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The role of education, occupational match on job satisfaction in the behavioral and social science workforce

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Abstract

While many studies that have been conducted in recent years examining the education and workforce outcomes of STEM graduates, few have focused on the behavioral and social sciences (BSS). Federal agencies, such as National Institutes of Health (NIH), are implementing policies to foster multidisciplinary research in an effort to find more effective solutions to complex problems. As a result, there is growing interest in the career pathways of BSS scientists. This study seeks to increase our understanding of how BSS graduates, particularly women and underrepresented minorities, transition to employment within their respective fields. The focus of this research is the impact of horizontal mismatch, defined as the misalignment between a worker's degree and occupational fields, on job satisfaction and wage outcomes. This analysis of returns to education when mismatch occurs, including a comparison among majors and various demographic groups, provides insights into the labor market experiences of these scientists. Mismatched graduates were found to be much more vulnerable, earning less, and having lower job satisfaction, than their counterparts employed in jobs that aligned with their field of study. Additional job-related training was found to have a positive influence on these outcomes. Also of interest in this study were variations in wage penalties and job satisfaction between groups having different gender and race diversity characteristics. These findings are useful to human resource development (HRD) professionals, governmental policymakers, and other stakeholders seeking strategies to improve the workforce outcomes of BSS scientists.

Keywords

behavioral and social science; education-job mismatch; job satisfaction; wage

1 | INTRODUCTION

This study focuses on the alignment between education degree and occupation for individuals in the behavioral and social sciences. We focus in on the impact of this alignment on job satisfaction. Research on human resource development (HRD) and human

resource management (HRM) has led to the hypothesis that individuals employed in occupations for which they are trained are being more satisfied with their jobs. Moreover, job satisfaction is strongly related to productivity. We term this alignment a “horizontal match.”

Horizontal mismatch is defined as existing when the subject of study for the terminal degree (e.g., sociology) is different than the primary field of the occupation (e.g., clerk) (Sloane, 2003). This research aims to increase our understanding of behavioral and social sciences (BSS) workers’ employment outcomes within their respective fields, and by workforce diversity group, with respect to job satisfaction and earnings. This study is concerned with the impact of horizontal mismatch given the high degree of uncertainty regarding whether the outcomes associated with it are more likely to be positive or negatively influenced (Bédoué & Giret, 2011; McGuinness, Pouliakas, & Redmond, 2018; Robst, 2007a; Verhaest, Sellami, & Van der Velden, 2017; Wolbers, 2003). Less is known about workforce outcomes relating to horizontal mismatch than other forms of education-job misalignment, including vertical mismatch (over or under employment), skills gaps, and skills obsolescence (Robst, 2007a; Robst & VanGilder, 2016; Verhaest et al., 2017). Mismatch may occur at the firm level with the impacts measured in aggregate, or at the individual level with effects on employee-related outcomes. We conducted logic regression and standard wage regression analyses on National Survey of College Graduates (NSCG) data to examine the return on investments in education when horizontal mismatch occurs. These results, along with the findings of our investigation of the impacts of horizontal mismatch on outcomes by various BSS degree fields and workforce diversity groups, provide valuable insights into the labor market experiences of BSS graduates.

2 | RESEARCH ON HORIZONTAL MISMATCH IN DIFFERENT DEGREE FIELDS

Students’ choice of major and college, and their success in the labor market after graduation, determine how well they maximize their return on investment in education (Robst, 2007b). The match between field of study and field of employment is one measure of a graduate’s ability to use their acquired knowledge and skills in the labor market. It is quite common for more recent graduates having less work experience to work in jobs that are not well aligned with their field of study; especially, in the social and behavioral sciences (Yuen, 2010). One reason for this mismatch is the labor market supply and demand dynamics. Gaps in the supply of graduates versus available jobs (demand) in certain sectors result in an increased likelihood that workers will accept job offers that are not aligned well with their education attainment level (Wolbers, 2003), resulting in their being over or under qualified for the position (Freeman & Hirsch, 2008). Likewise, their skill level may not meet, or may exceed, what is required due to being obsolete resulting in crowding or bumping out (Sloane, Mavromaras, O’Leary, McGuinness, & O’Connell, 2010). While earlier studies have found evidence of the variation of horizontal mismatch between different fields of study (Verhaest et al., 2017; Wolbers, 2003), there is interest in knowing if the most recent data available confirm this. Therefore, we hypothesize that the effects of horizontal mismatch for each workforce diversity (gender and race) group vary by different BSS degree fields.

Hypothesis H1 *Horizontal mismatch of each workforce diversity group differs by different BSS degree field.*

Horizontal mismatch is usually a problem for the initial entry into employment, as new college graduates search for jobs and accept or reject jobs based on many criteria, including wages, location, and occupational match. Horizontal mismatch outcomes differ by major fields of study and depend on graduates' personal characteristics, as well as labor market demand (Nordin, Persson, & Rooth, 2010; Robst, 2007a). Variations in unemployment rates frequently occur especially in cases where the labor market demand for a specific major is unstable. Thus, it is often difficult for students to anticipate future occupational demand and they have no assurances that there will be job opportunities in their chosen field once they receive their degree. Labor market instability is also an issue for incumbent workers who may be dislocated during economic downturns, such as the great recession from 2007–2009. Consequently, more experienced individuals may experience horizontal job mismatch when forced to find employment in tight labor markets. Conversely, when demand for workers is high, employers are more motivated to hire applicants who lack the ideal credentials, increasing the likelihood for horizontal job mismatch to occur.

Consequently, workforce outcomes are quite uncertain for many BSS major fields, resulting in challenges for individuals faced with choosing a program of study (Becker, 1994; Robst, 2007b). Individuals choose their major when they attend college by considering various career-related factors, including their chances for successful degree completion, the potential for job opportunities after graduation, the expected salaries associated with available jobs and anticipated labor market demand (Berger, 1988; Montmarquette, Cannings, & Mahseredjian, 2002; Polachek, 1978). Employers benefit from having an adequate supply of individuals well prepared with the knowledge, skills, and attitudes (KSAs) necessary to be productive, satisfied members of the workforce.

An increased bottom line is the benefit for organizations when they are successful in minimizing the risk for additional on-the-job training when employees are well matched. The overall economy of the nation is stronger when labor market supply and demand dynamics are closer to achieving equilibrium. Thus, gaining insights into how the likelihood of horizontal mismatch occurs for various workforce diversity groups by field of study using the most recent data available is useful to HRD experts and others, such as higher education program planners, concerned with ensuring a well-prepared workforce.

3 | RESEARCH ON HORIZONTAL MISMATCH AND WAGES

Higher education credentials are an investment in human capital and will make people more productive in the labor force resulting in greater earnings (Becker, 1994; Shaw, 1984). Unfortunately, graduates do not always realize the expected returns to their investments. Individuals, organizations, and society as a whole profit when human resources are used effectively (Schultz, 1961). Beyond the well-documented cases of wage penalties associated with vertical mismatch resulting from overeducation or undereducation (Freeman & Hirsch, 2008), there are wage implications for workers whose degree-related knowledge and skills are not utilized in their occupation (Nordin et al., 2010; Verhaest et al., 2017; Wolbers, 2003).

Many countries, including the United States, have recognized the connection between national productivity and HRD (McLean, 2004). The definition of HRD reflects this: “any process or activity that, either initially or over the long term, has the potential to develop adult’s work-based knowledge, expertise, productivity and satisfaction, whether for personal or group, team gain, or for the benefit of an organization, community, nation, or ultimately, the whole of humanity” (McLean & McLean, 2001). Jobs that do not employ workers’ capabilities have been shown to yield lower wages than jobs for which they are well matched (Béduwé & Giret, 2011), resulting in individual, organizational, and national economic costs due to horizontal mismatch (Robst, 2007b).

There are also differential impacts of the mismatch by gender and race, both because women and minorities have lower average earnings in the same jobs and because BSS occupations are to some degree segregated by gender and race (Fryer, Pager, & Spenkuch, 2013; Ginther & Kahn, 2006; Goldin, 2014; Hur, Andalib, Maurer, Hawley, & Ghaffarzadegan, 2017). In this study, we hypothesize that BSS workers who experience greater horizontal mismatch earn lower wages than workers with less mismatch do, regardless of their workforce diversity group.

Hypothesis H2 *BSS workers who have greater horizontal mismatch, regardless of workforce diversity group, earn lower wages than BSS workers with less mismatch do.*

As students enter college they expect to eventually find work in an occupation that is related to their field of study (Robst, 2007b; Wolbers, 2003). They also expect to gain KSAs from their selected program of study that will prepare them for the occupation in which they plan to seek employment. In reality, whether job seekers are new to the workforce or they are changing jobs once employed, various factors might lead to accepting a job that does not align with their formal education. In these cases, Robst (2007b) found that wage penalties associated with horizontal job mismatch vary by major, and that variations in the transferability of skills and knowledge learned in different areas of study influence the likelihood of experiencing mismatch. That is, degree fields in which graduates have highly transferable skills that are applicable to a broader range of occupations have smaller wage penalties. In fact, BSS majors are considered to have relatively high transferability, yet have been found to be more likely to experience horizontal mismatch (Yuen, 2010).

