than excellent health. There were no significant associations between occupational sector and health.

Model 3 added demographic factors as well as known predictors of health. Those undereducated at both times are now 2.5 times more likely to rate their health as fair or poor than very good or excellent. Those overeducated at both times were twice as likely to rate their health as good rather than very good or excellent. Each additional year of education still reduced the likelihood of rating health as less than very good or excellent. The health disadvantage of Black Americans is well documented (see Mays, Cochran, and Barnes 2007 for a review) and as suggested by the literature, race also influenced the risk of poorer health in this analysis. Black individuals were 1.8 times more likely to rate their health as good compared to very good or excellent. Age had a small but significant effect as well, with each additional year of age increasing the risk of fair or poor health by about 10%. Previous research has shown that married people were more likely to rate their health as better than non-married individuals (Prus 2011). This finding is supported in the data, with married individuals almost half as likely to rate their health as fair or poor and 34% less likely to rate their health as good compared to excellent. Those who rated their health as fair or poor in 1997 were also more than seven times as likely to rate their health as fair or poor in 2017. There was no significant relationship between income

in 2017 and health in light of the controls for education, nor was there a significant

relationship between immigrant status and health in this study.

Figure 3: Predicted Probabilities of Health Categories by Presence and Timing of Matches for Those with 12 Years of Education and 16 Years of Education, other values at means
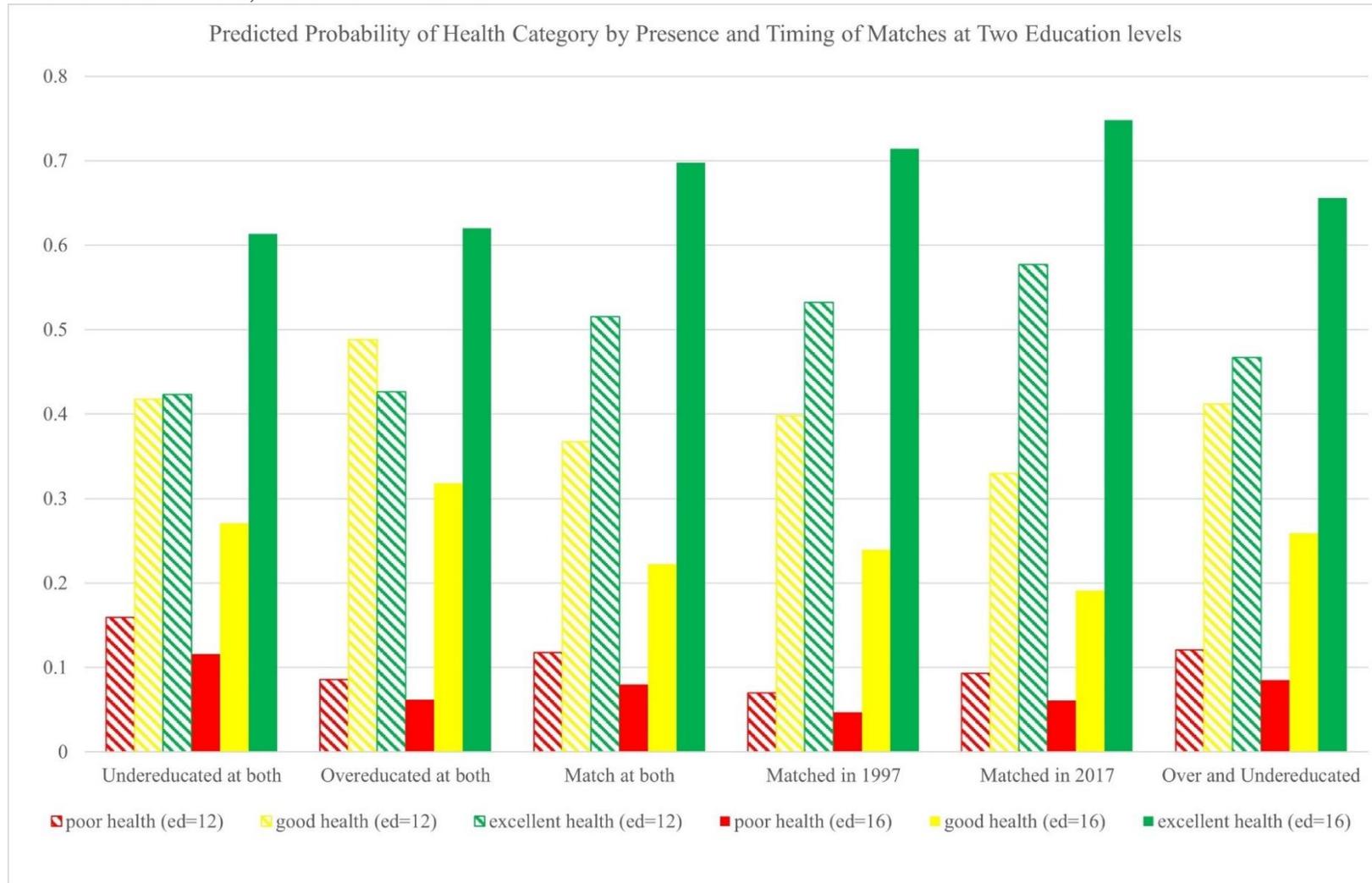
Figure 3 shows the predicted probabilities of being in each health status category based on presence and timing of matches category. These probabilities were plotted for individuals with 12 years of education and individuals with 16 years of education as proxies for high school and college credentials. When calculating these predicted probabilities all other variables were set to their mean values. The striped bars denote those who have 12 years of education and solid bars indicate those with 16 years. Colours indicate the health status category. The red bars indicate the fair or poor health category, yellow signify the good health category, and green denote the very good or excellent health category. Among those with 16 years of education, the probability of being in the very good or excellent health category is at or above 70% for categories that include at least one matched time point. Undereducated at both times and overeducated at both times have closer to a 60% chance of rating health as very good or excellent. For people with 12 years of education, those in categories that are matched at least once have above a 50% chance of rating their health as very good or excellent. As expected, those with 16 years of education had a lower probability of being in the fair or poor health group than the high school educated across every match category. However, even among the more educated group, those who were undereducated at both times for their jobs reported poorer health.

