ANALYZING THE EFFECT OF DEBT ON HORIZONTAL EDUCATION-OCCUPATION MISMATCH

by

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ABSTRACT

REBEKAH CARPENTER. The role educational loan debt on horizontal education-occupation mismatch for young Americans (aged 20 to 34). (Under the direction of DR. SCOTT FITZGERALD).

This study investigates the relationship between educational loan debt and horizontal education-occupation mismatch, or the extent to which an individual works in an occupation unrelated to their degree field. Research has documented rising levels of debt for all Americans, particularly young adults. While researchers have identified the potential social, economic, and life-course consequences for young Americans burden with large quantities of debt, less is known about the impact of educational loan debt on labor market decisions and outcomes. One particular labor market outcome is horizontal education-occupation mismatch. The purpose of this research is to examine if there is a relationship between an individual's amount of undergraduate educational loan debt and their likelihood of horizontal mismatch. Furthermore, this study aims to test if the relationship between educational loan debt and horizontal mismatch is moderated by predicted salary. Using a sample of young adults (aged 20 to 34) from the National Survey of College Graduates (survey years 2013, 2015, and 2017), I find that undergraduate educational loan debt does not impact the likelihood of horizontal educational-occupation mismatch, once controlling for basic demographic characteristics and predicted salary. Further testing does reveal that predicted salary is negatively associated with the likelihood of horizontal mismatch; however, the relationship between educational loan debt and horizontal mismatch is not moderated by predicted salary. The findings of this study highlight the important of controlling for predicted salary in the analysis of horizontal education-occupation mismatch.

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CHAPTER 1: INTRODUCTION

Research has documented rising levels of debt for all Americans. A recent report by the Federal Reserve Bank of New York (2020) has shown that American household debt has now increased to approximately $14.3 trillion overall. In an examination of total household debt in the United States, analysis has shown that students loans are now the second largest household debt category, only surpassed by mortgages (Household Debt and Credit Report 2020). Since 2009, the total amount owed in educational debt for Americans has increased more than two times, reaching approximately $1.64 trillion in 2020 (Pew Research Center 2019; Student Loan Hero 2020). As of 2019, 69% of all college students have taken out student loans and the average educational loan debt upon graduation is approximately $29,000 (Student Loan Hero 2020).

A more thorough analysis of educational debt has shown that the approximately $1.64 trillion in debt is shared amongst 45 million individuals across various demographic groups (Pew Research Center 2019; Student Loan Hero 2020); however, younger Americans, especially under the age of 35, are more likely to have taken out educational loans and have outstanding educational loan debt when compared to older adults (Federal Reserve Board 2019; Pew Research Center 2019). This information suggests that Americans are now more burdened by educational loan debt than ever before, especially younger Americans. Moreover, this phenomenon has prompted public and scholarly concern regarding the potential social, economic, and life-course consequences for young Americans burden with these large quantities of debt. Much of the research on youth indebtedness has focused on the psychological well-being and life-course transitions to adulthood; including marriage, homeownership, and fertility (Houle

2014; Houle and Berger 2015; Nau et al. 2015). Less research has been published looking at the impact of educational debt on labor market decisions and outcomes for young adults.

Broadly, extant research has examined the link between a variety of mechanisms that lead to differential labor market decisions and outcomes for individuals. More specifically, researchers have examined the relationship between occupational mismatch and various labor market outcomes, including salary, full time employment, and job satisfaction (Cohn and Kahn 1995; Hartog 2000; Robst 2007; Neumann et al. 2010; Tsai 2010; Bender and Heywood 2011; Moore and Rosenbloom 2016; Bol et al. 2019). Missing from this discussion is the role in which educational debt leads to differential labor market decisions and outcomes for individuals, particularly horizontal education-occupation mismatch, or the extent to which an individual works in an occupation unrelated to their degree field.

The aim of this study is to examine how varying levels of educational debt affect the labor market decisions and outcomes of young adult college graduates, particularly the likelihood of taking a job in a field unrelated to their degree. Specifically, I ask: (1) What is the relationship between student loan debt and horizontal education-occupation mismatch?; and (2) Is the relationship between student loan debt and horizontal education-occupation mismatch moderated by the predicted salary of the degree field? Understanding the relationship between educational loan debt and horizontal mismatch can add to the literature on mismatch by identifying if debt is a determinant of horizontal mismatch. Broadly, understanding this relationship can provide further insights into the mechanisms that impact career decisions and labor market outcomes, for young adults.

The paper proceeds as follow: The first section of this paper summarizes the previous literature on the rise of indebtedness in America, the rising cost of college, who educational loan debt impacts, the relationship between occupational mismatch and labor market outcomes, and the relationship between debt and labor market outcomes. I then follow with a discussion of my hypotheses. Then, the next section discusses the dataset, measures, and analytic technique used in this study. Finally, I conclude with a discussion of the results, the limitations of this study, and directions for future research.

CHAPTER 2: REVIEW OF THE LITERATURE

The Rise of Indebtedness

After the 2008 global financial recession, much public and scholarly attention was devoted to understanding the factors that impact economic inequality (Kalleberg and Mouw 2018; Piketty and Saez 2003; Piketty 2014; Chetty et al. 2014; Chetty et al. 2017; Dwyer 2018). One such factor related to increasing economic inequality, is the rising amount of debt for many Americans. A recent report by the Federal Reserve Bank of New York (2020) has documented that American household debt has now increased to approximately $14.3 trillion overall. Furthermore, by 2018, the average personal debt for Americans had exceeded roughly $38,000 (Northwestern Mutual 2018). Scholars have acknowledged that debt now plays an increasing role in supporting consumption for Americans and families (Leicht and Fitzgerald 2014; Dwyer 2018), which can thus lead to negative social and economic consequences.

Furthermore, the increasing precarious nature of work has exacerbated the inequality gap and has direct consequences on labor market outcomes for many Americans. Changes in the occupational structure and the financialization of the American economy during the twentieth and twenty-first centuries (Dwyer 2018) has consequently lead to an increase in insecure and precarious employment situations that impact individuals across all class structures (Kalleberg 2011, 2012; Vallas and Prener 2012). Furthermore, employers are now engaging in risk-shifting behaviors in which employees now receive fewer health, wage, and education benefits, as well as decreased employer backed career and job training (Kalleberg 2011). The increasing precarious nature of work has

subsequently increased the necessity of obtaining a college degree to prepare for the labor market and help better one's labor market outcomes.