4 | RESEARCH ON HORIZONTAL MISMATCH AND JOB SATISFACTION

While wages represent the monetary compensation in the labor market associated with choosing a specific major and finding a well-matched job (Robst, 2007b), job satisfaction represents both monetary and nonmonetary rewards to workers. Job satisfaction levels indicate the overall feelings of employees toward their jobs (Saari & Judge, 2004). Dissatisfaction with their current job is one of the main reasons people experiencing job mismatch search for new jobs (Allen & Van der Velden, 2001). Moreover, job mismatch has been found to be a significant cause of job dissatisfaction (Béduwé & Giret, 2011; Tsang & Levin, 1985). We hypothesize that employees experiencing horizontal mismatch are less likely to have high job satisfaction across all workforce diversity groups and BSS fields.

Hypothesis H3 *Horizontal mismatch is negatively associated with job satisfaction for all workforce diversity groups and BSS fields.*

Low job satisfaction due to horizontal mismatch is linked to lower productivity (Kim & Oh, 2002). Conversely, when education and job are well-matched employees use the knowledge and skills acquired from their educational experiences gained from attending universities or other training programs more effectively (Robst & VanGilder, 2016). When workers are able to fully engage with their work in this manner, job satisfaction increases (Allen & Van der Velden, 2001). That is, education-job mismatch negatively affects overall job satisfaction (Bender & Heywood, 2009; Johnson & Johnson, 2000; Vila & García-Mora, 2005).

Given the focus of much of the existing Science, Technology, Engineering and Mathematics (STEM) workforce research on natural and biological sciences, there is limited knowledge of the workforce outcomes and diversity of BSS scientists. Workforce outcomes are classified in three areas: whether or not the workers experience horizontal mismatch, how much they are paid, and whether or not they experience job satisfaction. First, horizontal mismatch indicates whether or not students succeed in the labor market by finding jobs in which they can apply the knowledge, skills, and abilities learned while in school (Robst, 2007b). Secondly, wages are a quantitative measure of workforce outcomes showing the returns to education that college graduates receive upon entering employment. The final measure is job satisfaction defined here as the overall positive or negative feelings employees have toward their jobs (Robst & VanGilder, 2016). Job mismatch has been identified as a primary reason for workers to be dissatisfied with their job and to, subsequently, change jobs (Allen & Van der Velden, 2001). Furthermore, job mismatch has been shown to have significant negative effects on the likelihood of a person being satisfied in their current position (Tsang & Levin, 1985). Workforce diversity is also recognized as being a potential factor influencing employment outcomes negatively (Quillian, Pager, Hexel, & Midtbøen, 2017; Xie & Shauman, 2003) and is considered here by including gender and race factors in our analyses. This research examines each of the employment outcomes of interest in turn in an effort to inform effective policy strategies designed to ensure a sustainable and robust BSS workforce.

We conducted logic regression and standard wage regression analyses on data from the NSCG. This analysis of the return on investments in education, together with our investigation of the impacts of horizontal mismatch on outcomes by various BSS degree fields and workforce diversity groups, provides valuable insights into the labor market experiences of these scientists.

5 | IMPORTANCE OF BSS AND CURRENT STATUS COMPARED TO OTHER FIELDS

Despite its importance, little attention has been paid to the behavioral and social science workforce in comparison to other STEM fields (Castaños-Lomnitz, 2006). The majority of empirical STEM workforce studies have focused on the natural and physical sciences including engineering, physics, chemistry, and biology (Congress, 1989; Ghaffarzadegan, Hawley, & Desai, 2014; McGee Jr, Saran, & Krulwich, 2012; National Institute of Health,

2012), excluding behavioral and social sciences. Many countries, including the United States, have been working for decades to address the need for a strong workforce in STEM fields to meet the growing demand necessary to remain competitive in the post-Great Recession global economy (Larson, Ghaffarzadegan, & Xue, 2014; Xue & Larson, 2015).

There is an increasing interest in identifying strategies to improve the size of the federal government's BSS workforce, which includes the fields of economics, political science, psychology, sociology & anthropology, and other social sciences (Presidential Executive Order, 2015). In 2015, President Obama's Executive Order (EO) 13,707 recognized the importance of contributions of this workforce with the directive to "strengthen agency relationships with the research community to better use empirical findings from the behavioral sciences." Despite the current administration's move to rescind EO 13707, the need for a strong BSS workforce persists. Public policy benefits from considering factors beyond what is expected when assuming that people are entirely rational in their decision-making, as this is often not the reality. In the case of health-related policy, the NIH has a history of recognizing the importance of BSS research (BSSR) and its ability to contribute to their "...understanding of the basic underlying mechanisms and treatment of mental and physical health and illness" (NIH, 2017). For example, the current opiate addiction crisis requires the BSS workforce to play a central role in development of solutions that include strategies emphasizing social and behavioral changes (Bershad, Miller, Norman, & de Wit, 2018).

There is ample evidence of the emerging need for a strong BSS workforce across BSS fields as summarized in the *Harvard Business Review* article titled "Why the U.S. Government is embracing behavioral science" (Gino, 2015). The author highlights various BSS disciplines including behavioral economics, behavioral decision research, and psychology that engage directly in efforts to better understand policy issues including tax payments, climate-change, and medical decision. National human resource development (NHRD) benefits from improved policies that improve the health of our populace.

The extent to which horizontal mismatch affects employment outcomes varies by country based on structural differences in education and employment systems. The decentralized/free market approach to NHRD policy in the United States allows states to determine their NHRD-related policies and processes. Furthermore, the United States uses a school-based model of occupational education and training in which higher education is primarily delivered through the formal education system (McGuinness et al., 2018; Wolbers, 2003). Japan has a similar system to the United States, whereas other nations, such as Germany and France, favor systems that tightly link education and vocational training with workplace training. The structure of the U.S. system, combined with the freedom students have in choosing jobs that may not align with their field of study, suggests there is a greater risk of workers experiencing lower job satisfaction and overall negative career outcomes (Verhaest et al., 2017). Another structural factor influencing the likelihood of horizontal mismatch occurring is unemployment. Graduates entering the labor force in tight labor market conditions, especially those with degrees in less-specialized fields, have been found to be more likely to experience horizontal mismatch (Robst, 2007a; Wolbers, 2003).

Table 1 indicates the differences in the mean scores of horizontal mismatch, annual wage, and job satisfaction between BSS and all non-BSS majors in STEM, including the results of significance tests (*t* tests) computed for the two groups in 2003 and 2013. The non-BSS major group consists of computer and mathematical sciences, biological sciences, physical and related sciences, engineering, and science and engineering (S and E)-related fields. Additional information about these different fields is provided in Table A1 in Appendix A.

According to the *t* test results using NSCG data, these two groups have significantly different levels of horizontal mismatch, annual wages, and job satisfaction. Those majoring in BSS fields had more horizontal mismatch, lower annual wages, and lower job satisfaction than non-BSS field majors in both 2003 and 2013. Although these differences were statistically significant, the differences in outcomes between these groups did not vary much from 2003 to 2013.¹

6 | WORKFORCE DIVERSITY (GENDER AND RACE) IN BSS

The U.S. population is increasingly diverse and employers of BSS workers in all sectors, whether government or business and industry, are better equipped to meet the needs of those they serve if their workforce and client or customer demographics are more closely aligned. The federal government has long recognized the advantages of increasing gender and racial diversity among its ranks and continues to seek policies and programs to achieve greater balance throughout the education and career pipeline (Córdova, 2016; Didion, 2012; NIH, 2012; NSB, 2015). There is a growing body of empirical research showing the positive outcomes of more gender and racially diverse teams in a variety of organizational contexts including team problem solving and research projects (Bear & Woolley, 2011; Cheruvelil et al., 2014; Freeman & Huang, 2014; McGee Jr et al., 2012). In fact, across occupations and industries, disciplines having lower representation of diverse groups leads face challenges in their efforts to attract and retain diverse employees. In other words, the more diverse a workforce is the more likely it is that it will sustain or even grow in its diversity (Branch, 2016; Ceci, Ginther, Kahn, & Williams, 2014; Lincoln, 2010; Xie & Shauman, 2003).

