

THE EFFECTS OF THE COMPULSORY SCHOOLING LAW ON  
EDUCATION-OCCUPATION MISMATCH IN THE TURKISH LABOR MARKET

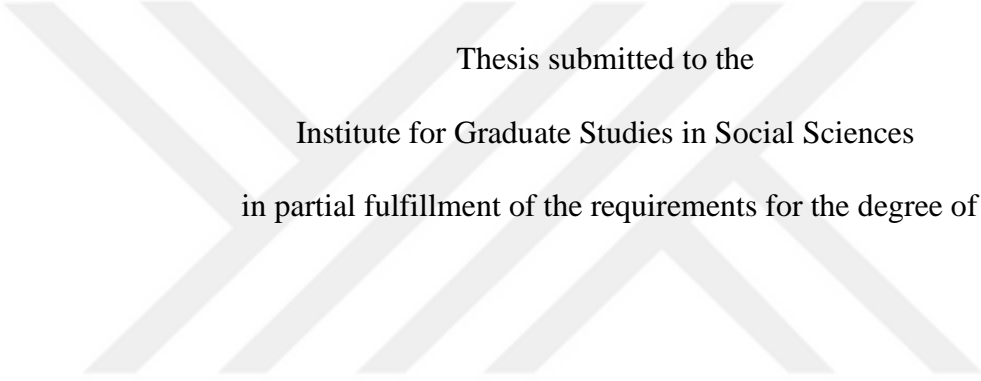


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The Effects of the Compulsory Schooling Law on  
Education-Occupation Mismatch in the Turkish Labor Market

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February 2021

## DECLARATION OF ORIGINALITY

I, Rabia Erarslan, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
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## ABSTRACT

### The Effects of the Compulsory Schooling Law on Education-Occupation Mismatch in the Turkish Labor Market

In Turkey, the duration of compulsory schooling increased from 5 years to 8 years in 1997. With this substantial change, the average educational attainment of individuals increased. This thesis estimates the effects of the eight years of compulsory schooling law on the education-occupation mismatch in the Turkish labor market using Turkish Household Labor Force Survey data between 2006-2018 on individuals between the ages of 21 and 32. Three measurement approaches are applied to determine the required years of schooling for each occupation. Individuals are categorized as overeducated, undereducated, and adequately educated according to these measurement methods. To capture the effects of compulsory schooling on the likelihood of being in any mismatch category, multinomial logit models are run by controlling individuals' characteristics. The empirical findings show that the change in years of compulsory schooling has no effect on the likelihood of being overeducated for either gender. The compulsory schooling reform has a significant and positive effect on the likelihood of being adequately educated for both women and men. The likelihood of being undereducated decreased for women and men with the education reform.

## ÖZET

### Zorunlu Eğitim Kanununun Türkiye İşgücü Piyasasındaki Eğitim-Meslek Uyuşmazlığı Üzerindeki Etkileri

Türkiye'de 1997 yılında zorunlu eğitim süresi 5 yıldan 8 yıla çıkmıştır. Bu önemli değişiklikle birlikte, bireylerin ortalama eğitim düzeyi artmıştır. Bu tez, 2006-2018 Türkiye Hane Halkı İşgücü Anket verisini 21-32 yaş arası bireyler için kullanarak sekiz yıllık zorunlu eğitim kanununun Türkiye işgücü piyasasındaki eğitim-meslek uyumsuzluğu üzerindeki etkilerini tahmin etmek amacıyla yapılmıştır. Her meslek için gerekli okullaşma yılını belirlemek amacıyla üç ölçüm yaklaşımı uygulanmıştır. Bireyler, ölçüm yöntemlerine göre fazla eğitilmiş, yetersiz eğitilmiş ve yeterli eğitilmiş olarak kategorize edilmiştir. Zorunlu eğitimin herhangi bir uyumsuzluk kategorisinde bulunma olasılığı üzerindeki etkilerini tespit etmek için bireylerin özelliklerini kontrol ederek çok terimli lojistik modeller uygulanmıştır. Ampirik bulgular, zorunlu eğitim yılındaki değişikliğin hem kadınlar hem de erkekler için fazla eğitilmiş olma olasılığını etkilemediğini göstermektedir. Zorunlu eğitim reformu hem kadınlar hem de erkekler için yeterli eğitim alma olasılığı üzerinde önemli ve olumlu bir etkiye sahiptir. Kadınların ve erkeklerin yetersiz eğitilmiş olma olasılığı ise, eğitim reformu ile birlikte azalmıştır.

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## TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION .....	1
CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW .....	5
2.1 Theoretical Framework .....	5
2.2 Literature Review .....	7
CHAPTER 3: TURKEY'S COMPULSORY SCHOOLING REFORM AND EDUCATION SYSTEM.....	14
CHAPTER 4: DATA AND DESCRIPTIVE STATISTICS.....	18
4.1 Dependent Variables .....	20
4.2 Independent Variables.....	24
CHAPTER 5: EMPIRICAL STRATEGY .....	27
CHAPTER 6: RESULTS AND ROBUSTNESS CHECK .....	29
6.1 Estimation Results.....	29
6.2 Policy Effect on College Degree Attainment.....	34
6.3 Policy Effect on Employment Status .....	34
6.4 Robustness Check .....	35
CHAPTER 7: CONCLUSION.....	39
APPENDIX A: TABLES FOR DESCRIPTIVES .....	41
APPENDIX B: TABLES FOR REGRESSION RESULTS AND ROBUSTNESS CHECK .....	56
APPENDIX C: DESCRIPTION OF VARIABLES.....	64
REFERENCES.....	66