The Rising Cost of College

Many American households are taking on high levels of credit and debt to support consumption as well as invest in future opportunities (Leicht and Fitzgerald 2014). A significant portion of this rising household debt can be attributed to the necessity of educational loans to help offset the rising cost of college attendance (Household Debt and Credit Report 2020). When looking at student loans, outstanding student loan debt now stands at $1.64 trillion in the United States, with individuals under the age of 35 holding more than half the total student loan debt (Pew Research Center 2019; Student Loan Hero 2020). Additionally, approximately one-third of individuals aged 18 to 29 currently have student loan debt (Federal Reserve Board 2018) and roughly 69% of college students have taken out some form of student loans (Student Loan Hero 2020). The increasing indebtedness of young Americans, as well as the wealth stagnation of young adults (Steuerle et al. 2013), highlights the precarious economic situation that the young Americans face today, particularly young American's burdened with large quantities of educational loan debt.

In addition, the cost of attending college has increased over the last 30 years, both at private and public institutions (Choy and Berker 2003; Bownen, Chingos, and McPherson 2009). Scholars have noted a declining trend of state subsidies for public universities and grant programs (Goldrick-Rab 2016). Due to the lack of employer, federal, and state backed subsidies and grant programs that offset the cost obtaining a degree (Kalleberg 2011; Prasad 2012; Goldrick-Rab 216), many families and individuals

are left with the burden of trying to finance of a college degree to increase labor market opportunities. This has led directly to the growing number of families and students who carry private and public educational loans (Federal Reserve Board 2018; Federal Reserve Bank of New York 2019), thus contributing to the overall problem of student loan debt that our society now faces. Due to the rising share of Americans who are taking on educational loans to attend college and better their labor market outcomes, there is a need to examine the impact of debt on an individual's labor market decisions and outcomes.

Educational Loan Debt: Who Does it Impact?

In the evolving labor market, a college degree and skill training is often seen as a way to increase one's human capital, thus ensuring success in the labor market by obtaining a well-paid job. Due to the rising cost of college (Choy and Berker 2003; Bownen, Chingos, and McPherson 2009), many individuals and families across various demographic backgrounds take on student loans and often view this form of debt as a financial investment that could help secure future employment. To understand the ways in which educational debt impacts labor market decisions and outcomes, it is important to examine who is impacted by educational loan debt.

According to recent reports, 45 million people in the United States have some form of educational loan debt (Pew Research Center 2019; Student Loan Hero 2020). Ratcliffe and McKernan (2013), find that educational loan debt varies across different educational attainments. For example, nine percent of individuals with no more than a high school degree, 25 percent of individuals with some college, 30 percent of individuals with a college degree, and 28 percent of individuals with a graduate degree have some form of student loan debt. This also varies based on class. For example, 20

percent of individuals who come from low-income households ($25,000 and under) and 18 percent of individuals who come from high-income households ($100,000 and above) have student loan debt.

Student loan debt has also been found to vary by age. Younger individuals, aged 20 to 29 years, are more likely to hold student loan debt compared to older individuals (Ratcliffe and McKernan 2013; Federal Reserve Bank 2018). African Americans and Hispanics are approximately two times more likely to hold student loan debt compared to whites. Both males and females have similar likelihoods in having educational loan debt (Ratcliffe and McKernan 2013), however, women are more likely to hold larger quantities of student loans than men (Dwyer et al. 2013). Taken together, these findings suggest that educational debt holding does vary by race, class and gender.

Educational loan debt is not the only form of indebtedness young adults in the United Sates face today. Young adults are more indebted, through both secured and unsecured debt, than previous generations. Using a sample of three cohorts of young adults in the 1970s, 1980s, and 2000s, Houle (2014) finds that young adults today hold larger quantities of debt than previous generations, especially unsecured debt and educational debt. Houle cautions that young adults today may take on even more debt because they have not reached all major adulthood life-course markers, such as getting married and buying a home. These findings suggest that young adults currently face precarious economic situations which may affect how much educational debt they take on, thus impacting their labor market and life-course decisions and outcomes.

Mismatch and Labor Market Outcomes

The research on mismatch and labor market outcomes has been centralized around the phenomena of vertical mismatch (Cohn and Kahn 1995; Hartog 2000; Tsai 2010) and has focused on a number of issues related to wages, turnover, job satisfaction, and productivity. Vertical mismatch examines the concepts of overeducation and undereducation. Vertical mismatch is defined as when an individual completes more or less education than what is required for their job (Tsai 2010: 608). The research on vertical mismatch has greatly focused on the potential wage rewards or penalties associated with mismatch. For example, overeducation is often associated with a wage penalty; however, much of this penalty is a result of individual heterogeneity and dependent upon an individual's skill ability (Tsai 2010).

The total sum of schooling is but only one way to measure the match between an individual's schooling and job. Sloane (2003) argues that workers can be mismatched in not only quantity of schooling, but also type of schooling. Therefore, the skills for one degree (type of schooling) will not be beneficial to a job in a different degree field. One example Sloane (2003) provides is that of an English major working as a statistician. Recently, scholars have begun to examine this second type of mismatch, often termed horizontal education-occupation mismatch (Sloane 2003; Robst 2007; Neumann et al. 2010; Bender and Heywood 2011; Moore and Rosenbloom 2016; Bol et al. 2019), which examines the match between a worker's schooling and job in regard to whether their degree field is related current job. Research on horizontal mismatch has shown that workers have higher earnings when they are in occupations that match their educational level and field of study (Robst 2007; Bol et al. 2019). Furthermore, researchers examining the individual factors that impact mismatch have found that the likelihood of

mismatch increases with age, being physically disabled, and being white or Asian (Robst 2007; Bender and Heywood 2011). In addition, Robst's (2007) work on horizontal mismatch found that never married individuals, individuals with a bachelor's degree, men, and graduates from majors that emphasize general skills all have a greater likelihood of being mismatched.

Debt and Labor Market Outcomes

Of the research analyzing the relationship between debt and labor market decisions and outcomes for individuals, there are have been mixed results regarding the direction and size of the effect. One study conducted by Minicozzi (2005) looked at the short-term effect of educational debt on job decisions for American men. Using data from the 1987 National Postsecondary Student Aid Survey, the author finds that men with larger quantities of educational debt are more likely to choose occupations and job positions that have a higher starting wage but are characterized by lower wage growth. More specifically, when educational debt increases from $5,000 to $10,000, initial wage rises by 8% but wage growth decreases by 5%.