Prior to this study, preliminary research was completed using National Science Foundation (NSF)-Survey of Doctoral Recipients (SDR) data from 1993 to 2013 in an effort to better understand the composition of the BSSR workforce. This work builds upon previous research into U.S. BSSR workforce trends conducted in 2016 (Hur, Andalib, Maurer, Hawley, & Ghaffarzadegan, 2017). Demographic characteristics of this workforce included in the results reported in the earlier study include gender, age, race, and citizenship status. While the percentage of minorities remained low (14% in 2003 to 18% in 2013), the results indicated that the proportion of female BSS scientists is increasing overall (42% in 2003 to 48% in 2013). Less than 10% of this workforce is comprised of non-U.S. citizens. Attraction

¹Furthermore, we divided Table 1 with gender to examine gender differences in the mean scores of horizontal mismatch, annual wage, and job satisfaction between BSS and all non-BSS majors (Table S1: Male, Table S2: Female). For both male and female groups, BSS fields had more horizontal mismatch, lower annual wages and lower job satisfaction than non-BSS field majors in both 2003 and 2013. In particular, male groups experienced greater differences in mismatch and annual wages than female groups. In 2013, mismatch levels between males in BSS and males in all non-BSS majors is 0.515, versus female groups where the difference is 0.420. In 2013, male workers in BSS earn annually \$18,306 less than male workers in non-BSS majors. Female workers in BSS earn annually \$14,256 less than female workers in non-BSS majors. See tables in the online links: <http://glenn.osu.edu/tables/>

and retention of women and underrepresented minorities into the BSS workforce, particularly in the mathematics intensive fields (such as economics) and in jobs requiring higher levels of degree attainment, remains an issue of concern and is well documented in the literature (Ceci et al., 2014; Ghaffarzadegan et al., 2014; Ginther et al., 2011).

Given the importance of understanding the unique circumstances of women and minorities in the BSS workforce, we investigated the differences in wages and job satisfaction that exist between diversity groups experiencing horizontal mismatch. We completed a robustness check to improve our interpretation of how horizontal mismatch affects the labor market outcomes of various groups. The findings of this analysis are shown in Tables 2 and 3. Table 2 indicates changes in diversity-related measures for each BSS field of study² over time using NSCG data from 2003 and 2013. Overall, the percentage of racial minorities (defined as all nonwhites) in BSS programs has increased since 2003, although the ratios are still small. In 2013, 21% of the BSSR workforce was nonwhite, which shows 5% growth in a decade. Especially, the percentage of nonwhite female graduates has increased from 12 to 16% in BSS fields. However, racial diversity is lacking in all BSS fields, and it appears that some remain predominantly white.

According to the ANOVA results of analysis conducted using NSCG data shown in Table 3, horizontal mismatch, annual wage, and job satisfaction differ by gender and race. Nonwhite females experience the highest levels of horizontal mismatch, and the lowest annual wage and job satisfaction. Moreover, women were found to earn lower annual wages than men.³

7 | DATA AND MEASUREMENT

This analysis uses data from the 2013 of NSCG, conducted by NSF. NSCG is a longitudinal survey dataset, which provides a demographic information and career history of a nationally representative sample of the population of bachelors, master, and doctoral to professional degree living in the United States or its territories under the age of 76. Data for the year 2013 were collected using a multimode approach of computer-assisted telephone interviewing (CATI) and self-administered paper or web questionnaire from February 2013 to July 2013. The dataset is anonymized and deidentified by NSF and is made available for research purposes upon request from NSF. The NSCG response rate was around 74% in 2013. Total sample size in 2013 was 115,152, and BSS majored graduates were 12,490.

As the observations we have shared suggest, the nature of diversity-related problems varies by field of study, with different major areas in BSS exhibiting unique workforce outcome-related patterns. To address these differences, we examine the BSS fields individually by considering five major groups, namely economics, political science, psychology, sociology & anthropology, and other social sciences. Furthermore, we analyzed workforce outcomes separately by gender and race groups to allow for observation of diversity-related variations.

²More information about different major fields is available in Table A1 in Appendix A.

³When we consider career stage, early career workers have higher levels of horizontal mismatch, and lower annual salary (Table S3) as compared to mid-career and late career workers. The results of additional ANOVA tests considering both gender/race and career progress are presented in Tables S4, S5 and S6. In all career stages, the nonwhite groups have higher levels of horizontal mismatch and lower job satisfaction. Women earn lower annual wages than men in all career stages. See tables in the online links: <http://glenn.osu.edu/tables/>

We use four categories to represent these groups: white male, white female, nonwhite male, and nonwhite female. The sample sizes do not allow for analysis by a more granular breakdown of minority status.

This study considered three dependent variables. First, the horizontal mismatch is the level of relevance between major and job. Survey respondents selected the degree to which their education and job match: not related, somewhat related, and closely related.⁴ Second, NSCG provides the annual wage data used to calculate the annual log annual wage. Third, we considered job satisfaction by using responses to a survey question designed to measure respondents' perceptions of their level of job satisfaction. Response options for indicating the level of job satisfaction include (choice of one): very dissatisfied, somewhat dissatisfied, somewhat satisfied, and very satisfied. Ordinal variables were converted to dummy variables for the purposes of this analysis. The factors were then evaluated to determine their effect on the dependent variables (horizontal mismatch, annual wage, and job satisfaction), including demographic traits, socioeconomic status, and organizational characteristics. Specifically, we consider the effects of age, marital and parental status, education attainment level, work hours, supervisory status, training received, work duration, employer size, employer type, and employer location. Table A2 (Appendix A) displays summary statistics for the main variables used in the analysis.

8 | METHOD

This study seeks to increase our understanding of how BSS graduates transition to employment within their respective fields. We examine variations in horizontal mismatch, wage, and job satisfaction outcomes for BSS degree holders in the labor market by considering key characteristics of workforce diversity (gender and race).⁵ Due to the significant observed differences between them, all regressions are run separately for the four diversity categories considered (white male, white female, nonwhite male, and nonwhite female).⁶ First, the focus is on measuring the extent to which mismatch varies across major fields of study. We performed logistic regression analysis because the dependent variable used was ordinal. Second, we used standard wage regression to analyze how horizontal mismatch effects wages and how these effects (wage penalties) differ by degree field. Third, we employed logistic regression analysis to consider the effects of horizontal mismatch on job satisfaction given that the dependent variables are ordinal.

9 | RESULTS

We examined the effects of horizontal mismatch on wage effects and job satisfaction using logic regression, the results of which are significant in several ways. Our analysis of mismatch-related workforce outcomes by major, and by diversity characteristic categories, revealed many interesting findings. These results yielded several notable insights, including (a) Nearly 18% of graduates with BSS degrees choose to work in unrelated fields; (b)

⁴This study is focused on the returns of education when horizontal mismatch occurs; therefore we excluded people who are self-employed.

⁵We follow the same analyses method that Robst (2007b) used.

⁶According to the results of ANOVA test in Table 4, we ran all regressions separately by diversity category.

Nonwhite females had the most difficulty finding jobs related to their education (25.37%), by far exceeding the average; and, (c) The likelihood of experiencing horizontal mismatch decreased with higher degree attainment levels with bachelor's degree holders having the highest mismatch, followed by master's and doctoral recipients. Also of interest is the finding that effects of horizontal mismatch varied across majors, and mismatched graduates were more likely to experience wage penalties and low job satisfaction than well-matched graduates. Moreover, workers with horizontal mismatch experience lower job satisfaction across all categories of diversity.^{7,8}

9.1 | Mismatch-related outcomes by major

Tables 4 and 5 present the results of the estimated marginal effects of a logistic regression analysis to determine whether horizontal mismatch differs by characteristics of diversity and major. These findings support the hypothesis (H1): *Horizontal mismatch of each workforce diversity group differs by different BSS degree field*. As indicated in Table 4, graduates with degrees in political sciences, psychology, sociology & anthropology, and other social sciences, for diversity groups except white female, have a greater likelihood of experiencing horizontal mismatch ("not related") when compared to graduates with degrees in economics. Graduates majoring in political science are associated with an increased probability of indicating that their job and education are "not related" with results showing 21.3% for white male, 10.8% for white female, 19.3% for nonwhite male, and 15.3% for nonwhite female when compared with those who majored in economics.

Similarly, we observed an increase in the probability of experiencing horizontal mismatch with education and job being "not related" in other majors (psychology, sociology & anthropology, and other social sciences) compared to economics major for all diversity categories (white male, white female, nonwhite male, and nonwhite female). As education attainment levels increase the chance of horizontal mismatch decreases. Master's, doctoral, and professional degree recipients are less likely to experience mismatch. A negative marginal effect means that an increase in the explanatory variable for a given individual decreases the probability of workers' horizontal match.

Each diversity group whose education level is "Master" has a decrease in the probability of workers having horizontal mismatch with job and education "not related" at 20.4% (white male), 21.1% (white female), 19.0% (nonwhite male), and 20.7% (nonwhite female) when compared to graduates with bachelor degrees. And each diversity group whose education level is "Doctorate" has a decrease in the probability of horizontal mismatch indicated as "not related" at 29.9% (white male), 28.6% (white female), 47.2% (nonwhite male), and 50.3% (nonwhite female). Finally, individuals who received work-related training are associated with decrease in the probability of horizontal mismatch indicating that their job

⁷See full analysis results of Table 4–11 in Table S7–S14. See tables in the online links: <http://glenn.osu.edu/tables/>

⁸Given that the field of economics is considered to be an outlier in the social sciences with respect to racial diversity and gender, salaries and mathematics requirements, we conducted a robustness check to determine its effects on our results. The wage and job satisfaction effects were reestimated, with the penalties for horizontal mismatch reduced as a result of excluding economics. However, workers with horizontal mismatch were found to have lower wages than those with no mismatch for all diversity categories. These results are shared in Table S15–S22. See tables in the online links: <http://glenn.osu.edu/tables/>

and education are “not related” at 10.9% for white female, 15.0% for nonwhite male, and 10.8% for nonwhite female.