One noteworthy pair of findings is the effects of overeducation at both times and undereducation at both times. Those undereducated at both time points with a high school education were equally likely to rate their health as good compared to excellent, while at the same level of education, those who were consistently overeducated were more likely to only rate their health as good rather than excellent.

Chapter 4

Discussion and Conclusion

Education-job mismatch is a common experience in the United States and Canada with approximately a third of workers overeducated (Green and Henseke 2016), and up to 10% of workers undereducated (Kalleberg 2007). Despite its prevalence, the determinates and outcomes of this type of mismatch are not clear. This study aimed to add to research about the determinants of mismatch and the income and health consequences of experiencing it by incorporating the Life Course perspective's concepts of timing and duration to better understand the ways workers experience mismatch during two periods of their work lives - early and mid-career. The aim was to address who is at risk of experiencing mismatch, how does the timing and duration of mismatch relate to mid-career income and health, and to what extent are workers able to exit mismatch. These questions were examined for a cohort of US workers using two survey waves from the PSID.

The consideration of pathways that include presence and timing of mismatch rather than focusing on static measures of mismatch at one point in time allows for novel contributions to literature on risk factors and consequences. For example, findings suggest there is movement in and out of mismatch across the work life course and that there are inequalities in the risk of experiencing mismatch and the likelihood of leaving that state. The question of reversibility of the potential negative effects of mismatch is key for understanding the long-term implications of this labour market experience, which could be either a short-term stressful state or an experience that is scarring for income and health. A noteworthy finding is that the outcomes of match either early or midcareer

is not significantly different from match at both points. In both income and health

models, the only significant negative income and health effects were associated with