Similarly, Rothstein and Rouse (2011) use a sample of students from a selective and prestigious university in the United States to examine the impact of student loans on early-career occupational choices. The authors find that high levels of debt influence students to choose higher-salary jobs with fewer benefits, especially during the first few years after graduation. Graduates with significant loan burdens also make specific career choices in favor of paying back student loans quicker. Higher levels of student debt were found to influence employment-sector choice in which individuals with higher levels of debt were more likely to end up in private sector occupations (Rothstein and Rouse

2011). This suggests that educational debt impacts the labor market decisions of individuals, particularly regarding what jobs they choose after graduation.

Other research examining educational debt and earnings has found negative relationships between debt and earnings (Weidner 2016; Gervais and Ziebarth 2017). For example, using a combination of data from the Baccalaureate and Beyond and the 2017 National Longitudinal Survey of Youth, Weidner (2016) finds that high levels of debt influences whether college graduates enter the labor market quicker and choose jobs that are unrelated to their field, thus leading to lower income levels. Similar research has suggested that graduates with large quantities of educational debt are more likely work in less stable jobs; particularly, high quantities of debt are associated with part-time employment and less pay (Gervais and Ziebarth 2017).

The mixed findings regarding educational debt and labor market outcomes suggests that more research is needed to fully understand this relationship, as well as how this relationship extends to other graduates in non-specialized fields. In all, these findings suggest that educational debt is related to labor market decisions and outcomes. Furthermore, much of the research on horizontal mismatch has examined major labor market outcomes such as wages and employment status. Less research has been focused the factors that could influence horizontal mismatch, particularly educational loan debt. Due to the fact that education loan debt has increased for all Americans, especially young adults, it is important to examine whether student loan debt may impact an individual's likelihood of horizontal mismatch.

CHAPTER 3: HYPOTHESES

In this study, I use data from the most recent waves of the National Survey of College Graduates (Years 2013, 2015, and 2017) to examine the relationship between undergraduate student loan debt and horizontal mismatch for young adults. Research has suggested educational debt impacts college graduates early labor market decisions (Gervais and Ziebarth 2017). Particularly, the pressure to pay off debt quickly after graduation may lead individuals to have lower standards when choosing jobs causing some individuals to get jobs outside their degree field, resulting in horizontal education-occupation mismatch. In order to analyze this relationship, my first hypothesis states:

> H_1: Undergraduate educational loan debt is positively associated with educational-occupational mismatch (horizontal mismatch).

Research on college major choice has found that individuals consider expected earnings when selecting a field of study (Berger 1988). Additionally, research has found that individuals consider labor market opportunities when deciding to attend and complete college (Bozick 2007). Labor market characteristics, such as proportion of jobs requiring college degrees, unemployment, pay, and job growth, matter in the decision process of attending college. Furthermore, individuals view educational loans as a risk (Glater 2017); however, loans are viewed as an important and necessary investment for increasing labor market outcomes (Baum and O'Malley 2003). Skill specific fields of study such as computer science and engineering tend to have higher financial compensation than general skill fields of study (i.e. social sciences) and lower likelihoods of mismatch (Robst 2007). These findings suggest a possible negative relationship

between predicted salary and likelihood of mismatch. To examine this relationship, I test the following hypothesis:

> H_2: Predicted salary is negatively associated with educational-occupational mismatch (horizontal mismatch).

Because individual's may be more likely to take on higher amounts of debt if they expect higher financial compensation upon graduating and entering the labor market, the relationship between educational debt and likelihood of mismatch may be moderated by predicted salary. To examine this moderating relationship, I test the following hypothesis:

> H_3: The interaction between *undergraduate loan* and *predicted salary* will lead to a lower likelihood of being horizontally mismatched.

CHAPTER 4: DATA AND METHODS

Data

To examine the relationship between educational loan debt and horizontal education-occupation mismatch, I use the National Survey of College Graduates dataset (NSCG). The National Survey of College Graduates (NSCG) is a cross-sectional survey completed biennially. The survey provides information on college graduates from the United States, with a focus on individuals with backgrounds in science and engineering. The survey contains data on a variety of measures related to educational and occupational outcomes. More specifically, the survey asks questions related to type of degree obtained, undergraduate and graduate educational loan amounts, occupational outcomes, work activities, salary, as well as various other demographic and background measures. I use the 2013, 2015, and 2017 survey years because they provide the most up to date information regarding college graduates' educational loan amounts and labor market decisions and outcomes, while also ensuring a large sample size.

The target population for the 2013 National Survey of College Graduates includes non-institutionalized individuals who earned a bachelor's degree or higher prior to January 2012; reside in the United States as of February 2013; and are younger than 76 years as of February 2013. This sample resulted in 104,599 individual observations. The target population for the 2015 National Survey of College Graduates includes non-institutionalized individuals who earned a bachelor's degree or higher prior to January 2014; reside in the United States as of February 2015; and are younger than 76 years as of February 2015. This sample resulted in 91,000 individual observations. The target population for the 2017 National Survey of College Graduates includes non-

institutionalized individuals who earned a bachelor's degree or higher prior to January 2016; reside in the United States as of February 2017; and are younger than 76 years as of February 2017. This sample resulted in 83, 672 individual observations. The overall number of observations for all three survey years is 279,271 observations.

Sample

The sample for this study consists of participants who met three criteria. First, the National Survey of College Graduates employs a sampling design that samples individuals from previous survey years, while also sampling a new cohort of individuals each year. Due to data limitations, I cannot match individuals from previous survey years across each survey wave included in the analysis (Survey years 2013, 2015, and 2017). Therefore, I only included the new cohort of individuals for each survey year in my analyses. Second, I am only interested in analyzing the relationship between educational loan debt and horizontal mismatch for individuals who have a bachelor's degree. Therefore, I limited my sample to only individuals who possessed one bachelor's degree at the time of survey. Third, educational loan debt has been found to be concentrated amongst younger individuals (Federal Reserve Board 2019); particularly individuals under the age of 35. Furthermore, educational debt my have a larger impact on labor market decision earlier on in one's career, right after graduation (Gervais and Ziebarth 2017). Therefore, to analyze how educational debt impacts career decisions for these younger individuals, I limit my sample to individuals under the age of 35. After employing all selection criteria, my final sample size included 20,539 respondent observations.