9.2 | Mismatch-related wage effects

Tables 6 and 7 contain the results of how horizontal mismatch effects wage outcomes (returns of education). First, we examine whether workers experiencing horizontal mismatch have higher or lower wages than those in well-matched jobs. As reported in Table 6, for all diversity categories, workers with jobs unrelated to their degree fields have lower wages than those with no mismatch. Consequently, these groups have different returns on their investment in education once employed in the labor market. The degree to which mismatched wage effects vary across majors was also determined. By evaluating the interaction between major and degree of mismatch, we further analyzed the wage effects of horizontal mismatch by diversity categories.⁹ Table 7 displays these results.

We found that most workers in jobs that are not aligned with their field of study experience wage penalties and the effects vary by major and by diversity characteristics. Therefore, we can support the hypothesis (H2): *BSS workers who have greater horizontal mismatch, regardless of workforce diversity group, earn lower wages than BSS workers with less mismatch do*. Our findings for graduates in BSS fields indicate that economics majors have somewhat smaller wage effects than other BSS majors. There is also variation in wage effects within diversity groups, indicating that some subcategories face higher penalties. For example, within the nonwhite category, black workers of both genders with horizontal mismatch are less likely to incur wage penalties than other nonwhite groups. This variation also presents within majors. For instance, of individuals who majored in psychology, nonwhite males were found to have 25.6% wage penalties from horizontal mismatch, while nonwhite females had 19.6% less than matched groups. This result is consistent with theory given that their skills are considered to be highly transferable and, therefore, applicable to a wider variety of jobs.

9.3 | Mismatch and job satisfaction

The results also indicate that workers with higher degrees of mismatch experience lower job satisfaction across all categories of diversity and BSS fields. These findings support the hypothesis (H3): *Horizontal mismatch is negatively associated with job satisfaction for all workforce diversity groups and BSS fields*. Tables 8 and 9 report the estimated marginal effects of logit regression in which the dependent variable is an indicator for respondents' four levels of job satisfaction. There is a significantly negative effect of horizontal mismatch on the likelihood of workers being “very satisfied” on the job. A negative marginal effect means that an increase in the explanatory variable for a given individual decreases the probability of workers' job satisfaction level. Each diversity group whose education is “somewhat related” to their job decreases the probability of workers being very satisfied by 8.3% (white male), 10.1% (white female), 12.0% (nonwhite male), and 10.8% (nonwhite female). And each diversity group whose education is “not related” to their job decreases the

⁹We interacted being horizontally mismatched with each degree field. We made the horizontal mismatch variable a dummy variable to focus on workers who report having horizontal mismatch: 1 = not related, 0 = somewhat related or closely related. We created an interaction term between this horizontal mismatch variable and BSS majors.

probability of workers being very satisfied by 16.9% (white male), 16.4% (white female), 16.0% (nonwhite male), and 19.2% (nonwhite female). These results were determined to be statistically significant ($p < 0.001$). Nonwhite female group has the highest marginal effects on job satisfaction as 19.2%. The effects of log annual wage on the likelihood of workers being “very satisfied” on the job varied across and within categories of diversity characteristics: 8.7% (white male), 8.3% (white female), 15.2% (nonwhite male), and 7.5% (nonwhite female).

Workers receiving work-related training experienced positive effects on job satisfaction in all diversity categories. Workers receiving work-related training experienced an increase in the probability of all diversity categories (except nonwhite female) being very satisfied as 3.7% for white male, 4.3% for white female, and 4.6% for nonwhite male. We also find interesting results from using the supervisor variable. The effects of supervisor variable are different by workforce diversity groups in the same way as mismatch effects are. White male workers in supervisory roles are 6.4% more likely to report being very satisfied with their job. White female and nonwhite female workers in supervisory roles are 3.0 and 4.3% less likely to being somewhat dissatisfied with their job.

We further analyzed the job satisfaction effects of horizontal mismatch by diversity categories by evaluating the interaction between major and degree of mismatch. These results are reported in Tables 10 and 11. We found that most workers in jobs that are not aligned with their field of study experience job satisfaction penalties as well as wage penalties and the effects vary by major and by diversity characteristics. Workers majoring in psychology experiencing horizontal mismatch show a decrease in the probability of all diversity categories being very satisfied at 12.6% for white male, 7.6% for white female, 11.0% for nonwhite male, and 16.5% for nonwhite female. These job satisfaction penalties are also occurring for those in other majors (psychology, sociology & anthropology, and other social sciences) and all diversity groups (white male, white female, nonwhite male, and nonwhite female). Notably, white females who majored in economics and have horizontal mismatch have the highest job satisfaction penalties (23.9%) among all majors and all groups.

10 | DISCUSSION AND CONCLUSION

This study analyzed how the effects of horizontal mismatch experienced by college graduates in the United States throughout their careers vary by the BSS field of study to better understand their wage and job satisfaction outcomes. We investigated the occurrence of mismatch and its effects in the context of diversity characteristics to highlight differences by gender and race. Our analysis of the returns to education in this context provides unique insights into the experiences of BSS workers in the labor market. Using horizontal mismatch as a measure of workers’ returns on their investments in higher education (Belman & Heywood, 1997; Sattinger, 1993), this study shows that horizontal mismatch often results in lower wages (Robst, 2007b) and dissatisfied workers (Tsang, 1987) regardless of BSS degree field or workforce diversity characteristics. The issue of horizontal mismatch is of great concern because it is shown to adversely affect both retention of workers in the workforce pipeline and their productivity (Groot, 1993; Sloane, Battu, & Seaman, 1996),

through undesirable job-leaving behavior (McGoldrick & Robst, 1996) and a reduced level of effort (Belfield, 2000).

Our finding that mismatched workers are much more vulnerable to experiencing wage penalties and low job satisfaction than those who were well matched raises concerns. There is empirical evidence showing that workers experiencing wage penalties and low job satisfaction have a significantly higher risk of turnover (Tett & Meyer, 1993). Moreover, research has shown that there is a relationship between job satisfaction and workplace training (Schmidt, 2007). Further research is needed to better understand how workplace training might be helpful in mitigating the negative outcomes experienced by mismatched employees.

Given that all workers in BSS and non-BSS fields have some degree of horizontal mismatch, (see Table 1) it is interesting to note that there is a greater chance of mismatch for BSS workers, especially those in the early stage of their careers. We also found that workers receiving training in addition to their university education were less likely to experience horizontal mismatch for all categories of diversity characteristics. These findings suggest that policies and interventions focused on mitigating negative effects for new BSS workers experiencing horizontal mismatch may improve their chances for better wage and job satisfaction outcomes. Mentoring, formal education and on the job training are all possible strategies for increasing the KSA deficits that these workers may be experiencing in an effort to improve their wage and job satisfaction outcomes.

Job satisfaction was increased for graduates who received work-related training in addition to their formal education. These findings are consistent with other studies indicating the benefits of workforce training (Jacobs & Washington, 2003; Verhaest et al., 2017). Training opportunities not only provide job-specific knowledge and skills (Hashimoto, 1981; Shaw, 1984; Weiss, 1971), but also improve workers' ability to apply their field-specific knowledge to perform better in their jobs.

Horizontal mismatches are common in labor markets in which individuals are free to choose from available employment options, where jobs have heterogeneity in the KSAs required for successful performance and in which the graduates with identical degrees are heterogeneous in their abilities and preferences. This complexity is inherent in the job search and match process in the United States. Our findings regarding the effectiveness of work-related training suggest that our current system would be more effective with the integration of more occupation-specific training into formal programs of study. This strategy is employed to varying degrees, but is not consistent across all higher education programs. We believe that higher education program planners adopting a more integrated approach to experiential education through stronger partnerships with government, business, and industry partners would reduce the risk of program completers experiencing horizontal mismatch when entering the workforce.

Examining the likelihood of experiencing mismatch by categories of diversity characteristics (Table 2) is also of interest. Responses to the survey questions concerning the most important reason for working outside of one's major field tell us that 17.76% of people with

BSS degrees chose to work in unrelated fields because jobs were not available in their field (see Table A4 in the Appendix A). However, within this group nonwhite females (25.37%) struggled to find matched jobs more than white females, far more than the average BSS worker did. This result, when considered with our findings that black women were less likely to be satisfied with their jobs than other nonwhite females, and that nonwhite females experience higher wage penalties than other groups, suggests that minority women are encountering disproportionate employment-related challenges. While all diversity categories experienced lower job satisfaction, the combination of an increased risk for horizontal mismatch and more negative labor market outcomes than all other groups confirms that further research is needed to investigate whether there is gender and/or racial discrimination occurring (Ceci, Ginther, Kahn, & Williams, 2015; Fox & Stephan, 2001; Quillian et al., 2017).