## LIST OF TABLES

Table A1. The Cohorts Affected by the Law in the Sample .....	41
Table A2. Codes and Definitions of International Standard Classification of Occupations (ISCO 88) and (ISCO 08) .....	42
Table A3. Distributions according to ISCO-88 and ISCO-08 Classification for the Sample of Individuals Aged 21-32 .....	43
Table A4. Alternative of International Standard Classification of Occupations .....	44
Table A5. Distribution of New Isco Codes for All Sample and a Restricted Sample of Aged 21-32 .....	45
Table A6. Distribution of Mismatch Status According to Mean Measurement Method .....	46
Table A7. Distribution of Mismatch Status According to Mode Measurement Method .....	47
Table A8. Coefficients Calculated from the OLS Estimation .....	48
Table A9. Distribution of Mismatch Status According to OLS Estimation Method with 2 Years Bandwidth .....	49
Table A10. Distribution of Mismatch Status According to OLS Estimation Method with 1.5 Years Bandwidth .....	50
Table A11. Distribution of Mismatch Status According to Mean and Mode Estimation Methods .....	51
Table A12. Ratio of the Dependent Variables Across the Years for All Sample .....	52
Table A13. Ratio of the Dependent Variables Across the Years for Women.....	53
Table A14. Ratio of the Dependent Variables Across the Years for Men.....	54

Table A15. Demographic Characteristics of Individuals by Years in the Sample .....	55
Table B1. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by OLS 2 Years Dependent Variable .....	56
Table B2. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mean newisco Dependent Variable .....	57
Table B3. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mode newisco Dependent Variable .....	58
Table B4. Policy Effect on College Degree Attainment .....	59
Table B5. Policy Effects on Employment Outcomes .....	60
Table B6: The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mean Dependent Variable with Actual ISCO Codes .....	61
Table B7: The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mode Dependent Variable with Actual ISCO Codes .....	62
Table B8. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by OLS 1.5 Years Dependent Variable .....	63

# CHAPTER 1

## INTRODUCTION

Growth rate is positively related to human capital accumulation in the economics literature (Barro, 1991). Schooling, on the job-training and learning-by-doing are important in the formation of human capital accumulation (Lucas, 1988). As observed by many economists, the quantity of schooling is a good proxy for human capital accumulation. Early growth literature found empirical evidence supporting the existence of a positive relationship between years of schooling and economic growth. Thus, many developing countries put emphasis on policies and incentives which increased the educational attainment of their populations over the past decades. On average, the ratio of adults with tertiary education in the OECD countries has risen by nearly 18 percent in the last 25 years.<sup>1</sup>

One of the major developments over the past two decades in Turkey has been the increase in the educational attainment of the population. In 1997, the duration of compulsory schooling increased from 5 years to 8 years.<sup>2</sup> Students who started school in September 1993 or afterward were bound by this policy. Since children in Turkey start school at the age of six, children who were born in or after September 1986 were affected.

Educational mismatch is a possible source of inefficiency in the labor market. This inefficiency in the allocation of human resources can be caused when workers end

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<sup>1</sup> See <https://data.oecd.org/eduatt/adult-education-level.htm#indicator-chart>

<sup>2</sup> Basic Education Law (no. 4306, dated 16 August 1997).

up in occupations that require more or less education than their own levels. According to the education-occupation mismatch literature, a worker who has more educational attainment than what his/her occupation requires is said to be overeducated. On the other hand, a worker who has less educational attainment than his/her job requires is specified as undereducated. An implication of this mismatch problem is that overeducated (undereducated) workers are likely to earn less (more) income compared to similarly educated ones whose education levels actually match their jobs.

The seminal paper by Duncan and Hoffman (1981) draws attention to the education-occupation mismatch in the labor market and the incidence of overeducation. Similar to human capital literature, Becker (1964) argues that education increases personal income since it is one of the main factors of workers productivity. The human capital literature assumes workers' human capital is efficiently allocated in the labor market, and workers' wages are equal to their marginal revenue product. However, most empirical studies conclude that there is a wage penalty for overeducated workers in the labor market (Sloane, Battu, and Seaman, 1999).

This thesis examines the effects of the 1997 law which increased the years of compulsory schooling from 5 years to 8 years on workers' likelihood of being overeducated, undereducated or adequately educated using multinomial logistic regression. The Turkish Household Labor Force Survey (HLFS) data conducted by Turkish Statistical Institute from 2006 to 2018 is used in this study. The entire sample contains individuals aged between 0 and 117. Since the subsample affected by the change in the law, and not affected by a subsequent change in 2012, is composed of individuals aged between 21 and 32, the subsample not affected by the law is also taken from the same age bracket.

This thesis utilizes all objective measurement methods in the literature to capture mismatch: mean measurement method, mode measurement method, and OLS estimation measurement method. The mismatch variable contains three categories: overeducated, undereducated, and adequately educated. The analysis is performed by regressing the mismatch variable on the policy variable which is a dummy variable for the birth years affected by the law while controlling for other covariates, which are the number of employees in the firm, main occupation classification, gender, marital status, age, survey year, and regional dummy variables. To my knowledge, this is the first research to analyze the effect of the eight-years compulsory schooling law on the education-occupation mismatch. This is also the first study to use the OLS method to measure the education-occupation mismatch in Turkey.

I find that the eight-year compulsory schooling law has increased the likelihood of an individual's being adequately-educated. The policy has not had a discernable effect on the likelihood of being overeducated. Also, it decreased the likelihood of being undereducated. The marginal effects of the policy are smaller for women than men. Overall, the law seems to have been effective in improving efficiency in the labor market. Additionally, I find that the effect of being married on the probability of being undereducated is positive. Another finding is that the probability of mismatch is smaller for larger firms. This suggests that larger firms with more established human resources practices may succeed in hiring more efficiently in this respect.

In the next chapter, I provide background about the theoretical framework and give a review of the literature. Chapter 3 provides detailed information about the schooling reform and education system in Turkey. Chapter 4 describes the data used in

this study. Chapter 5 gives details about estimation method. Chapter 6 presents the estimation results and the robustness assessments. Chapter 7 concludes the thesis.



## CHAPTER 2

### THEORETICAL FRAMEWORK AND LITERATURE REVIEW

#### 2.1 Theoretical Framework

Duncan and Hoffman (1981) were the first to question the possible labor market inefficiencies in the allocation of human resources, due to differences between workers' required and actual human capital levels. This inefficient allocation of labor possibly causes some workers to be in an occupation that requires an educational level different than the worker's actual educational level. The literature on education-occupation mismatch is based on three classical labor market theories discussed below.