pathways that did not include match in either wave. For those experiencing mismatch as a

transient rather than a persistent state, mismatch may reflect individual job choices and

compromises that were made more strategically to support other life events, such as

childrearing and caregiving, health limitations, or returns to education, rather than

indicate labour market barriers to appropriate employment. Or they could reflect more

macro labour market pressures that influenced the availability of jobs at a particular level

of educational attainment. A lack of difference in outcomes between the once matched

and matched at both time points might lend some support to Search and Match theories,

which see mismatch as a temporary state and suggests that employees will move, or be

forced to move, to new jobs that match their level of education (Voon and Miller 2005).

However, this is only speculation as the current analysis is not able to address these

questions directly. Because of the complexity of the PSID, this thesis did not utilize all 40

available waves of PSID data. However, this analysis of two time points, early and mid-

career, suggests that mismatch may be more harmful when experienced for some duration

over the work life course. Further research would benefit from defining more nuanced

pathways to test this conclusion.

There is some indication in these results that, as suggested by Capsada-Munsech

(2017), overeducation is another type of labour market stratification, with less privileged

individuals more likely to become and remain overeducated. The increased risk of both

overeducation and undereducation among visible minorities (Kalleberg 2007; McKee-

Ryan and Harvey 2011; Sicherman 1991) is partially supported by these results, with

Black individuals more likely to become unmatched after having been matched previously, as well as to experience both over and undereducation. Even though, net of controls, there was no significant difference in mid-career income for those who were matched in only one wave versus matched in both, becoming unmatched mid-career, particularly for disadvantaged groups, may reflect and be another form of structural labour market inequality that disadvantages marginalized and racialized groups. Again, this is only a possible implication that is not fully testable here. Immigrants were not associated with higher risk of mismatch here, as was found in previous studies (Capsada-Munsech 2017; Hultin et al. 2016; Li et al. 2006), but this may also be due to group variations that cannot be detected with these data. Incorporating more details, including the timing and category of immigration may help distinguish across the very different life circumstances of immigrants that may affect their education-job match.

The results from the OLS models examining the presence and timing of matches and logged 2017 income generally align with previous research. The income penalty of overeducation (Green and Henseke 2016; Korpi and Tåhlin 2009; Montt 2017; Verhaest and Omey 2006) and slower growth of wages for those who are overeducated (Büchel and Mertens 2004) are supported by this analysis. However, no negative association between wages and undereducation was found, which contradicts prior research (Alba-Ramirez 1993; Iriondo and Pérez-Amaral 2016; Wiedner 2021). The relationship between experiencing both overeducation and undereducation and wages has not been investigated before, but since it includes states that have been associated with income penalties, it makes sense for there to be income penalty associated with this pathway.

Regarding health outcomes, an important note is that the harm of mismatch may depend on a person's level of education. This may be acting through job characteristics. Those with lower levels of education may be harmed more by the conditions of their employment than by the mismatch itself. This was proposed by Hultin et al. (2016). Someone with 12 years of education who is overeducated is likely working in a job which does not require a high school diploma. The conditions of that job are likely very different than the conditions at a job where someone with 16 years of education is overeducated. Further research would benefit from the inclusion of job characteristics to determine if those effects are separate from the effects of mismatch. Health results align with prior research as both overeducated and undereducated individuals were more likely to report lower SRH than those who were matched (Hultin et al. 2016). The relationships between education and marriage with SRH were as expected (Prus 2011).