Measures

Dependent Variable

The key outcome variable to answer my research question is a measure of horizontal education-occupation mismatch. For this study, the measure of horizontal education-occupation mismatch is derived from a single survey question in which respondents were asked: "To what extent was your work on your principal job related to your highest degree? Was it closely related, somewhat related, or not related?" Responses to this question are self-reported and subjective; however, similar studies that examine this concept using the National Survey of College Graduates also use this subjective measure of horizontal education-occupation mismatch (Robst 2007). I consider an individual who reported working in a field closely related to their educational degree to be fully matched, while a person who reported working in a field somewhat related to their educational degree is considered to be partially matched. Moreover, I consider a person working in a field not related to their educational degree to be fully mismatched.

To operationalize the measure of horizontal education-occupation mismatch, I create an ordinal level variable ranging from 0 to 2, where 0 indicates a response of "closely related" or fully matched, 1 indicates a response of "somewhat related" or partially matched, and 2 indicates a response of "not related" or fully mismatched.

Independent Variables

To analyze the relationship between educational loan debt and horizontal education-occupation mismatch, my main theoretical variable of interest is the amount of undergraduate student loan debt each respondent borrowed to finance their degree. My measure of this concept is derived from a single survey question that asks respondents: "What is the total amount you borrowed to finance your undergraduate degree(s)?" There

are 11 response categories. The categories include “$0”, $1-$10,000”, “$10,001-$20,000”, “$20,001-$30,000”, “$30,001-$40,000”, “$40,001-$50,000”, “$50,001-$60,000”, “$60,001-$70,000”, “$70,001-$80,000”, “$80,001-$90,000”, and “90,001 and above”. For each response category, I take the midpoint and convert the measure into a continuous level variable ranging from $0 to $90,001. For ease of interpretation, I then log transform the measure.

Prior research has shown that expected earnings can influence the choice of college major (Berger 1988). Furthermore, expected earnings could impact the amount of student loans an individual may take out. For example, and individual who expects high earnings may be more willing to borrow a higher loan amount than an individual who expects lower earnings. To account for this in my analyses, I create a measure that reports the predicted salary of each undergraduate major in my analyses. The National Survey of College Graduates provides data regarding respondents’ undergraduate degree field. The survey provides a comprehensive list of 142 majors. However, for ease of analysis and interpretation, I will follow previous research and group the majors into 27 field categories that are provided by the survey questionnaire (Robst 2007). I will then create a dichotomous variable for each degree field. To measure predicted salary based on major, I will perform a series of regression analyses to create predicted salaries for hypothetical individuals within each specified major. I will then log transform the predicted salary measure.

Control Variables

In addition to previous variables, I will control for a variety of measures that are found to be significant factors that impact the likelihood of horizontal mismatch. These

include gender, age, race/ethnicity, marital status, physical disability status, citizenship status, job tenure, and full-time work status (Witte and Kalleberg 1995; Wolbers 2003; Robst 2007; Bender and Heywood 2011; Farooq 2011; Bender and Roche 2013). Gender is measured as male or female (1= "Male", 0= "Female"). Race is a self-reported measure in which respondents identify as either white or another race (other than white) (1= "White", 0= "Other Race"). Martial status is a dichotomous variable that compares individuals who have never been married to individuals of other marital statuses (1= "Never Married", 0= "Other Marital Status").

Physical disability is measured as a dichotomous variable that compares individuals who self-report a physical disability to individuals who do not self-report a physical disability (1= "Physical Disability", 0= "No Physical Disability"). Full time work status measures whether an individual works 30 hours or more a week (1= "Works 30 hours or more", 0= "Works less than 30 hours"). Citizenship status is a dichotomous variable that measures whether an individual is a U.S. citizen or not (1= "U.S. Citizen", 0= "Not a U.S. Citizen"). Job tenure is a continuous variable that measures how long (in years) an individual has been working their primary job at the time of the survey. Job tenure ranges from 0 to 18 years.

Educational loan debt is concentrated amongst younger individuals (Federal Reserve Board 2019); with individuals under 35 holding half of the nation's student loan debt. In addition, Gervais and Ziebarth (2017) show that educational debt has a larger impact on labor market decisions earlier in one's career because the pressure to pay of educational debt may be greater right after college completion. To ensure I examine the individuals who may be most impacted by educational debt, I limit my sample to only

include individuals 34 years old and younger. The final age measure ranges from 20 to 34 years.

I also include a measure that assess parental SES. Due to data limitations, I can only include a measure that assesses parental education. To measure parental education for each respondent's mother, I create four dichotomous variables based on the categories: High School Degree or Less, Some College, Bachelor's Degree, and Graduate/Professional Degree. The level of education for each respondent's father was measured identical to mother's education.

Analytic Method

The primary aim of this study is to examine the relationship between educational loan debt and horizontal education-occupation mismatch. Particularly, I examine an individual's likelihood of horizontal mismatch based on a variety of factors, including both quantity of educational loan debt and predicted salary based on field of degree. As stated previously, I measure horizontal mismatch as an ordinal level variable ranging from 0 to 2, where 0 indicates a response of "closely related" or fully matched, 1 indicates a response of "somewhat related" or partially mismatch, and 2 indicates a response of "not related" or fully mismatched. One effective analysis method for a three-category, ordinal level dependent variable is ordered logistic regression. One main tenet of the ordered logit model is the Proportional Odds Assumption, in which the slope is assumed to be the same for both equations of the model (Long 1997). If the Proportional Odds Assumption is not met, then the ordered logit model is mis-specified. Therefore, to account for violations of the Proportional Odds Assumption, I will use generalized ordered logistic regression over ordered logistic regression (Williams 2016).

CHAPTER 5: RESULTS

Descriptive Statistics

The following sections present the results of my descriptive statistics and the four models used to test the hypotheses discussed above. A correlation matrix of the variables used for analysis is provided in *Appendix A*. None of the included variables are correlated above a Pearson correlation of 0.5. *Table 1* presents the descriptive statistics for all variables which includes the 20,539 respondent observations. My outcome variable, horizontal mismatch, measures the level of mismatch based on three categories: fully matched, partially matched, and fully mismatched. Looking at the table, it can be seen that 50.68 % of the sample is fully matched, 29.01% of the sample is partially matched, and 20.13% of the sample is mismatched.