The first explanation is human capital accumulation. In the neoclassical model of the human capital theory Becker (1964) states that each worker earns a wage equal to his/her marginal revenue product. Productivity depends on the human capital accumulation level which is gained through schooling, on-the-job training, and learning-by-doing over time. Mincer (1974) empirically finds wage to be a function of formal years of schooling. The neoclassical labor market model prevents the mismatches between labor demand and labor supply by using a wage mechanism. Therefore, an education-occupation mismatch can occur due to a temporary disequilibrium. However, Gottschalk and Hansen (2003) state that mismatches can occur because of workers' job preferences and a discrepancy between the production process and the required skill level.

The second main theoretical framework is the job competition theory. In the job competition model Thurow (1975) supposes that employers hire an employee on the basis of his/her cost of training for that job. In the employment procedure, firms consider

the workers' characteristics such as education, vocational training, and experience.

Firms use education as a proxy for the amount of training. Greater education implies less training requirements. Thus, employers are inclined to recruit more educated workers without taking job requirements into account. This scenario may cause an education-occupation mismatch in the labor market.

The third explanation of the education-occupation mismatch in the labor market is assignment models. The main principle in these models is to ensure matching heterogeneous workers with various job characteristics. Sattinger (1993) states that job characteristics are as important as the workers' characteristics. Under the assignment model, education-occupation mismatch could arise from the heterogeneity of workers and the distribution of jobs. In addition to the assignment model, the job searching mechanism can clarify the mismatch. In most of the developing countries, there is imperfect information in the job search mechanism. Most job seekers reach out to their friends and relatives to find a job rather than applying to agencies and foundations. Such an inefficiency leads to individuals with low/high-level skills or less/more educational attainment to fill the jobs that require high/low-level skills or more/less educational attainment.

Many developing economies have less capital incentive production processes compared to advanced economies. In this type of economy, there are jobs that require less skilled labor. Workers with less educational attainment can easily find jobs that require less skills. Thus, the incidence of education-occupation mismatch is a more likely scenario in developing economies.

## 2.2 Literature Review

The majority of the existing literature on the education-occupation mismatch evaluates the impact of being overeducated (undereducated) on earnings (Hartog, 2000) and the measurement of being overeducated or undereducated in developed countries (Groot and Maassen Van Den Brink, 2000). However, little attention is paid to the education-occupation mismatch problem in developing countries.

Duncan and Hoffman (1981) examine the U.S. Panel Study of Income Dynamics (1976) data to estimate the individuals' returns to schooling by separating required years of schooling for that occupation and the years of overeducation or undereducation. The PSID (1976) survey asks the question "How much formal education is required to get a job like yours?". In other words, workers make a self-assessment about being overeducated or undereducated. Using the self-reported job requirements information and actual educational attainment, they decide if there is a mismatch. The individual's actual educational attainment is compared with the required years of education for that job and the years of surplus or deficit education are determined. They find evidence that being overeducated has a significant and positive effect on wage rates.

In another study, Verdugo and Verdugo (1989) evaluate the effect of overeducation on earnings using the 1980 census data. They use an objective measurement method to identify the overeducated or undereducated workers in the sample. They calculate the mean and standard deviations of individuals' schooling years for each occupation. Workers are defined as overeducated and undereducated if their education level is, respectively, more than one standard deviations higher or lower than the mean level of education in that job category. They use attained years of schooling with overeducation and undereducation in their earnings equation. According to their

estimation results, the overeducated workers earn 13% less than the adequately educated.

Kiker, Santos and Oliveira (1997) use the mode values of educational attainment across occupations to measure overeducation and undereducation in the Portuguese labor market. They use the sample mode of the years of schooling in each job category as the required education level. They define workers as overeducated/undereducated if their education is higher/lower than the mode value of the years of schooling in that job category. This type of measurement of overeducation (undereducation) is also classified as an objective measurement method. The reason behind the suggestion of a new measurement method is to be able to capture the effect of technological change in the labor market. With technological advancements, the required years of schooling will increase. They state that the firm should supply occupational retraining to old workers and hire new employees with the required level of education. Newly hired workers become the majority for a number of years, and mismatch classification will change instantaneously. However, the mean of schooling years increases steadily over time. Thus, they indicate that mode method captures the impact of the technological changes. They report that the increase in the incidence of overeducation for women is larger than for men. In this study the mode method gives a higher proportion of mismatch than the mean method.

Sloane et al. (1999) examine the educational mismatch problem in the British labor market. They use the Social Change and Economic Life Initiative (SCELI) survey which contains the direct question about the required education level for each job to wage and salary workers. They argue that the mean measurement shows a downward bias in overeducation due to the measurement error in required education. In their

specifications, they use marital status, gender, experience, tenure, current job status, and past socioeconomic status of individuals as the determinants of educational mismatch. They find that more formal education is correlated with lower levels of achievement related to working, like experience and training. Thus, overeducated workers may not have more human capital. Also, they find that there is a greater wage penalty in overeducated female workers in comparison with male workers.

Tsai (2010) pays attention to unobservable heterogeneity and measurement error problems in the estimation of returns to overeducation. She uses PSID panel data to capture the time-invariant characteristics of individuals. She uses fixed effects estimation to overcome the endogeneity problem. She concludes that most of the workers have a lower ability or other unobserved characteristics that make them overeducated. Also, this study states that being overeducated does not lead to lower earnings compared to well-matched workers.

The education-occupation mismatch problem attracts little attention in developing economies since human capital accumulation is much lower compared to developed countries. To the best of my knowledge, only a few studies on education-occupation mismatch use data from developing economies.

Quinn and Rubb (2006) investigate the education-occupation mismatching problem in the Mexican labor market by using objective measurement methods. In this study, since they use multi-period cross-sectional data, similar with this thesis, they argue that the required education level may depend on the technological changes and the quality of education. Thus, they propose a different definition of overeducated and undereducated workers by considering the year of birth and survey year. Technically, they regress actual education on occupation dummies, year of birth, and survey year

without a constant term. Then the required years of education in a given occupation is equal to the summation of coefficients of the related occupation, survey year and birth year for each individual. They also obtain standard errors of each occupation from the regression. They define individuals as overeducated/undereducated if their actual education is more/less than one standard error of related occupation. The new method by using OLS estimation for the measurement of overeducation and undereducation shows similar results with the mean measurement method. On the other hand, their analysis shows that the returns to additional years of schooling depend on being overeducated, undereducated, or adequately educated in developing country settings as well. Additionally, they find overeducation coefficient estimates to be consistent with the developed countries' results.