The Life Course perspective also highlights this importance of historical time and place; part of the historical context of this study are the changes in the nature of work that began before this cohort entered the workforce but continued during the period of interest. Thus, results for other cohorts of workers might look quite different. Historical changes, including the growth of non-standard work and job insecurity, as well as the shifting of risk onto employees (Kalleberg 2009), have implications for being able to compare both the prevalence and consequences of mismatch over time. Such shifts may undermine Job Competition theory (Thurow 1975) as employers have shifted training costs onto employees rather than invest in the potential of job applicants; a highly trainable candidate costs more than one who has job specific skills (Brown and Souto-Otero 2020; Kalleberg 2009). Findings indicate mixed support for theories of job

allocation. Most individuals remain in the same match category in both waves, which would imply that mismatch is a permanent state as proposed by Job Competition theory and Assignment Theory. However, a small portion of each group does move to another match category in the second wave which supports the position that mismatch is a temporary state as put forth by Search and Match theory and Human Capital theory. However, of those who moved from mismatched in 1997 to matched in 2017, over half obtained more education after 1997. The changes from mismatch to match for this group may not be through the mechanisms described by Human Capital and Search and Match theories. Regarding credentialism, the analyses conducted are not able to speak to the change in the importance of credentials over time; however, the significance of having a degree for minimizing the risk of experiencing overeducation at both times highlights the value of a degree over and above the years of education completed to acquire it.

Historical time and place affect these relationships immensely. This has implications for the effects of mismatch as levels of education among the population continue to rise. With more people having post-secondary degrees, this credential becomes "a defensive tool" rather than an advantage in the labour market (Brown and Souto-Otero 2020: 96). the relationship between mismatch and health may be mediated by other factors. Overeducation has a weaker association with depressive symptoms in countries where the rate of overeducation is high (Dudal and Bracke 2019). The unemployment rate also affects the strength of the relationship between overeducation and depressive symptoms (Dudal and Bracke 2019). If overeducation is common, it is less likely to lead to feelings of relative deprivation which is one of the potential mechanisms through which mismatch is related to health.

While this study provides novel results and potential guidance for further research, it is not without its limitations. Regarding measures, the difficulty in converting from 1970 to 1990 occupational classifications prevented finding modal education levels from larger data sets. Recall that responses from the PSID are only given by the reference person and therefore the health ratings for their spouse are technically proxy-rated. When a proxy rates an individual's health, there is more discrepancy when the individual is in poor health; the proxy tends to rate their health as better than the individual does (Epstein et al. 1989; Vuorisalmi et al. 2012) so there may be underestimation of poor health among this cohort. Also, information about the accuracy of proxy rated health tends to focus on older individuals (65 and older) (Ayalon and Covinsky 2009; Epstein et al. 1989; Vuorisalmi et al. 2012) so little is known about the accuracy of proxy rated health for the ages in this study. Occupational sector was only identified in 2017, which did not allow the model to account for how a change in occupational sector might be related to presence and timing of matches. Individuals who were unemployed in either 1997 or 2017 were excluded from the analytic sample, but those who were employed at one time would have a match status at the time they were employed. However, this would necessitate including additional pathways in the analysis or expanding the definition of at least one pathway to include this group.

For models of presence and timing of matches and mid-career income, the difference in level of education may shape outcomes in ways that were not accounted for. Those who do not complete post-secondary education will be at a different place in their careers compared to those who spend longer in education. The former group has had longer to find a matching job and to have earned pay raises. Comparing their match status

and income at ages 25-35 to those of people who spent longer in post-secondary education is therefore a bit more nuanced than what is considered here. It would be beneficial to incorporate data from other survey waves to get a more complete picture of the pathways taken through employment. It may also be worth examining how the degree of mismatch may alter the relationships with income and health. In this study, over and undereducation variables begin with one year of surplus or deficient education. Measuring degrees of mismatch or defining it more conservatively may yield different results. A larger difference between actual and modal level of years of education may be associated with larger decreases in income or health.