Looking at my main independent variable the mean borrowed undergraduate loan amount is approximately 10.07 log dollars, which equates to roughly $23,624. This amount is similar to national averages for undergraduate loan amounts; however, it is below the national average (Federal Reserve Board 2019). Furthermore, approximately 32.02% of the sample did not take out any undergraduate student loans, which is similar to the national average of college graduates who have not taken out any student loans (Student Loan Hero 2020). The mean predicted salary for this sample is 11.11 log dollars, which is approximately $66,836.

Table 1. Descriptive Statistics for All Variables

Variable	*Mean/Percentage*	*Standard deviation*
Dependent Variable		
Horizontal Mismatch (Level of Mismatch)		
Fully Matched	50.86%	---
Partially Matched	29.01%	---
Fully Mismatched	20.13%	---
Independent Variables		
Borrowed Undergraduate Loan (Log Dollars)	10.07	0.85
Percentage of Individuals Who Did Not Borrow	32.02%	---
Predicted Salary (Log Dollars)	11.11	0.14
Demographics		
Gender (male = 1)	53.32%	---
Age	27.81	2.79
Age Squared	781.47	158.45
Race (white = 1)	59.77%	---
Marital Status (never married = 1)	48.97%	---
Disability Status (no physical disability = 1)	93.64%	---
Mother's Education		
High School or Less	27.83%	---
Some College	25.84%	---
Bachelor's Degree	28.70%	---
Graduate and Professional Degree	17.63%	---
Father's Education		
High School or Less	28.50%	---
Some College	21.91%	---
Bachelor's Degree	27.16%	---
Graduate and Professional Degree	22.43%	---
Working Full Time (yes = 1)	90.79%	---
Job Tenure (in years)	3.11	2.41
Citizenship Status (U.S. citizen = 1)	97.55%	---

Source: Data for the analysis are drawn from the National Survey of College Graduates (2013, 2015, and 2017 survey years).
Note: N = 20,539.

Calculation of Predicted Salary

As stated previously, individuals account for expected earnings when selecting a college major (Berger 1988), which can then impact their decision to take on student loans. To control for this in subsequent analyses, I perform a series of linear regression analyses that compute predicted salaries for hypothetical individuals for each major, while holding all control variables at their means or modes. *Figure 1* presents the predicted salary by major in dollars. Each of the 27 majors are ranked in order from lowest predicted salary (top of the figure) to highest predicted salary (bottom of figure).

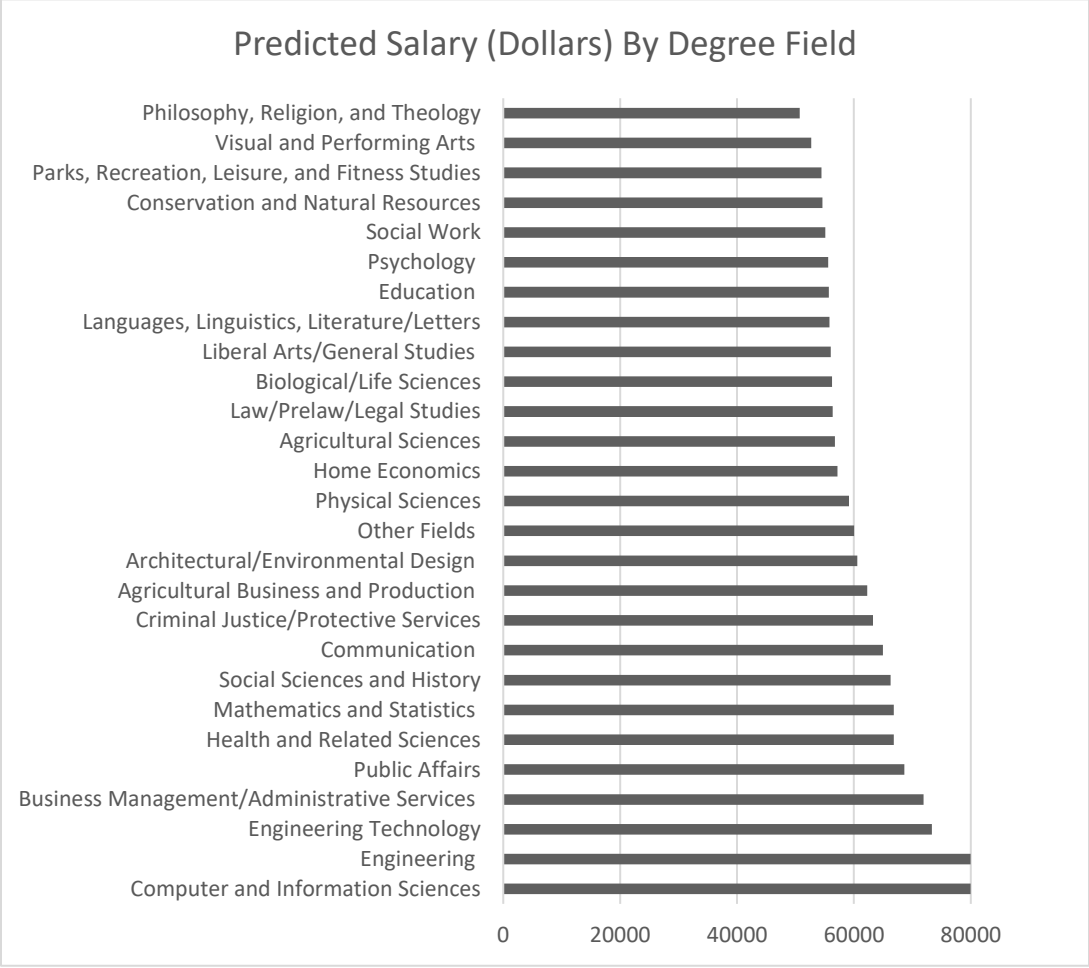

Figure 1. Predicted Salary in Dollars by Degree Field

As can be seen from *Figure 1* above, Computer and Information Science majors have the highest predicted salary of approximately $80,000, while Philosophy, Religion, and Theology majors have the lowest predicted salary of approximately $50,000. To use in further analyses, I log transform the predicted salary based on major choice for each observation.

Demographics and Mismatch

To test the relationship between my variables of interest and horizontal education-occupation mismatch, I estimate a sequence of generalized ordered logistic regression analyses. As stated previously, generalized ordered logistic regression is used over ordered logistic regression to account for violations of the Proportional Odds Assumption. Using generalized ordered logistic regression results in a series of binary logit models in which the dependent variable is collapsed into two categories (Category 1 vs. Categories 2 and 3; and Categories 1 and 2 vs. Category 3); therefore, coefficients can be interpreted similarly to binary logit model.