Using labor force surveys from four developing countries, namely Philippines, Mexico, India and Thailand, Mehta, Felipe, Quising, and Camingue (2011) construct a new method in order to test the existence of overeducation. With their new method, they remove the need for the measurement of years of required education for a job. In their methodology, they examine a country for two time periods. They determine the unskilled jobs which is the rate of pay is below a determined cut-off for each period. They denote the workers who remain in the unskilled jobs and have secondary and tertiary education as overeducated. Mehta et al. (2011) conclude with the evidence for the existence of overeducation in unskilled jobs in the Philippines, mild evidence for Mexico, and little evidence for India and Thailand.

There are only a few studies that analyze the education-occupation mismatch in the Turkish labor market. Filiztekin (2011) evaluates the incidence of overeducation using data from 1994 and 2002 Turkish Household Budget and Expenditure Surveys. In

this study, objective measurement methods are used to identify the overeducated and undereducated workers. Filiztekin (2011) finds that the incidence of overeducation decreases from 1994 to 2002. This study also shows that the incidence of overeducation and undereducation varies with the measurement method. He finds that 15.1% of workers were overeducated and 9.6% of workers were undereducated using the mean method in the 2002 survey, whereas these numbers were 24.6% and 14.7% using the mode method.

This thesis tries to connect two fundamental questions in the economics of education literature: the education-occupation mismatch problem, and the effect of a change in the compulsory schooling law. The rest of the literature review will focus on the eight years of compulsory schooling law and its effects on the Turkish labor market.

Many studies estimate the causal effects of compulsory schooling law on households' labor market outcomes in Turkey. Aydemir and Kırđar (2017) estimate the effects of the 1997 compulsory schooling law on earnings and further educational attainment using 2002-2013 HLFS of Turkey. In their study, identification is based on the birth cohorts of individuals, and the compulsory schooling law is independent of the year of births. They create a dummy variable, policy, which is equal to one for the individuals who born in 1987 or later, and is equal to zero for the earlier birth cohorts. Their purpose is to estimate the effect of compulsory schooling law on earnings by comparing the individuals affected and unaffected by the policy. In their study, they address the endogeneity problem of schooling due to omitted variables such as ability, and parental connections. The regression discontinuity design method is used to solve the omitted variable bias problem. In their estimation method, they use the eight years of compulsory schooling reform as an instrumental variable. In their results, they find that

the reform had a significant spillover effect on high school grade attainment. However, they show that compulsory schooling law had no significant effect on college degree attainment for men and women. Also, they show the positive effect of the policy on schooling on the wages of both men and women in their restricted wage workers sample. They conclude that an additional year of schooling increase earnings by 7-8% for women and 2-2.5% for men.

Torun (2018) evaluates the estimates the causal effects of the 1997 compulsory schooling law in Turkey on the labor market by using 2004-2011 HLFS. In this study, he considers only the young adults who are aged between 20-29 in the labor market. The effect of compulsory schooling on the sector of employment is questioned first in this paper. He finds that women became more likely to work in occupations requiring high skills with the law. Women shifted to finance and business services with the reform rather than manufacturing services. Also, women moved from the private sector to the public sector with the compulsory schooling reform. Similar to the Aydemir and Kirdar (2017) study, he finds that there is no significant effect of the schooling reform on the attainment of a college degree. In his main result, he shows evidence that the schooling reform had a positive and large effect on women's wages, but a relatively small effect for men, using instrumental variable estimation. He finds that additional year of schooling increases earnings by 9-10% for non-college graduate women and by 0-2% for non-college graduate men.

To my knowledge, my thesis is the first research to analyze the effect of compulsory schooling law on the education-occupation mismatch in the Turkish labor market. The longer compulsory education may decrease the likelihood of being undereducated or increase the probability of being overeducated. Moreover, the possible

spillover effects of compulsory schooling on getting further education than the required years may have an escalating impact on labor market mismatch.



## CHAPTER 3

### TURKEY'S COMPULSORY SCHOOLING REFORM AND EDUCATION SYSTEM

Most children start school at the age of six in Turkey. Until the 1997 compulsory schooling reform in Turkey, the basic education system was built on five years of compulsory primary school and voluntary subsequent education. Primary school was followed by three years of non-compulsory lower secondary school. Students who completed lower secondary school had the option to continue with three years of high school education. High school education consisted of general high schools or vocational high schools. In 1997, the Ministry of National Education increased the duration of compulsory schooling from five years to eight years with the Basic Education Law (no. 4306, dated 16 August 1997). With the new compulsory schooling law, primary school and lower secondary school were combined and called primary education.

According to national education statistics, one year before years of compulsory schooling was increased, the net enrollment rate in grades 1-5 was 89.4%, while this number was 52.8% in grades 6-8.<sup>3</sup> Four years after the law was changed, on the other hand, the net enrollment rate for grades 1-8 had become 95.3%. These numbers show that the enrollment rate in grade 6-8 almost doubled as a result of the law. Thus, there was a drastic change in the educational attainment of individuals. In order to meet the increased demand for education, the Ministry of National Education tried to provide infrastructure in a short time through the construction of new schools and the construction of new classes in existing schools to provide additional capacity. New

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<sup>3</sup> TUIK (Turkish Statistical Institute), Education Statistics

teachers were hired to decrease the student-to-teacher ratio, and bus services were provided for the students in the rural areas.

The new compulsory schooling law was implemented in 1997 for the 1997-1998 academic year without any exception. All children who completed five years of primary school in the 1997-1998 academic year were required to continue to sixth grade. Considering the school starting age, children who began school in September 1993 and after were bound with the new compulsory schooling law. Thus, the birth cohorts in 1986 or after were affected by the policy. But, some children who were born in 1986 and started school earlier than age 6 may not have been affected by the policy. Also, some children who born in 1987 and started school late may have been affected by the policy. Additionally, non-compliance was widely observed both before and after the reform. The new law did not coincide with other policies that would be expected to have an effect on schooling to make it hard to identify the effects of the law.