Future research should give more consideration to pathways, perhaps focusing on identifying common pathways in more detail across the work life course. It would be beneficial to include unemployment as a possible state in addition to overeducation, undereducation, and match, and it would be interesting to identify common sequences of match and mismatch to further understand inequalities in moving into and out of mismatch. Life course concepts should continue to be utilized to examine the reversibility of mismatch and the associated outcomes. Continued focus on historical time and place is crucial as conclusions may be very difficult to generalize. It may also be beneficial to examine job characteristics alongside match status to determine how what job someone is matched or mismatch in might shape the relationship with health and match status. Job characteristics may also help mediate the relationship between education-job mismatch and outcomes of interest. For example, more job control is associated with a lower chance of reporting subjective overqualification (Weststar 2009). More research should also investigate the mechanisms through which mismatch may

affect health. Focusing on the modal level of education is ideal for capturing the effects of relative deprivation. The continued increase in the average level of education among the population may decrease feelings of relative deprivation. If another mechanism is of interest, then other methodologies may be more useful. If the underutilization of human capital is the focus, then subjective reports or job analysis would likely better capture those nuances.

In sum, this study is unique for its focus on the process through which education-job mismatch occurs and its effects on income and health. Other longitudinal studies have inadvertently investigated transitions and duration, but none, to my knowledge, investigated the role of timing or considered mismatches within the context of longer-term work pathways. Thinking about pathways allows for the inclusion of other changes that may occur along career paths, such as going back to school. While the health and income of those who are matched at one time are more similar to the outcomes of people matched at both time points, findings suggest both a health and income penalty associated with longer periods of mismatch. Overall, further research is needed on a longer portion of the work life course to understand more of the nuances of education-job mismatch as an understudied form of labour market disadvantage. This is particularly relevant for more recent cohorts of workers as levels of education in the population continue to rise.

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Appendices

Appendix A: Conversions from 1970 to 1990 Occupation Codes

1970 Title	**1990 Title**
Chemical engineers	Chemical engineers
Librarians	Librarians
Geologists	Geologists and geodists
Chiropractors	Health diagnosing practitioners, n.e.c.
Veterinarians	Veterinarians
Dental hygienists	Dental hygienists
Heath record technologists	Health record technologists and technicians (364)
Radiologic technologists	Radiologic technicians
Therapy assistants	Health aides, except nursing
Religious workers	Religious workers
Chemistry teachers	Chemistry teachers
Math teachers	Math. Science teachers
Health specialties teachers	Health specialties teacher
Economics teachers	Economics teachers
Coaches and PE teachers	Physical education teachers
Education teachers	Education teachers
English teachers	English teachers
Misc. teach, college + uni	Postsecondary teachers, subject not specified
Teachers, college + uni, subject not specified	Teachers, college + uni, subject not specified
Adult education teachers	Teachers, nec
Agricultural + bio technicians	Biological technicians
Industrial engineering technichians	Industrial engineering technicians
Airplane pilots	Airplane pilots and navigators
Flight engineers	Airplane pilots and navigators
Technicians, nec	Technicians, nec
Athletes	Athletes
Dancers	Dancers
Photographers	Photographers
Writers, artists, entertainers, nec	Artists, performers, and rel. workers, n.e.c
Assessors, controllers, and treasurers; local public admin	Bookkeepers, accounting, and auditing clerks
Buyers + shippers, farm products	Purchasing agents and buyers, farm products

Buyers, wholesale and retail trade	Buyers, wholesale and retail trade except farm products
Officials of lodges, societies, and unions	n/a
School admin, college	Admin, education and rel. fields
Hucksters and peddlers	Misc sales
Enumerators and interviewers	Interviewers
Library attendents and assistants	Library clerks
Mail handlers, except post office	Mail clerks, except postal service
Messengers and office boys	Messengers
Tabulating machine operators + Office machine operators, n.e.c.	Office mach. operators, n.e.c.
Telegraph operators	Telephone operators
Telephone operators	Telephone operators
Cabinet makers	Cabinet makers
Compisitors and typesetters	Typesetters and compositors
Cranemen, derrickmen and hoistmen	Hoist and winch operators, and crane and tower operators
Decorators and window dressers	Hand painting, coating, and decorating occupations
Dental laboratory technicians	Dental laboratory and medical appliance technicians
Glaziers	Glaziers
Locomotive engineers	Rail vehicle operators, n.e.c
Automobile body repairmen	Automobile body and rel. repairers
Data processing machine repairmen	Data processing equipment repairers
Farm implement	Specified mechanics and repairers, n.e.c.
Household appliance and accessory installers	Hhld appliance and power tool repairer
Loom fixers	Specified mechanics and repairers, n.e.c.
Office machine	Office machine repairs
Molders, metal	Patternmakers and model makers, metal
Pressmen and plate printers	Pressing machine operators
Roofer and slaters	Roofers
Structural metal craftsmen	Structural metal workers
Craftsmen and kindred workers, nec	Misc precision woodworkers
Bottling and canning operatives	Packaging and filling machine operators
Clothing ironers and pressers	Launderers and ironers
Cutting operatives, nec	Textile cutting machine operators
Drillers, earth	Drillers, earth
Dry wall installers and lathers	Drywall installers
Dyers	Miscellaneous hand working occupations