Gaining insights into the relationships between education and employment in BSS fields provides more information to workers, HRD professionals, and policy makers regarding the impact of misalignment between degree and occupational fields. These perspectives are also useful to higher education program planners interested in improving program design to ensure that graduates are prepared for success in the workforce. The quality of higher education programs was not considered in this study, but undoubtedly plays a key role in the ability of their graduates to successfully transition into jobs in their chosen fields. We recognize that even the most effective programs will never achieve a perfect placement rate for completers, nor does a high rate of horizontal mismatch of a program's graduates necessarily confirm that it is of poor quality.

While this study provides a greater understanding of the workforce outcomes of horizontally mismatched workers in the BSS fields, it has certain limitations. First, the measures of workforce outcomes include horizontal mismatch, wages, and job satisfaction. However, additional measures are needed to fully evaluate these labor market outcomes, such as vertical mismatch, labor productivity, performance, and turnover. Second, the diversity concept is simplified using gender and race, though diversity is a multidimensional concept that extends to other characteristics such as age, career stage, and ethnicity. As well, the survey data are limited in that they do not allow for further analysis to determine if there is evidence of discrimination underlying the observed differences between diversity groups' mismatch-related outcomes. Future studies that include more detailed analysis and differentiate between different minority groups, age groups, and country of origin will be beneficial. Despite these limitations, this study provides valuable insights into the current status of aspects of the BSS workforce that inform HRD theory and practice. Governmental and organizational policies aimed at decreasing horizontal mismatch in the BSS workforce that also address observed trends in diversity characteristics would prove beneficial to our country's overall NHRD and ability to remain competitive in the global economy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

APPENDIX

TABLE A1

Field of study

Field of study (major group)	Field of major (minor group)
Computer and mathematical sciences	Computer and information sciences Mathematics and statistics
Biological, agricultural and environmental life sciences	Agricultural and food sciences Biological sciences Environmental life sciences
Physical and related sciences	Chemistry, except biochemistry Earth, atmospheric, and ocean sciences Physics and astronomy Other physical sciences
Behavior and social sciences	Economics Political and related sciences Psychology Sociology & anthropology Other social sciences
Engineering	Aerospace, aeronautical, and astronautical engineering Chemical engineering Civil and architectural engineering Electrical and computer engineering Industrial engineering Mechanical engineering Other engineering
S and E-related fields	Health Science and mathematics teacher education Technology and technical fields Other S and E related fields
Non-S and E fields	Management and administration fields Education, except science and math teacher education Social service and related fields Sales and marketing fields Art and humanities fields Other non-S and E fields

TABLE A2

Descriptive statistics for variables

Variables	Summary stat	Domain
Mismatch	Closely related: 40.7% Somewhat related: 30.3% Not related: 29.0%	1–3 What extent is your current work related to your educational level?
Log annual wage	M: 10.6 SD: 1.0	5–14 What is your salary?
Job satisfaction	Very dissatisfied: 3.8% Somewhat dissatisfied: 11.1% Somewhat satisfied: 46.2% Very satisfied: 38.8%	1–4 Please rate your overall job satisfaction.
Degree of field	Economics: 17% Political and related sciences: 18.3% Psychology: 36.7% Sociology and anthropology: 16.2% Other social sciences: 11.7%	1–5 What is the primary field of study for this degree?
Male	Male: 41.7% Female: 58.3%	0–1 Are you: Male/Female. Note: Male is coded as 1.
Race	White: 57.2% Black: 11.1% Asian: 11.7%	1–5 What is your race?

Variables	Summary stat	Domain
	Hispanic: 14.9% Others: 5.0%	
Workforce diversity	White Male: 25.6% White Female: 31.6% Nonwhite Male: 16.1% Nonwhite Female: 26.7%	1–4 Workforce diversity is coded based on gender and race information.
Age	M = 39.6 SD = 13.1	22–75 What is your age?
Married	Yes: 53.2% No: 46.8%	0–1 Are you married? Note: Married is coded as 1.
Child	Yes: 36.5% No: 63.5%	0–1 Do you have child? Note: Have child is coded as 1.
Degree	Bachelor: 65.6% Master: 31.5% Doctorate: 1.7% Professional: 1.1%	1–4 What type of degree did you earn?
Full time	Yes: 79.5% No: 20.5%	0–1 Are you working full time? Note: Full time is coded as 1 (more than 35 hr per week).
Supervisor	Yes: 33.7% No: 66.3%	0–1 Do you supervise the work of others? Note: Supervisor is coded as 1
Training	Yes: 60.7% No: 39.3%	0–1 Did you attend any work-relate training? Note: Training is coded as 1
Work duration (month)	M = 70.8 SD = 89.3	0–644 How long do you work at your job?
Employer size	1–10 employees: 14.2% 11–24 employees: 5.5% 25–99 employees: 11.6% 100–499 employees: 15.4% 500–999 employees: 13.9% 1,000–4,999 employees: 13.3% 5,000–2,499 employees: 18.76% 2,500+ employees: 22.1%	1–8 How many people work for your employers?
Employer type	Academia: 22.1% Business/Industry: 61.8% Government: 16.1%	1–3 What is your job sector?
Employer location	Northeast: 21.4% Midwest: 18.5% South: 31.1% West: 28.9%	1–4 Where is your current employer?

Note. Data 2013 National Survey of College Graduates.

TABLE A3

Pairwise correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Job satisfaction	(1) 1												
Log annual wage	(2) 0.17 *	1											
Mismatch	(3) -0.22 *	-0.11 *	1										
Degree of field	(4) -0.01	-0.18 *	0.00	1									
Male	(5) 0.02	0.18 *	0.05 *	-0.18 *	1								
Race	(6) -0.05 *	-0.05 *	0.06 *	0.03	-0.06 *	1							
Age	(7) 0.14 *	0.11 *	0.00	-0.01	0.12 *	-0.16 *	1						
Married	(8) 0.12 *	0.15 *	-0.04 *	-0.04 *	0.10 *	-0.11 *	0.30 *	1					

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Child	(9)	0.07 *	0.12 *	−0.02	−0.02	0.01	0.00	0.15 *	0.45 *	1				
Degree	(10)	0.08 *	0.07 *	−0.36 *	0.03 *	−0.06 *	−0.07 *	0.06 *	0.08 *	0.00	1			
Full time	(11)	0.02	0.53 *	−0.03	−0.09 *	0.12 *	−0.01	−0.08 *	0.01	0.03	−0.04 *	1		
Supervisor	(12)	0.09 *	0.26 *	−0.02	−0.08 *	0.11 *	−0.01	0.06 *	0.07 *	0.07 *	−0.03	0.18 *	1	
Training	(13)	0.11 *	0.14 *	−0.21 *	0.05 *	−0.08 *	−0.02	−0.02	0.04 *	0.04 *	0.13 *	0.13 *	0.04 *	1
Work duration	(14)	0.11 *	0.18 *	−0.03	−0.02	0.12 *	−0.11 *	0.52 *	0.18 *	0.09 *	0.01	0.05 *	0.08 *	0.01
Employer size	(15)	−0.03 *	0.21 *	−0.06 *	−0.03 *	0.03 *	0.03 *	−0.14 *	−0.04 *	0.01	0.03	0.20 *	−0.05 *	0.12 *
Employer type	(16)	0.01	0.21 *	0.12 *	−0.08 *	0.11 *	−0.01	0.05 *	0.02	0.04 *	−0.10 *	0.19 *	0.07 *	0.02
Employer location	(17)	0.03	−0.01	0.02 *	0.05 *	0.00	0.17 *	0.00	−0.01	−0.00	−0.02	−0.02	0.00	−0.02

Note. Data 2013 National Survey of College Graduates.

* $p < 0.001$.

TABLE A4

Most important reason for working outside field in BSS fields

	All BSS	White Male	White Female	Nonwhite Male	Nonwhite Female
Pay, promotion opportunities	27.11%	32.31%	20.96%	35.38%	24.32%
Working conditions	11.91%	10.27%	13.92%	12.27%	10.66%
Job location	6.53%	6.08%	6.93%	5.63%	7.24%
Change in career or professional interests	19.85%	24.97%	18.90%	12.86%	14.54%
Family-related reasons	11.05%	3.37%	18.59%	7.60%	13.19%
Job in highest degree field not available	17.76%	14.94%	17.38%	17.86%	25.37%
Other reason for not working	5.79%	8.05%	3.33%	8.40%	4.68%

Note. Data 2013 National Survey of College Graduates. BSS, behavioral and social sciences.