Figure 1 presents the change in the ratio of individuals between the ages of 21 and 32 in the 2006-2018 HLFS who completed at least eight years of education. In panel (a) all the data is used, while panel (b) uses a bubble and excludes people with birth years 1986 and 1987, because of the possible exceptions described in the previous paragraph. Linear polynomials are fitted on both sides of the cut-off. As observed in Figure 1, both in panel (a) and (b) there is a jump in the educational attainment around the cut-off point. However, they show similar trends both before and after the schooling reform.

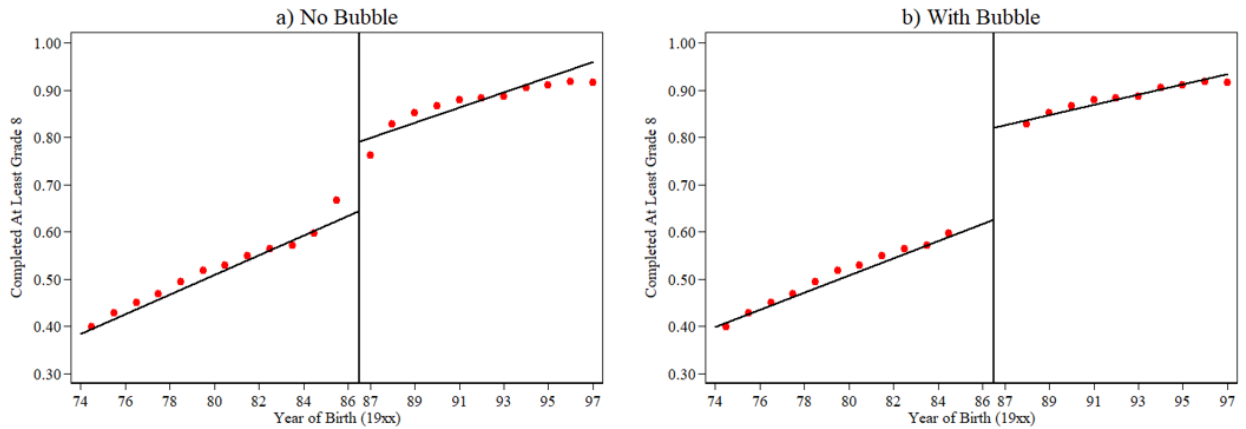


Figure 1. The ratio of individuals who completed eight years of education or more in the survey

Figure 2 shows the ratio of individuals who completed at least grade 8 by gender across years (without a bubble). Before the schooling reform, the educational attainment of females and males show similar trends, while after the schooling reform females show a steeper slope and the trend for males slows down. These numbers provide evidence that compliance rates increased at a higher rate for females, and the law may have been instrumental in bringing the educational attainment levels of women and men closer.

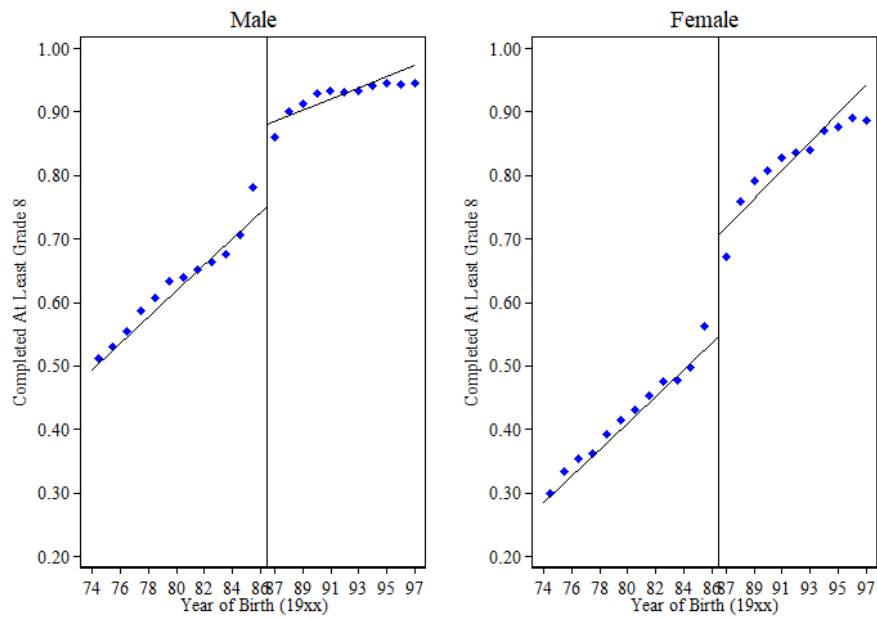


Figure 2. The ratio of individuals who completed eight years of education or more by gender

## CHAPTER 4

### DATA AND DESCRIPTIVE STATISTICS

The data used in this study comes from the Turkish HLFS conducted by the Turkish Statistical Institute. HLFS is an annual cross-sectional survey and it includes individuals' demographic characteristics and a detailed set of labor market variables.

There are approximately 400,000 individuals in each survey. This thesis uses the 2006-2018 releases of the HLFS. The reason for starting with the 2006 survey data is to obtain a symmetric dataset in terms of the age distribution of individuals affected and unaffected from the compulsory schooling reform. Table A1 (Appendix A) presents the affected and unaffected ages for each survey year. Also, a subsequent education reform in 2012 extended the years of compulsory schooling from eight to twelve years. The individuals affected by the 2012 law, people whose year of birth is greater than or equal to 1998, were left out to be able to separate the two laws' effects. The age range of those who were affected by the 1997 law (and not affected by the subsequent 2012 law) in the data is 21-32. The entire sample for the estimations is restricted to individuals who are aged between 21 and 32 in any survey year to get a comparable control group. Starting with the age of 21 also eliminates the group who are in high school (and hence are not working) due to the possible spillover effects of compulsory schooling law on high-school completion.