Table 2 provides the results of the model that regresses mismatch on a variety of measures that have been found to be determinants of horizontal education-occupation mismatch (Somers et al. 2019). Consistent with previous literature, the likelihood of being horizontally mismatched relates to an individual's race, gender, age, marital status, disability status, full-time working status, job tenure, and citizenship. For ease of interpretation, I will only interpret the model that compares fully mismatched to fully matched and partially matched.

Gender, race, disability status, employment status, job tenure, and having a mother with a graduate/professional degree all have significant negative relationships

with being horizontally mismatched. Compared to females, being male decreases the odds of being mismatched by approximately 19% (=(1-exp [-0.21])*100, $p < .001$). Furthermore, being white (compared to other races) decreases the odds of being mismatched by approximately 42% (p-value <0.001). Compared to individuals who are physically disabled, not having a physical disability decreases the odds of being mismatched by approximately 25% (p-value <0.001). Full-time employment decreases the odds of being mismatched by approximately 29% (p-value <0.001). Additionally, a one-year increase in job tenure, decreases the odds of being mismatched by approximately 7% (p-value <0.001). Furthermore, having a mother with a graduate/professional degree decreases the odds of being mismatched by approximately 10% (p-value <0.05). Taken together, these findings suggest that being male, white, physically abled, working full-time, having longer job tenure, and having a mother with a graduate/professional degree reduces the odds of being horizontally mismatched.

In contrast, age, marital status, and citizenship status are positively associated with being mismatched. Holding all other factors constant, a one-year increase in age increases the odds of being mismatched by approximately 40% (p-value <0.001). Having never been married increases the odds of being mismatched by approximately 24% (p-value <0.001). In addition, being a U.S. citizen increases the odds of being mismatched by approximately 43% (p-value <0.01). Therefore, age, having been never married, and being a U.S. citizen increases the odds of being horizontally mismatched.

Table 2. Generalized Ordered Logistic Regression (Demographics)

	Fully Matched vs. Partially Matched, Mismatched			Fully Matched, Partially Matched vs. Mismatched		
Variable	***Coefficient***	***Std. Err.***	***OR***	***Coefficient***	***Std. Err.***	***OR***
Demographics						
Male	-0.21***	0.03	0.81	-0.31***	0.04	0.74
White	-0.55***	0.03	0.58	-0.55***	0.03	0.58
Age	0.33***	0.08	1.40	0.33***	0.08	1.40
Age Squared	-0.005**	0.001	0.995	-0.005***	0.001	0.995
Marital Status	0.22***	0.03	1.24	0.22***	0.03	1.24
Disability Status	-0.29***	0.05	0.75	-0.29***	0.05	0.75
Mother's Education[1]						
Some College	-0.03	0.04	0.97	-0.03	0.04	0.97
Bachelor's Degree	-0.07	0.04	0.93	-0.07	0.04	0.93
Graduate/Professional Degree	-0.10*	0.05	0.90	-0.10*	0.05	0.90
Father's Education[1]						
Some College	-0.009	0.04	0.99	-0.009	0.04	0.99
Bachelor's Degree	-0.06	0.04	0.94	-0.06	0.04	0.94
Graduate/Professional Degree	0.04	0.05	1.04	-0.05	0.05	0.95
Working Full Time	-0.35***	0.05	0.71	-0.77***	0.05	0.46
Job Tenure	-0.07***	0.006	0.93	-0.07***	0.006	0.93
Citizenship Status	0.36***	0.09	1.43	0.36**	0.09	1.43
Constant	-4.54***	1.20	0.01	-5.51***	1.20	0.004

Source: Data for the analysis are drawn from the National Survey of College Graduates (2013, 2015, and 2017 survey years) (N = 20,539).

*Note: *** p-value < .001, ** p-value < .01, *p-value < .05*

[1]High School or Less than High School is reference category.

Educational Loan Debt and Mismatch

Next, I test *Hypothesis 1,* which states that undergraduate educational loan debt is positively associated with educational-occupational mismatch (horizontal mismatch). *Table 3* shows the results of the model analyzing this relationship. From the table below, it can be seen that educational loan debt has a positive coefficient; however, the relationship is not statistically significant at the $p<0.05$ level. A one-unit increase in the log transformed educational loan debt variable, increases the odds that a respondent is mismatched (compared to fully matched or partially matched) by approximately 0.3%, but this relationship is not statistically significant using the standard measure of significance ($p<0.05$ level). Therefore, because of the lack of statistical significance at the $p<0.05$ level, the results do not lend support for *Hypothesis 1*. Furthermore, gender, race, disability status, employment status, age, marital status, having a mother with a graduate/professional degree, job tenure, and citizenship status are all statistically significant in the same directions as the previous model (*Table 2).*

Table 3. Generalized Ordered Logistic Regression (Debt and Demographics)

	Fully Matched vs. Partially Matched, Mismatched			Fully Matched, Partially Matched vs. Mismatched		
Variable	***Coefficient***	***Std. Err.***	***OR***	***Coefficient***	***Std. Err.***	***OR***
Independent Variable						
Educational Loan Amount (Log)	0.003	0.003	1.003	0.003	0.003	1.003
Demographics						
Male	-0.21***	0.03	0.81	-0.30***	0.04	0.74
White	-0.55***	0.03	0.58	-0.55***	0.03	0.58
Age	0.33***	0.08	1.40	0.33***	0.08	1.40
Age Squared	-0.005***	0.001	0.995	-0.005***	0.001	0.995
Marital Status	0.22***	0.03	1.24	0.22***	0.03	1.24
Disability Status	-0.29***	0.05	0.75	-0.29***	0.05	0.75
Mother's Education[1]						
Some College	-0.03	0.04	0.97	-0.03	0.04	0.97
Bachelor's Degree	-0.07	0.04	0.93	-0.07	0.04	0.93
Graduate/Professional Degree	-0.10*	0.05	0.91	-0.10*	0.05	0.91
Father's Education[1]						
Some College	-0.01	0.04	0.99	-0.01	0.04	0.99
Bachelor's Degree	-0.06	0.04	0.94	-0.06	0.04	0.94
Graduate/Professional Degree	0.04	0.05	1.04	-0.04	0.05	0.96
Working Full Time	-0.35***	0.05	0.71	-0.77***	0.05	0.46
Job Tenure	-0.07***	0.006	0.93	-0.07***	0.006	0.93
Citizenship Status	0.36***	0.09	1.43	0.36***	0.09	1.43
Constant	-4.55***	1.20	0.011	-5.51***	1.20	0.004

Source: Data for the analysis are drawn from the National Survey of College Graduates (2013, 2015, and 2017 survey years) (N = 20,539).
*Note: *** p-value < .001, ** p-value < .01, *p-value < .05*
[1]High School or Less than High School is reference category.