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TABLE 1

Mean values of horizontal mismatch, annual wage, and job satisfaction for BSS and others (all)

	2003			2013		
	BSS	Non-BSS	Difference	BSS	Non-BSS	Difference
Mismatch ^a	1.921	1.408	0.513	1.883	1.420	0.463
			$t = 55.62$			$t = 65.42$
			$p < 0.001$ Cohen's d = 0.746			$p < 0.001$ Cohen's d = 0.660
Annual wage	\$55,932	\$77,127	-\$21,195	\$58,868	\$79,401	-\$20,533
			$t = 27.38$			$t = 31.27$
			$p < 0.001$ Cohen's d = 0.367			$p < 0.001$ Cohen's d = 0.316
Job satisfaction ^b	3.291	3.339	-0.048	3.2	3.316	-0.116
			$t = 5.21$			$t = 15.86$
			$p < 0.001$ Cohen's d = 0.070			$p < 0.001$ Cohen's d = 0.160
Number of observations	6,647	34,082		12,490	45,781	

Note. Data: 2003, 2013 National Survey of College Graduates. BSS, behavioral and social sciences.

^a 1: Closely related, 2: Somewhat related, and ^a: Not related.

^b 1: Very unsatisfied, 2: Somewhat unsatisfied, 3: Somewhat satisfied, and 4: Very satisfied.

TABLE 2

Demographic trends in diversity

Major fields	<u>White Male</u>		<u>White Female</u>		<u>Nonwhite Male</u>		<u>Nonwhite Female</u>	
	2003	2013	2003	2013	2003	2013	2003	2013
Computer and mathematical sciences	49%	46%	22%	18%	17%	24%	11%	12%
Biological sciences	47%	40%	32%	34%	10%	11%	10%	16%
Physical sciences	59%	51%	18%	23%	14%	17%	9%	9%
Behavior and social sciences	41%	34%	39%	40%	9%	10%	12%	16%
Engineering	67%	58%	7%	9%	22%	27%	4%	6%
S and E-related fields	35%	29%	42%	44%	10%	11%	13%	17%

Note. Data: 2003, 2013 National Survey of College Graduates.

TABLE 3

ANOVA tests for homogeneity across gender/race in horizontal mismatch, annual wage, and job satisfaction in BSS

Variable	Race/Gender	N	Mean	Rank	F-value
Horizontal mismatch ^a	White Male	3,191	1.896	3	$F(3, 12,474) = 32.54$, $p < 0.001$ $\eta^2 = 0.008$
	White Female	3,946	1.784	4	
	Nonwhite Male	2,008	1.983	1	
	Nonwhite Female	3,333	1.929	2	
Annual wage	White Male	3,191	\$75,988	1	$F(3, 12,474) = 131.01$ $p < 0.001$ $\eta^2 = 0.031$
	White Female	3,946	\$51,759	3	
	Nonwhite Male	2,008	\$63,242	2	
	Nonwhite Female	3,333	\$48,273	4	
Job satisfaction ^b	White Male	3,191	3.262	1	$F(3, 12,474) = 27.42$ $p < 0.001$ $\eta^2 = 0.007$
	White Female	3,946	3.249	2	
	Nonwhite Male	2,008	3.143	3	
	Nonwhite Female	3,333	3.119	4	

Note. Data: 2013 National Survey of College Graduates. BSS, behavioral and social sciences.

^a 1: Closely related, 2: Somewhat related, and 3: Not related.

^b 1: Very unsatisfied, 2: Somewhat unsatisfied, 3: Somewhat satisfied, and 4: Very satisfied.

TABLE 4

Marginal effects of horizontal mismatch of degree field on job mismatch from the logit regression (White Male, White Female)

Rank order (Likert scale)	White Male			White Female		
	(1) Closely related	(2) Somewhat related	(3) Not related	(1) Closely related	(2) Somewhat related	(3) Not related
<i>Degree field</i>						
Political and related sciences (Ref: Economics)	0.144 *** (0.023)	-0.077 *** (0.023)	0.213 *** (0.021)	-0.068 * (0.030)	-0.039 (0.030)	0.108 *** (0.028)
Psychology	-0.035 (0.022)	-0.105 *** (0.023)	0.144 *** (0.022)	0.033 (0.026)	-0.076 ** (0.026)	0.036 (0.025)
Sociology and anthropology	-0.051 (0.026)	-0.098 *** (0.027)	0.153 *** (0.025)	-0.054 (0.029)	-0.053 (0.029)	0.104 *** (0.027)
Other social sciences	-0.016 (0.027)	-0.088 ** (0.029)	0.107 *** (0.028)	-0.082 ** (0.031)	-0.043 (0.031)	0.118 *** (0.029)
Degree: Mastern (Ref: Bachelor)	0.259 *** (0.015)	-0.117 *** (0.019)	-0.204 *** (0.019)	0.294 *** (0.012)	-0.144 *** (0.016)	-0.211 *** (0.015)
Doctorate	0.547 *** (0.081)	-0.58 *** (0.147)	-0.299 ** (0.093)	0.466 *** (0.064)	-0.346 *** (0.082)	-0.286 *** (0.082)
Professional	0.788 *** (0.189)	-0.517 * (0.208)	—	0.567 *** (0.085)	-0.411 *** (0.114)	-0.425 *** (0.113)
Supervisor	0.019 (0.017)	0.066 *** (0.017)	-0.082 (0.016)	0.005 (0.016)	0.061 *** (0.016)	-0.061 *** (0.015)
Training	0.061 *** (0.016)	0.029 (0.017)	-0.086 (0.016)	0.156 *** (0.015)	-0.040 ** (0.015)	-0.109 *** (0.013)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 3,191$ (White Male), $N = 3,946$ (White Female); and Prob > χ^2 0.0000.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

TABLE 5

Marginal effects of horizontal mismatch from the logit regression (Nonwhite Male, Nonwhite Female)

Rank order (Likert scale)	Nonwhite Male			Nonwhite Female		
	(1) Closely related	(2) Somewhat related	(3) Not related	(1) Closely related	(2) Somewhat related	(3) Not related
<i>Degree field</i>						
Political and related sciences (Ref: Economics)	-0.099 *** (0.029)	-0.098 ** (0.030)	0.193 *** (0.028)	-0.111 *** (0.030)	-0.046 (0.030)	0.153 *** (0.029)
Psychology	-0.021 (0.028)	-0.097 ** (0.030)	0.115 *** (0.029)	-0.021 (0.026)	-0.068 ** (0.027)	0.080 ** (0.026)
Sociology and anthropology	-0.069 * (0.032)	-0.088 ** (0.033)	0.152 *** (0.031)	-0.133 *** (0.030)	-0.005 (0.029)	0.129 *** (0.029)
Other social sciences	-0.088 * (0.036)	-0.097 * (0.039)	0.187 *** (0.036)	-0.085 ** (0.032)	-0.108 ** (0.034)	0.186 *** (0.031)
Race: Asian (Ref: Black)	-0.031 (0.029)	0.029 (0.031)	0.007 (0.029)	-0.024 (0.024)	0.038 (0.024)	-0.012 (0.023)
Hispanic	0.034 (0.027)	-0.008 (0.030)	-0.026 (0.028)	0.047 * (0.021)	-0.017 (0.022)	-0.031 (0.021)
Other	-0.048 (0.036)	0.062 (0.037)	-0.019 (0.036)	-0.021 (0.028)	0.028 (0.029)	-0.009 (0.027)
Degree: Master (Ref: Bachelor)	0.208 *** (0.020)	-0.079 ** (0.026)	-0.190 *** (0.026)	0.235 *** (0.015)	-0.079 *** (0.019)	-0.207 *** (0.019)
Doctorate	0.430 *** (0.090)	-0.308 ** (0.113)	-0.472 * (0.189)	0.569 *** (0.103)	-0.392 ** (0.125)	-0.503 ** (0.187)
Professional	0.231 * (0.116)	-0.231 (0.166)	-0.093 (0.147)	0.482 *** (0.095)	-0.325 * (0.126)	-0.393 ** (0.136)
Supervisor	0.018 (0.021)	0.043 (0.022)	-0.060 ** (0.021)	0.012 (0.018)	0.055 ** (0.018)	-0.069 *** (0.018)
Training	0.080 *** (0.020)	0.082 *** (0.022)	-0.150 *** (0.019)	0.096 *** (0.017)	0.023 (0.018)	-0.108 *** (0.015)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 2,008$ (Nonwhite Male), $N = 3,333$ (White Female); Prob > χ^2 0.0000.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

TABLE 6

The wage effects of horizontal mismatch by diversity category

Dependent Variable: Log annual wage	White Male Model 1	White Female Model 2	Nonwhite Male Model 3	Nonwhite Female Model 4
<i>Mismatch</i>				
Somewhat related (Ref: Closely related)	-0.034 (0.031)	0.003 (0.032)	-0.040 (0.040)	-0.030 (0.032)
Not related	-0.209 *** (0.033)	-0.173 *** (0.035)	-0.197 *** (0.042)	-0.216 *** (0.034)
<i>Degree field</i>				
Political and related sciences (Ref: Economics)	-0.091 ** (0.035)	-0.045 (0.054)	-0.106 * (0.046)	-0.043 (0.048)
Psychology	-0.274 *** (0.035)	-0.284 *** (0.046)	-0.226 *** (0.045)	-0.177 *** (0.043)
Sociology and anthropology	-0.307 *** (0.041)	-0.309 *** (0.052)	-0.212 *** (0.050)	-0.229 *** (0.048)
Other social sciences	-0.244 *** (0.042)	-0.229 *** (0.056)	-0.225 *** (0.058)	-0.237 *** (0.053)
Race: Asian (Ref: Black)			0.149 ** (0.046)	0.187 *** (0.038)
Hispanic			0.130 ** (0.043)	0.050 (0.034)
Other			0.109 (0.056)	0.048 (0.045)
Degree: Master (Ref: Bachelor)	0.083 ** (0.029)	0.129 *** (0.028)	0.048 (0.039)	0.162 *** (0.030)
Doctorate	0.455 *** (0.087)	0.413 *** (0.093)	0.435 *** (0.116)	0.284 * (0.120)
Professional	0.206 (0.124)	0.514 *** (0.100)	0.239 (0.203)	0.502 *** (0.125)
Supervisor	0.245 *** (0.025)	0.261 *** (0.027)	0.294 *** (0.033)	0.210 *** (0.028)
Training	0.063 * (0.025)	0.145 *** (0.027)	0.192 *** (0.033)	0.130 *** (0.027)
Constant	7.871 *** (0.168)	7.802 *** (0.177)	7.527 *** (0.224)	7.990 *** (0.187)
Observations	3,191	3,946	2,008	3,333
AdjR ²	0.4265	0.4089	0.4328	0.4117

Note. Data 2013 National Survey of College Graduates.