Filers, polishers, sanders, buffers	Grinding, abrading, buffing, and polishing machine operators
Furnacemen, smeltermen, and pourers	Furnace, kiln, and oven operators, except food
Garage workers and gas station attendants	Garage and service station rel. occupations
Produce graders and packers, except factory and farm	Grader and sorter, agricultural products
Meat cutter and butchers	Butchers and meat cutters
Mixing operatives	Mixing and blending machine operators
Painters, manufactured articles	Painting and paint spraying machine operators
Photographic process workers	Photographic process machine operators
Lathe and milling machine operatives	Operators, lathe and turning machine
Punch and stamping operatives	Punching and stamping press machine operators
Riveters and fasteners	Misc precision metal workers
Shoemaking machine operatives	Shoe machine operators
Solderers	Solderers and brazers
Knitter, loops and toppers	Knitting, looping, taping, and weaving machine operators
Spinners, twisters, and winders	Winding and twisting machine operators
Textile operatives, nec	Miscellaneous textile machine operators
Fishermen and oystermen	Fishers
Not specified laborers	Laborers, except construction
Farm foreman	Supervisors, farm workers
Farm laborers, unpaid family worker	Farm workers
Chambermaids and maids, excepts private households	Janitors and cleaners
Busboys	Waiters'/waitresses' assistants
Dishwashers	Miscellaneous food preparation occupations
Food counter and fountain workers	Food counter, fountain and rel. occupations
Airline stewardesses	Public transportation attendants
Attendants, recreation and amusement	Attendants, amusement and recreation facilities
Attendants, personal service nec	Nursing aides, orderlies, and attendants
Baggage porters and bellhops	Baggage porters and bellhops
Barbers	Barbers
Welfare service aid	Welfare service aides
Crossing guards and bridge tenders	Crossing guards
Sheriffs and bailiffs	Sheriffs, bailiffs, and other law enforcement officers

Cooks, private household	Cooks, private household
Housekeepers, private household	Housekeepers and butlers

Appendix B: Major Occupation Group Recodes from CPS 2017 Annual Social and Economic (ASEC) Supplement

Major Occupation Group Recodes (01-11)

These codes correspond to Items PRMJOCC1 and PRMJOCC2 located in positions 482-485 of the Basic CPS record layout in all months **except** March. In **March**, these codes correspond to Item A-MJOCC and are located in positions 159-160.

CODE	CODE DESCRIPTION	OCCUPATION CODE
1	Management, business, and financial occupations	0010-0950
2	Professional and related occupations	1000-3540
3	Service occupations	3600-4650
4	Sales and related occupations	4700-4965
5	Office and administrative support occupations	5000-5940
6	Farming, fishing, and forestry occupations	6000-6130
7	Construction and extraction occupations	6200-6940
8	Installation, maintenance, and repair occupations	7000-7630
9	Production occupations	7700-8965
10	Transportation and material moving occupations	9000-9750
11	Armed Forces	9840

This is taken from Appendix B to the Current Population Survey 2017 Annual Social and Economic Supplement.

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