Educational Loan Debt, Predicted Salary, and Mismatch

To test *Hypothesis 2* which states predicted salary is negatively associated with educational-occupational mismatch (horizontal mismatch), I include the addition of predicted salary based on degree field in my models. Results from *Table 4* suggest there is a highly significant (p-value <0.001) negative relationship between predicted salary and horizontal mismatch. Therefore, a one-unit increase in the log transformed predicted salary variable, decreases the odds of being partially matched or mismatched (compared to fully matched) by approximately 88% (p-value <0.001). Furthermore, a one-unit increase in the log transformed predicted salary variable, decreases the odds of being mismatched (compared to fully matched or partially matched) by approximately 97% (p-value <0.001). Taken together, these findings suggest that as predicted salary increases for individuals, the odds of being mismatched decreases. These findings are consistent with previous literature that suggests that skill specific fields of study such as computer science and engineering, which tend to have higher salaries, are less likely to be mismatch (Robst 2007). The results from this model show a significant relationship between predicted salary and horizontal mismatch. Therefore, the results support Hypothesis 2 which states: predicted salary is negatively associated with educational-occupational mismatch (horizontal mismatch).

One important thing to note is that once predicted salary is included in the analysis, the variable that measures gender becomes insignificant. This finding highlights the important of controlling for predicted salary in the analysis of horizontal mismatch, especially regarding the impact of gender. In addition, race, disability status, employment status, age, marital status, having a mother with a graduate/professional

degree, job tenure, and citizenship status are all statistically significant in the same directions as the previous models (*Table 2 and Table 3).*

Table 4. Generalized Ordered Logistic Regression (Debt, Predicted Salary, and Demographics)

	Fully Matched vs. Partially Matched, Mismatched			Fully Matched, Partially Matched vs. Mismatched		
Variable	***Coefficient***	***Std. Err.***	***OR***	***Coefficient***	***Std. Err.***	***OR***
Independent Variables						
Educational Loan Amount (Log)	0.002	0.003	1.002	0.002	0.003	1.002
Predicted Salary (Log)	-2.08***	0.11	0.12	-3.62***	0.14	0.03
Demographics						
Male	-0.01	0.03	0.99	-0.01	0.03	0.99
White	-0.54***	0.03	0.58	-0.54***	0.03	0.58
Age	0.35***	0.09	1.42	0.35***	0.09	1.42
Age Squared	-0.005**	0.002	0.99	-0.005***	0.002	0.99
Marital Status	0.20***	0.03	1.23	0.20***	0.03	1.23
Disability Status	-0.24***	0.05	0.78	-0.24***	0.05	0.78
Mother's Education[1]						
Some College	-0.05	0.04	0.96	-0.05	0.04	0.96
Bachelor's Degree	-0.06	0.04	0.94	-0.06	0.04	0.94
Graduate/Professional Degree	-0.11*	0.05	0.89	-0.11*	0.05	0.89
Father's Education[1]						
Some College	-0.01	0.04	0.99	-0.01	0.04	0.99
Bachelor's Degree	-0.02	0.04	0.98	-0.02	0.04	0.98
Graduate/Professional Degree	0.06	0.05	1.06	-0.03	0.05	0.97
Working Full Time	-0.26***	0.05	0.77	-0.67***	0.05	0.53
Job Tenure	-0.07***	0.006	0.94	-0.07***	0.006	0.94
Citizenship Status	0.33***	0.09	1.39	0.33***	0.09	1.39
Constant	18.15***	1.67	7.65E+07	34.14***	1.94	6.72E+14

Source: Data for the analysis are drawn from the National Survey of College Graduates (2013, 2015, and 2017 survey years) (N = 20,539).
*Note: *** p-value < .001, ** p-value < .01, *p-value < .05*

Interaction Between Educational Loan Debt and Predicted Salary

Finally, I test *Hypothesis 3* which states the interaction between *undergraduate loan* and *predicted salary* will lead to a lower likelihood of being horizontally mismatched. *Table 5* shows the results of the model analyzing this relationship. As can be seen below, the interaction between undergraduate educational debt and predicted salary is insignificant. This result does not lend support for *Hypothesis 3.* Consistent with *Table 4*, the results show that predicted salary is negatively associated with horizontal mismatch. Furthermore, race, disability status, employment status, age, marital status, job tenure, and citizenship status are all statistically significant in the same directions as the previous models (*Table 2, Table 3, and Table 4).* These findings suggest that even when controlling for educational loan debt, predicted salary, and the interaction between the two, being white, physically abled, having a mother with a graduate/professional degree, job tenure, and working full-time reduces the odds of being horizontally mismatched, whereas age, having been never married, and being a U.S. citizen increases the odds of being horizontally mismatched.

Table 5. Generalized Ordered Logistic Regression (Interaction Between Educational Loan Amount and Predicted Salary)

	Fully Matched vs. Partially Matched, Mismatched			Fully Matched, Partially Matched vs. Mismatched		
Variable	***Coefficient***	***Std. Err.***	***OR***	***Coefficient***	***Std. Err.***	***OR***
Independent Variables						
Educational Loan Amount (Log)	0.15	0.22	1.17	0.15	0.22	1.17
Predicted Salary (Log)	-1.99***	0.17	0.14	-3.53***	0.19	0.03
*Educational Loan Amount (Log)*Predicted Salary (Log)*	-0.014	0.02	0.99	-0.014	0.02	0.99
Demographics						
Male	-0.01	0.03	0.99	-0.01	0.03	0.99
White	-0.54***	0.03	0.58	-0.54***	0.03	0.58
Age	0.35***	0.09	1.42	0.35***	0.09	1.42
Age Squared	-0.005***	0.002	0.99	-0.005***	0.002	0.99
Marital Status	0.20***	0.03	1.23	0.20***	0.03	1.23
Disability Status	-0.24***	0.05	0.78	-0.24***	0.05	0.78
Mother's Education[1]						
Some College	-0.05	0.04	0.96	-0.05	0.04	0.96
Bachelor's Degree	-0.06	0.04	0.94	-0.06	0.04	0.94
Graduate/Professional Degree	-0.11*	0.05	0.89	-0.11*	0.05	0.89
Father's Education[1]						
Some College	-0.01	0.04	0.99	-0.01	0.04	0.99
Bachelor's Degree	-0.02	0.04	0.98	-0.02	0.04	0.98
Graduate/Professional Degree	0.06	0.05	1.06	-0.03	0.05	0.97
Working Full Time	-0.26***	0.05	0.77	-0.64***	0.05	0.53
Job Tenure	-0.07***	0.006	0.94	-0.07***	0.006	0.94
Citizenship Status	0.33***	0.09	1.39	0.34***	0.09	1.39
Constant	17.12***	2.23	2.73E+07	33.10***	2.45	2.36E+14