SEs in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

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TABLE 7

The wage effects of horizontal mismatch by degree field

Dependent Variable: Log salary	White Male Model 1	White Female Model 2	Nonwhite Male Model 3	Nonwhite Female Model 4
<i>Mismatch[*] degree field</i>				
Economics	-0.132 [*] (0.054)	-0.173 [*] (0.093)	-0.144 [*] (0.065)	-0.120 (0.073)
Political and related sciences	-0.196 ^{***} (0.043)	-0.091 (0.062)	-0.149 ^{**} (0.056)	-0.130 [*] (0.053)
Psychology	-0.228 ^{***} (0.049)	-0.197 ^{***} (0.043)	-0.256 ^{***} (0.061)	-0.196 ^{***} (0.042)
Sociology and anthropology	-0.260 ^{***} (0.061)	-0.231 ^{***} (0.055)	-0.154 [*] (0.067)	-0.325 ^{***} (0.053)
Other social sciences	-0.324 ^{***} (0.072)	-0.140 ^{**} (0.068)	-0.348 ^{***} (0.082)	-0.264 ^{***} (0.062)
Race: Asian (Ref: Black)			0.189 ^{***} (0.045)	0.219 ^{***} (0.038)
Hispanic			0.138 ^{**} (0.043)	0.057 (0.034)
Other			0.109 (0.056)	0.056 (0.045)
Degree: Master (Ref: Bachelor)	0.073 [*] (0.028)	0.131 ^{***} (0.027)	0.050 (0.039)	0.167 ^{***} (0.029)
Doctorate	0.468 ^{***} (0.087)	0.411 ^{***} (0.093)	0.466 ^{***} (0.115)	0.306 [*] (0.120)
Professional	0.120 (0.123)	0.466 ^{***} (0.099)	0.175 (0.202)	0.486 ^{***} (0.124)
Supervisor	0.261 ^{***} (0.026)	0.263 ^{***} (0.028)	0.297 ^{***} (0.034)	0.211 ^{***} (0.028)
Training	0.042 (0.025)	0.123 ^{***} (0.027)	0.189 ^{***} (0.033)	0.120 ^{***} (0.027)
Constant	7.667 ^{***} (0.168)	7.530 ^{***} (0.172)	7.330 ^{***} (0.222)	7.783 ^{***} (0.182)
Observations	3,191	3,946	2,008	3,333
AdjR ²	0.4103	0.3985	0.4252	0.4062

Note. Data 2013 National Survey of College Graduates.

SEs in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

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TABLE 8

Marginal effects of job satisfaction from the logit regression (White Male, White Female)

Rank order (Likert scale)	White Male				White Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
White Male	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied
<i>Mismatch</i>								
Somewhat related (Ref: Closely related)	0.018	0.021	0.059 **	−0.083 ***	0.030 **	0.044 ***	0.048 *	−0.101 ***
	(0.011)	(0.015)	(0.023)	(0.022)	(0.010)	(0.013)	(0.021)	(0.020)
Not related	0.047 ***	0.065 ***	0.052 *	−0.169 ***	0.056 ***	0.079 ***	0.026	−0.164 ***
	(0.011)	(0.015)	(0.025)	(0.024)	(0.010)	(0.014)	(0.023)	(0.022)
Log annual wage	−0.013 ***	−0.029 ***	−0.028 *	0.087 ***	−0.011 ***	−0.013 *	−0.051 ***	0.083 ***
	(0.004)	(0.008)	(0.014)	(0.014)	(0.004)	(0.006)	(0.011)	(0.011)
<i>Degree field</i>								
Political and related sciences	0.003	−0.006	0.023	−0.025	−0.010	0.019	−0.039	0.031
(Ref: Economics)	(0.009)	(0.016)	(0.026)	(0.025)	(0.013)	(0.022)	(0.035)	(0.000)
Psychology	−0.006	−0.009	0.062 *	−0.047	−0.011	0.029	−0.050	0.034
	(0.010)	(0.016)	(0.026)	(0.025)	(0.011)	(0.020)	(0.030)	(0.030)
Sociology and anthropology	−0.006	0.001	0.077 *	−0.073 *	−0.018	0.019	−0.050	0.053
	(0.011)	(0.018)	(0.031)	(0.030)	(0.012)	(0.022)	(0.034)	(0.033)
Other social sciences	0.002	0.003	0.049	−0.049	0.008	0.002	−0.082 *	0.068
	(0.011)	(0.019)	(0.031)	(0.030)	(0.012)	(0.023)	(0.036)	(0.035)
Degree: Master	0.003	0.021	−0.008	−0.017	0.004	0.025 *	−0.021	−0.012
(Ref: Bachelor)	(0.009)	(0.013)	(0.022)	(0.021)	(0.007)	(0.012)	(0.019)	(0.018)
Doctorate	0.009	−0.033	−0.034	0.025	0.006	0.056	−0.032	−0.031
	(0.031)	(0.052)	(0.065)	(0.061)	(0.025)	(0.034)	(0.061)	(0.057)
Professional	0.045	0.029	−0.158	0.072	0.046	0.035	−0.057	−0.027
	(0.032)	(0.065)	(0.099)	(0.088)	(0.025)	(0.047)	(0.069)	(0.064)
Supervisor	−0.020 **	−0.007	−0.050 **	0.064 ***	−0.014	−0.030 *	0.031	0.005
	(0.008)	(0.012)	(0.019)	(0.018)	(0.008)	(0.012)	(0.018)	(0.018)
Training	−0.016 *	−0.022	0.004	0.037 *	−0.015 *	−0.023 *	−0.002	0.043 *
	(0.007)	(0.011)	(0.019)	(0.018)	(0.007)	(0.011)	(0.018)	(0.017)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:***
 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 3,191$ (White Male), $N = 3,946$ (White Female); Prob $> \chi^2 = 0.0000$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

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TABLE 9

Marginal effects of job satisfaction from the logit regression (Nonwhite Male, Nonwhite Female)

Rank order (Likert scale)	Nonwhite Male				Nonwhite Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
White Male	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied
<i>Mismatch</i>								
Somewhat related	−0.009	0.051 *	0.094 **	−0.120 ***	0.021	0.079 ***	0.034	−0.108 ***
(Ref: Closely related)	(0.016)	(0.022)	(0.029)	(0.026)	(0.012)	(0.016)	(0.022)	(0.020)
Not related	0.044 ***	0.094 ***	0.020	−0.160 ***	0.059 ***	0.095 ***	0.044	−0.192 ***
	(0.014)	(0.022)	(0.031)	(0.028)	(0.012)	(0.017)	(0.024)	(0.022)
Log annual wage	−0.015 **	−0.036 ***	−0.069 ***	0.152 ***	−0.016 ***	−0.022 **	−0.030 *	0.075 ***
	(0.006)	(0.010)	(0.017)	(0.018)	(0.005)	(0.008)	(0.013)	(0.012)
<i>Degree field</i>								
Political and related sciences	−0.008	0.010	−0.023	0.023	0.008	0.020	−0.032	0.003
(Ref: Economics)	(0.014)	(0.022)	(0.034)	(0.031)	(0.015)	(0.022)	(0.034)	(0.031)
Psychology	0.002	−0.012	0.012	0.010	−0.007	0.002	−0.026	0.032
	(0.013)	(0.022)	(0.033)	(0.031)	(0.014)	(0.020)	(0.030)	(0.028)
Sociology and anthropology	−0.006	−0.050	0.010	0.054	0.001	−0.021	−0.009	0.029
	(0.014)	(0.026)	(0.037)	(0.034)	(0.015)	(0.023)	(0.034)	(0.031)
Other social sciences	−0.044 *	−0.031	0.021	0.052	−0.027	−0.024	−0.005	0.052
	(0.022)	(0.029)	(0.042)	(0.039)	(0.018)	(0.025)	(0.037)	(0.034)
Race: Asian	−0.002	−0.033	0.051	−0.009	−0.055 ***	−0.015	0.052 *	0.021
(Ref: Black)	(0.014)	(0.022)	(0.033)	(0.031)	(0.013)	(0.018)	(0.027)	(0.025)
Hispanic	0.006	−0.021	0.022	−0.003	−0.019 *	−0.022	−0.006	0.056 *
	(0.013)	(0.020)	(0.032)	(0.029)	(0.010)	(0.016)	(0.024)	(0.022)
Other	0.022	−0.050	−0.003	0.030	−0.032 *	−0.013	−0.047	0.099 ***
	(0.016)	(0.028)	(0.041)	(0.037)	(0.014)	(0.021)	(0.032)	(0.029)
Degree: Master	0.016	−0.015	0.026	−0.022	0.020 *	0.035 *	−0.010	−0.043 *
(Ref: Bachelor)	(0.013)	(0.021)	(0.029)	(0.026)	(0.010)	(0.014)	(0.021)	(0.019)
Doctorate	—	−0.132	0.049	−0.004	—	0.076	−0.240 **	0.141
	—	(0.110)	(0.085)	(0.073)	—	(0.055)	(0.093)	(0.072)
Professional	—	0.098	−0.205	0.085	—	—	−0.104	0.113
	—	(0.087)	(0.168)	(0.130)	—	—	(0.091)	(0.079)
Supervisor	−0.017	−0.014	0.006	0.012	−0.010	−0.043 **	0.029	0.017