There could be a selection bias problem. If the eight years of compulsory schooling policy can affect the probability of getting tertiary education, then some of the affected individuals would be in university and would not participate in the labor market, failing to show up in our sample. Therefore, I examine the effect of compulsory

schooling reform on college degree attainment in Section 6.2. Further analysis will show that there is no significant effect of the policy on college degree attainment for both women and men. Same results are obtained with Aydemir and Kirdar (2017) study. The sample is restricted to only full time employed wage workers. Thus, part-time workers and workers who have other types of employment status such as employer, self-employed, and unpaid family worker are excluded from the analysis. As a result, the final sample has 421,105 observations.

One of the challenges of this thesis is to estimate the required years of schooling for each occupation. The measurement ways for required schooling in the education-occupation mismatch literature can be classified into three categories: job analysis, worker self-assessment, and realized match. Since the survey does not contain questions regarding job analysis and worker self-assessment methodologies, the realized match measurement methods are implemented. Emphasis is put on the occupation classification in the HLFS data. Until 2012, the occupations were classified according to the International Standard Classification of Occupation (ISCO-88 two-digit codes) in the survey data. ISCO-88 contains twenty-seven different occupations. Since 2012, the occupations have been classified according to the International Standard Classification of Occupation (ISCO-08 two-digit codes), covering forty different occupations. Table A2 in Appendix A shows the definitions of the occupation classification in ISCO-88 and ISCO-08. Thus, 2006-2018 HLFS merged data includes different occupation classifications across the years. The required schooling years for each occupation are calculated for each survey year separately. Table A3 (Appendix A) shows the distributions of individuals in the sample according to ISCO-88 and ISCO-08 classifications.

On the other hand, as an alternative occupation classification, a new variable, (*new isco* in the regressions), which contains twenty-five categories is generated. To generate it, occupation categories in ISCO-08 with ISCO-88 were matched according to their detailed definitions. The detailed information of the match is provided in Table A4 (Appendix A). Since there is not a sufficient number of observations in category 62, (Subsistence Agricultural and Fishery Workers), it is excluded from the sample. Table A5 in Appendix A shows the distributions of new occupation codes for ages 21-32. It presents the distributions for two different samples. One contains all types of employment status while the other is restricted to full-time employed and wage-workers. As shown, the difference between the distributions of the two samples for each new occupation dummy is small. Hence, the sample restriction does not lead to a sample selection problem in terms of occupational groups.

#### 4.1 Dependent Variables

This subsection gives the details about the dependent variables used in this study. The dependent variables are named as *mismatch by OLS 2 years*, *mismatch by mean newisco*, *mismatch by mode newisco*, *mismatch by OLS 1.5 years*, *mismatch by mean*, and *mismatch by mode*.

The empirical works on education-occupation mismatch define overeducation/undereducation as a worker's educational attainment being greater/lower than the required educational attainment for an occupation group. The required educational attainment can be found with subjective and objective measurement methods. Job analysis and worker self-assessment are subjective methods. In the job analysis method, job experts determine the required level and type of education for each

job. Such data is available only in a few developed countries. In the worker self-assessment method, workers give direct answers to the question “What do you believe to be the education level required to actually do your job?” To determine their status, workers’ answers are compared with their actual education level. Realized match methods, on the other hand, yield objective measures. Statistical measurements are used in realized matching. Required schooling years of a worker for a specific job is calculated from the mean or mode of actual schooling years of all workers in that job. Then the worker’s actual education is compared with the required schooling years. All methods have advantages and drawbacks and the method is driven by the available data.

In the mean measurement method, workers are defined as overeducated or undereducated if their years of schooling is, respectively, more than one standard deviation higher or lower than the mean level of years of schooling for individuals in that job category. The method was used by Verdugo and Verdugo's (1989) for US data, and by Filiztekin (2011), and Acar (2016) for Turkish data. Using Verdugo and Verdugo's (1989) measurement method, the means and standard deviations of the schooling years for each occupation group and each survey year are calculated in the Turkish HLFS data for this thesis. Mismatch by mean newisco is generated with the newly designed ISCO classification and the mean measurement method. Individuals are defined as overeducated/undereducated if their years of schooling is respectively more than one standard deviation higher/lower than the mean level of years of schooling for individuals in that *newisco* category. According to mean measurement with the newly generated occupation groups, 74% of the sample is defined as adequately educated, 13% as undereducated, and 13% as overeducated. Mismatch by mean newisco uses the occupational categories provided in Table A6 in Appendix A.

In the mode measurement method, a worker is defined as overeducated or undereducated if their schooling years is higher or lower than the mode value of the schooling years of the individuals in that job category. Kiker et al. (1997) used this measurement with Portuguese data, and Mercan, Karakas, Citci, and Babacan (2015), Filiztekin (2011) and Acar (2016) used it with Turkish data. With the new designed ISCO classification and the mode measurement method, mismatch by mode *newisco* is created. Individuals are defined as overeducated or undereducated if their schooling years is higher or lower than the mode value of the schooling years of the individuals in that *newisco* category. Its fraction by the occupational category is provided in Table A7 in Appendix A. According to the classification by the mode method, 51% of the sample is defined as adequately educated, 26% as undereducated, and 23% as overeducated.

The third measurement method used in this thesis, introduced by Quinn and Rubb (2006) and used for Mexico data, is obtained by OLS estimation of Equation 1.

$$\text{Actual Educ} = \sum \beta_{\text{occup}} \text{Occup} + \beta_{\text{birth}} \text{Birth} + \beta_{\text{year}} \text{Year} + \varepsilon \quad (1)$$

In this method, actual years of education are regressed on each occupation dummy variable, dummy variable for the year of birth, and survey year with no constant term. Then the required years of education in a given occupation is equal to the summation of the estimated coefficients of the related occupation, survey year and birth year from the regression.

Quinn and Rubb (2006) define an individual as overeducated or undereducated if his/her actual years of schooling is respectively more or less than one standard error of related occupation than the required years of schooling for that individual found through the OLS regression. The coefficients of occupations, survey years, and year of births are

calculated according to Equation 1. The coefficients from the OLS estimation for each occupation category, survey year, and birth year are shown in Table A8 in Appendix A. The results present that there is not a drastic change in the coefficients of survey years and year of births. In this way, the required years of schooling are obtained by controlling for age and year effects. The baseline dependent variable is created by using designed ISCO categories, OLS estimation method, and a 2-year bandwidth which called mismatch by OLS 2 years.