Source: Data for the analysis are drawn from the National Survey of College Graduates (2013, 2015, and 2017 survey years) (N = 20,539).

*Note: *** p-value < .001, ** p-value < .01, *p-value < .05*

[1]*High School or Less than High School is reference category.*

CHAPTER 6: DISCUSSION OF RESULTS

The purpose of this paper was to answer my main research question: "What is the relationship between student loan debt and educational-occupational mismatch (the extent to which an individual works in an occupation unrelated to their degree field)?" While many researchers have examined the role of horizontal mismatch on various labor market outcomes, such as salary, few have examined the mechanisms that impact an individual's likelihood of being horizontally mismatched. I attempt to fill this gap in the literature by examining the role of educational loan debt on horizontal education-occupation mismatch, as well as the role of predicted salary on likelihood of horizontal mismatch.

My findings regarding the impact of undergraduate student loan debt on horizontal education-occupation mismatch are not statistically significant. Despite finding marginally significant results in my first model in *Table 3,* I was not able to show that higher amounts of educational loan debt are associated with greater likelihood of being horizontally mismatched. Due to these findings, I cannot support my first hypothesis (H_1) which states: Undergraduate educational loan debt is positively associated with educational-occupational mismatch (horizontal mismatch). Additionally, this study does not find support for the third hypothesis (H_3), which examines the interaction between predicted salary and educational loan debt.

In contrast, I was able to find evidence of support for my second hypothesis (H_2) stating that predicted salary is negatively associated with the likelihood of horizontal mismatch. In other words, individuals with higher predicted salaries were less likely to be horizontally mismatched. These findings are consistent with research arguing that

individuals account for expected earnings when selecting a college major (Berger 1988). In addition, these results build upon prior research conducted by Robst (2007) that examines horizontal mismatch. Robst finds that degree fields such engineering and computer science have lower rates of horizontal mismatch. Robst argues that the lower rates of mismatch in these fields are due to the more skill-specific nature of these degrees, especially compared to more general-skilled degree fields such as the humanities and social sciences. Therefore, the results of my study can build on Robst's argument about the likelihood of horizontal mismatch for both skill-specific and higher paid (predicted pay) majors/degree fields. Furthermore, the inclusion of the predicted salary in the second model presented in *Table 4* results in the gender variable becoming insignificant, thus highlighting the importance of controlling for predicted salary.

Lastly, across each model I find that being white, physically abled, job tenure, having a mother with a graduate/professional degree, and working full-time reduces the odds of being horizontally mismatched, whereas age, having been never married, and being a U.S. citizen increases the odds of being horizontally mismatched. These findings are consistent with the literature on the factors that impact horizontal mismatch (Witte and Kalleberg 1995; Wolbers 2003; Robst 2007; Bender and Heywood 2011; Farooq 2011; Bender and Roche 2013; Somers et al. 2019).

CHAPTER 7: CONCLUSION, LIMITATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

The present paper builds upon previous studies that examine the factors that impact labor market decisions and outcomes for young adults. Particularly, this study builds on the body of research that focuses on the causes and consequences of horizontal education-occupation mismatch (Cohn and Kahn 1995; Hartog 2000; Robst 2007; Neumann et al. 2010; Tsai 2010; Bender and Heywood 2011; Moore and Rosenbloom 2016; Bol et al. 2019). I extend and contribute to this literature by examining if educational loan debt is a determinant of horizontal mismatch for young adults and whether that relationship is moderated by the predicted salary of the degree field. I find no association between educational loan debt and horizontal mismatch; however, I do find a negative association between predicted salary and horizonal mismatch. In other words, individuals with higher predicted salaries are less likely to be horizontally mismatched. This finding highlights the importance of controlling for predicted salary when studying horizontal mismatch. Furthermore, this finding is consistent with previous research that indicates individuals account for expected earnings when selecting a college major (Berger 1988), as well as potential labor market opportunities after college completion (Bozick 2007).

The present paper suffers from multiple limitations. First, this study is limited through the use of cross-sectional data. To fully understand how educational loan debt impacts horizontal education-occupation mismatch, it would be beneficial to use longitudinal data. Longitudinal data would allow researchers to analyze how the likelihood of horizontal mismatch changes throughout an individual's time in the labor

market. Future research should employ the use of longitudinal data to examine if horizontal mismatch is greater in the time period right after college graduation (when individuals face more risk of not paying off loans), or if horizontal mismatch remains constant. For example, the likelihood of horizontal mismatch may be greater in the first five years after graduation because individuals face more pressure to pay of their educational loans and avoid extended periods of unemployment.

Another limitation of this study is the way in which the main independent variable, undergraduate loan amount, is coded. The National Survey of College Graduates (NSCG) does not provide exact amounts for the borrowed educational loan variable. Instead, the NSCG asks respondents if they took out undergraduate student loans and what the approximate amount was; however, the responses were grouped in categories ranging from $0 to $91,000 and above. Operationalizing the main independent variable as actual loan amounts (in dollars) may change the results of the tested relationship and allow future researchers to examine and account for the true variation between the differing loan amounts in the analysis.

In summary, Americans are increasingly becoming more indebted, especially young adults. Educational loan debt is now the second largest household debt category (Household Debt and Credit Report 2020), reaching a staggering $1.64 trillion nationwide (Pew Research Center 2019; Student Loan Hero 2020). Overall, understanding the role debt plays in both educational and labor market decisions and outcomes is crucial for understanding broader patterns of societal inequality, particularly regarding social inclusion and exclusion, directing life chances, and the allocation of economic rewards.

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APPENDIX: CORRELATION MATRIX