Rank order (Likert scale)	Nonwhite Male				Nonwhite Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
White Male	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied
	(0.011)	(0.017)	(0.025)	(0.023)	(0.010)	(0.015)	(0.020)	(0.018)
Training	−0.040***	−0.021	0.007	0.046*	−0.025**	−0.007	0.004	0.031
	(0.012)	(0.016)	(0.024)	(0.022)	(0.008)	(0.013)	(0.019)	(0.018)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 2,008$ (Nonwhite Male), $N = 3,333$ (White Female); Prob > $\chi^2 = 0.0000$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

TABLE 10

Marginal effects of job satisfaction and horizontal mismatch from the logit regression (White Male, White Female)

Rank order (Likert scale)	White Male				White Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
White Male	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied
<i>Mismatch* degree field</i>								
Economics	0.063*** (0.021)	0.046* (0.026)	0.044 (0.040)	−0.141*** (0.037)	0.058** (0.031)	0.046 (0.041)	0.143* (0.060)	−0.239*** (0.050)
Political and related sciences	0.042*** (0.014)	0.059*** (0.021)	−0.003 (0.032)	−0.111*** (0.030)	0.042** (0.019)	0.083*** (0.030)	0.022 (0.040)	−0.148*** (0.037)
Psychology	0.026** (0.013)	0.060** (0.024)	0.035 (0.036)	−0.126*** (0.034)	0.024** (0.011)	0.054*** (0.019)	−0.005 (0.028)	−0.076** (0.027)
Sociology and anthropology	0.037** (0.019)	0.071** (0.031)	0.026 (0.045)	−0.140** (0.042)	0.038*** (0.015)	0.070*** (0.025)	−0.012 (0.036)	−0.110** (0.034)
Other social sciences	0.043** (0.023)	0.050 (0.034)	0.045 (0.053)	−0.15** (0.050)	0.105*** (0.027)	0.039 (0.028)	−0.078 (0.043)	−0.088* (0.042)
Log annual wage	−0.013*** (0.004)	−0.029*** (0.007)	−0.035** (0.013)	0.094*** (0.014)	−0.011*** (0.004)	−0.013* (0.006)	−0.049*** (0.011)	0.081*** (0.011)
Degree: Master	0.001 (0.008)	0.017 (0.013)	−0.017 (0.021)	−0.003 (0.020)	−0.002 (0.007)	0.015 (0.011)	−0.034 (0.018)	0.015 (0.017)
(Ref: Bachelor)								
Doctorate	0.003 (0.030)	−0.043 (0.052)	−0.055 (0.064)	0.058 (0.060)	−0.002 (0.024)	0.038 (0.033)	−0.045 (0.061)	0.005 (0.056)
Professional	0.033 (0.031)	0.014 (0.064)	−0.162 (0.098)	0.098 (0.087)	0.030 (0.024)	0.024 (0.047)	−0.081 (0.068)	0.013 (0.063)
Supervisor	−0.020** (0.008)	−0.006 (0.012)	−0.050** (0.019)	0.063*** (0.018)	−0.013 (0.008)	−0.029* (0.012)	0.032 (0.018)	0.003 (0.018)
Training	−0.016* (0.007)	−0.022* (0.011)	0.008 (0.019)	0.035 (0.018)	−0.018** (0.007)	−0.026** (0.010)	−0.009 (0.018)	0.056*** (0.017)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 3,191$ (White Male), $N = 3,946$ (White Female); Prob > $\chi^2 = 0.0000$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.

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TABLE 11

Marginal effects of job satisfaction and horizontal mismatch from the logit regression (Nonwhite Male, Nonwhite Female)

Rank order (Likert scale)	Nonwhite Male				Nonwhite Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
White Male	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied	Very dissatisfied	Somewhat dissatisfied	Somewhat satisfied	Very satisfied
<i>Mismatch* degree field</i>								
Economics	0.051 ** (0.023)	0.082 ** (0.035)	−0.060 (0.047)	−0.077 (0.044)	0.071 *** (0.031)	0.075 * (0.039)	0.014 (0.051)	−0.161 ** (0.043)
Political and related sciences	0.055 *** (0.020)	0.081 ** (0.030)	−0.038 (0.041)	−0.110 ** (0.037)	0.062 *** (0.020)	0.090 *** (0.029)	−0.017 (0.037)	−0.134 *** (0.032)
Psychology	0.070 *** (0.024)	0.076 ** (0.032)	−0.055 (0.044)	−0.110 * (0.041)	0.049 *** (0.015)	0.046 * (0.021)	0.066 * (0.030)	−0.165 *** (0.025)
Sociology and anthropology	0.046 ** (0.022)	0.020 (0.031)	−0.014 (0.049)	−0.055 (0.046)	0.072 *** (0.021)	0.043 (0.026)	0.002 (0.037)	−0.124 *** (0.033)
Other social sciences	−0.002 (0.016)	0.062 (0.043)	0.011 (0.060)	−0.060 (0.057)	0.008 (0.015)	0.006 (0.028)	0.028 (0.043)	−0.041 (0.041)
Log annual wage	−0.014 ** (0.006)	−0.035 *** (0.011)	−0.072 *** (0.017)	0.151 *** (0.017)	−0.016 *** (0.005)	−0.021 ** (0.008)	−0.030 * (0.012)	0.074 *** (0.012)
Race: Asian (Ref: Black)	−0.002 (0.014)	−0.028 (0.022)	0.055 (0.033)	−0.020 (0.031)	−0.054 *** (0.013)	−0.013 (0.018)	0.056 * (0.026)	0.013 (0.025)
Hispanic	0.006 (0.013)	−0.021 (0.021)	0.019 (0.032)	−0.001 (0.029)	−0.019 * (0.010)	−0.024 (0.016)	−0.006 (0.024)	0.058 ** (0.022)
Other	0.023 (0.015)	−0.047 (0.028)	0.003 (0.041)	0.021 (0.038)	−0.03 * (0.014)	−0.01 (0.021)	−0.045 (0.032)	0.091 ** (0.029)
Degree: Master (Ref: Bachelor)	0.017 (0.013)	−0.024 (0.020)	0.010 (0.028)	−0.001 (0.026)	0.017 (0.010)	0.023 (0.014)	−0.018 (0.021)	−0.022 (0.019)
Doctorate	—	−0.152 (0.110)	0.021 (0.084)	0.033 (0.073)	—	0.041 (0.055)	−0.256 (0.092)	0.185 * (0.072)
Professional	—	0.082 (0.086)	−0.216 (0.166)	0.108 (0.129)	—	—	−0.127 ** (0.090)	0.163 * (0.078)
Supervisor	−0.018 (0.011)	−0.013 (0.017)	0.006 (0.025)	0.012 (0.023)	−0.009 (0.010)	−0.040 ** (0.015)	0.030 (0.020)	0.012 (0.018)
Training	−0.040 *** (0.012)	−0.022 (0.016)	0.007 (0.024)	0.048 * (0.022)	−0.026 *** (0.008)	−0.011 (0.013)	0.002 (0.019)	0.038 * (0.018)

Note. Data 2013 National Survey of College Graduates. *SEs* in parentheses:

 $p < 0.001$

**
 $p < 0.01$, and

*
 $p < 0.05$.

$N = 2,008$ (Nonwhite Male), $N = 3,333$ (White Female); Prob > $\chi^2 = 0.0000$.

All analyses include controls for age, marriage, children, full time status, work duration, employer size, employer type, and employer location.