Quinn and Rubb (2006) analyzed a sample that contains 100 occupational categories and 4,945 observations. Since they had a much smaller number of observations per occupational category compared to this study, they ended up with higher standard errors for the occupation categories. This thesis analyzes a total of 421,105 observations in 24 different occupational categories. Hence, the standard error for each occupational group is about 0.07. The cutoffs generated with such standard errors do not create meaningful results. The standard deviation of the absolute value of the difference between the required years of schooling and actual years of schooling in the sample is calculated as 1.84 years. Using this result as an approximate pointer, upper and lower bandwidths are determined as 2 years, and then another variable with a 1.5-years is also tried. The 2-years cutoff is used in the benchmark model. According to the OLS estimation measurement method, a worker is defined as overeducated or undereducated if his/her actual years of schooling are respectively 2 years higher or lower than the required years of schooling for that individual. According to classification by OLS estimation results, 51% of the sample is defined as adequately educated, 24% as undereducated, and 25% as overeducated. This variable's distribution by the occupational category is provided in Table A9 in Appendix A

In order to test the robustness of the results, the required years of schooling are also calculated with a 1.5-year bandwidth. Details for mismatch by OLS 1.5 years are provided in Table A10 in Appendix A. Further tests of robustness are conducted using newly designed occupational categories mismatch by mean and mismatch by mode, both of which are found with the original ISCO-08 and ISCO-88 occupational categories. The distributions of education-occupation mismatch status according to mean measurement and mode measurement methods, are detailed in Table A11 (Appendix A). Table A12-A14 in Appendix A show the ratios of each dependent variable across the survey years for the entire sample as well as women and men separately. As shown in Table A12, mismatch by OLS 2 years and mismatch by mode newisco presents similar distribution across the years. Mismatch by mean newisco shows less proportion of overeducated and undereducated individuals compared to mismatch by OLS 2 years and mismatch by mode newisco. As shown in Table A13 and Table A14 in Appendix A, there are no drastic differences in ratio of the mismatch status for women and men.

## 4.2 Independent Variables

This subsection gives details about the independent variables used in the models in this study.

The data contains information about individuals' social and demographic characteristics as well as employment conditions: age, gender, educational attainment, marital status, type of employment, occupation, and the number of employees in the current job. Table A15 in Appendix A presents the summary statistics of these variables. The ratio of married individuals is approximately 51% with a decreasing pattern over time. The mean age remains stable over the survey years, nearly at 27 years. Thus, the

decrease in the married ratio is not due to a decrease in the ages across the survey years. As shown in the table, the distribution of gender remains the same over the years. There is a remarkable increase in the ratio of the college graduates and above for this age group. It increases by 21% from 2006 to 2018.

The Turkish Household Labor Force Surveys do not provide the exact information about the completed years of schooling. It contains a variable on the highest completed educational degree. Thus, the years of schooling for different educational degrees were proxied by the usual years of schooling for these degrees. The years of schooling variable is 0 years for the illiterate, 1 year for the literate with no diploma, 5 years for primary school graduates, 8 years for secondary school graduates, 11 years for high school graduates, and 15 years for college graduates and those with higher degrees. Filiztekin (2011) assigned these numbers of schooling years for each educational degree in his study to measure the incidence of overeducation.

In order to determine the affected groups, individuals' years of birth are calculated by subtracting their age from the survey year. Then, a policy dummy variable is generated which is equal to one for those born in 1986 or after and zero for those born earlier. The policy dummy is the key variable of interest.

In the survey, marital status encompasses four categories as single, married, divorced, and widowed. The marital status of individuals used in the regressions is a dummy variable denoting if an individual is married or not. Being single, divorced, and widowed are combined in the category of not married.

The number of employees in the current job is a categorical variable which changes across the survey years. Thus, in order to obtain a classification of the number of employees in the current job which is consistent across the years, three groups were

formed: number of employees in the current job is less than 10, between 11- 49, and more than 50.

In the survey data, occupations are defined with two-digit codes. According to their codes, nine main occupational categories are obtained. Appendix C presents the details. The main occupation categories do not change with changes from ISCO-88 to ISCO-08 classifications. The regressions also control for gender, age of individuals, survey years, and NUTS-1 level regional dummies.

CHAPTER 5  
EMPIRICAL STRATEGY

In this section, I describe the econometric specifications that I employ in this study. To estimate the impact of the compulsory schooling law on the education-occupation mismatch in the Turkish labor market, I estimate the following equation:

$$\ln \left( \frac{\Pr (Mismatch_i=m)}{\Pr (Mismatch_i=A_i)} \right) = \beta_0 + \beta X'_i + \delta D_i + \varepsilon_i \text{ where } m = \{O_i, U_i\} \quad (2)$$

where  $Mismatch_i$ <sup>4</sup> denotes the education-occupation mismatch status of individual  $i$ ,  $D_i$  is a binary dummy variable for the policy that takes the value 1 for individuals born in or after 1986 and 0 for those born before 1986, and  $X'_i$  is a vector of individual controls such as the number of employees, the main occupational category, the female dummy, the married dummy, age, the survey year dummy, and NUTS-1 level regional dummy variables. Since the dependent variable is categorical, the multinomial logistic regression model is used in the estimation. In Equation 2, being adequately educated,  $A_i$ , is chosen as the base category to capture the effects on education-occupation mismatch. The exponential  $\delta$  coefficient denotes the change in the probability of being in a particular category compared to the reference category conditional on a one unit change of the policy dummy variable. Also, exponential  $\beta$  coefficients denote the changes in the probability of being in a particular category compared to the reference category conditional on a one unit change of the corresponding independent variable.

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<sup>4</sup>  $Mismatch_i$  indicates an individual's education-occupation mismatch status.  $O_i$  shows Overeducated,  $U_i$  shows Undereducated  $A_i$  shows Adequately-Educated.

When using the multinomial logistic regression, the odds ratios for all regressors for each category of the dependent variables are calculated separately. However, the reference category is omitted from the analysis as the multinomial logit model is running  $K - 1$  independent logistic regression models for  $K$  possible outcomes. Also, it is difficult to directly interpret the coefficient of parameters in the multinomial logit model. Thus, to determine the effect of each variable, marginal effects were computed. Marginal effects are found by fixing all other variables at their mean values. The effects of discrete changes are computed by the following equation for each independent variable:

$$\frac{dY}{dX_k} = \Pr(Y = 1|X, X_k = 1) - \Pr(Y = 1|X, X_k = 0) \quad (3)$$

## CHAPTER 6

### RESULTS AND ROBUSTNESS CHECK

This section presents the estimated effects of the law which changed compulsory schooling from five to eight years on the education-occupation mismatch status in the Turkish labor market. This paper carries out the estimations with all three types of mismatch measurement methods mentioned above, which are the mean method, the mode method, and the OLS method. The sample contains only individuals aged between 21 and 32 who are full-time employed wage workers.

#### 6.1 Estimation Results

Results with all three dependent variables, mismatch by mean newisco, mismatch by mode newisco, and mismatch by OLS 2 years are presented in Table B1-B3 in Appendix B. The standard errors are clustered at the NUTS-1 level. The multinomial logistic regressions for the three different dependent variables are run as defined in Equation 2. Then the discrete marginal effects are calculated for each variable in the regressions by using Equation 3. The effects on women and men are also estimated separately. The first model, mismatch by OLS 2 years, is taken as the benchmark model.

Table B1 in Appendix B reports the effects of the compulsory schooling reform on the likelihood of mismatch using the dependent variable mismatch by OLS 2 years. As shown in Table B1, there is a significant but nearly zero effect of the policy variable on the likelihood of being overeducated, and the same is true for women and men separately in the benchmark model. The estimates from the benchmark model show that there is a significant negative effect of the policy variable on the likelihood of being

undereducated for the entire sample as well as women and men separately, with the effect on men being larger on women. Also, there is a positive significant effect of the policy variable on the likelihood of being adequately educated.

Interestingly, while the policy leads to a larger rate of increase in the educational attainment of women (as measured by completing 8 years of education) than men as shown in Figure 2, the likelihood of being adequately educated is affected positively to a smaller degree for women compared to men, and the impact of the reform in reducing undereducated workers is again larger on men. This suggests that the mismatch in men's jobs was higher to start with. Figure 3 supports this idea when we examine the undereducated and adequately-educated worker ratios for men and women in the beginning years of the sample. Men have higher mismatch ratios. With the definition of mismatch by OLS 2 years, the percentage change in the ratio of adequately educated women between 2006 and 2018 is 6.8% while, this percentage change is 9.2% for men as shown in Figure 3. The likelihood of being adequately educated increases by 11% for men who are affected by the reform whereas this number is 4% for women.

Overall, the policy has no substantial effect on the probability of being overeducated. The policy variable decreases the likelihood of being undereducated by 9%. This negative effect of the law of being undereducated persists in the regressions with the alternative dependent variables mismatch by mean newisco and mismatch by mode newisco as shown in Tables B2 and B3, but the estimated impact is smaller.

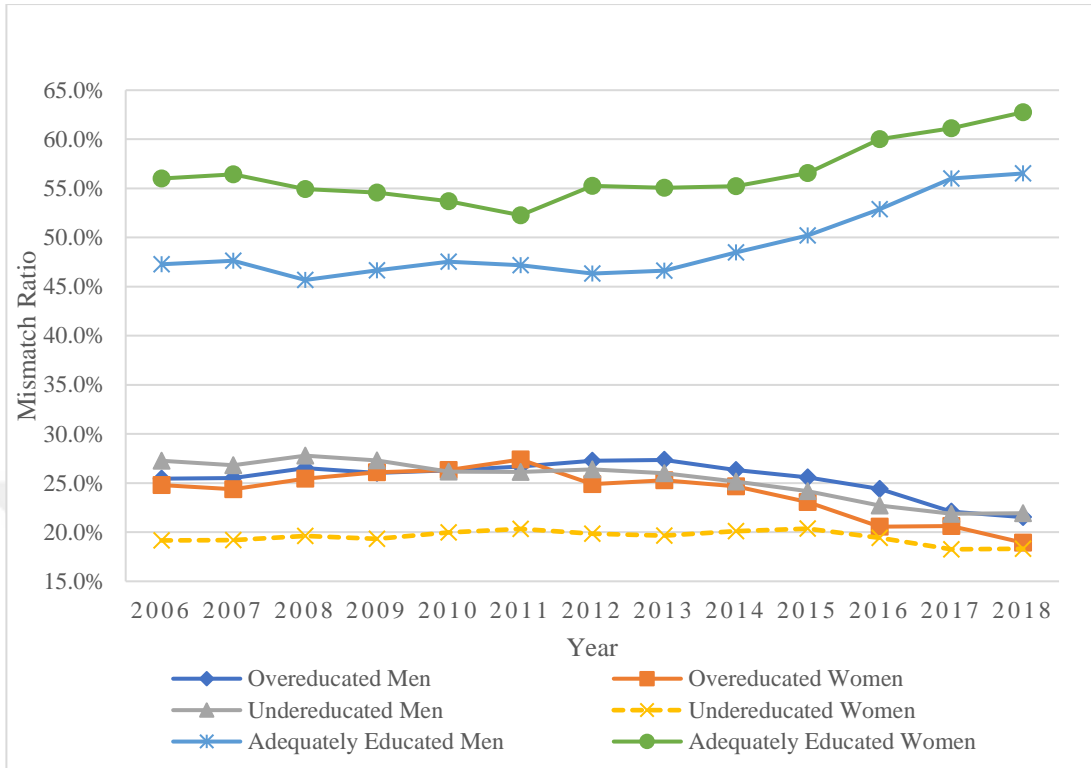


Figure 3. The ratio of mismatch by OLS 2 years by gender

In addition, being married has a significant effect on the mismatch status for both women and men. In total, being married increases the likelihood of being undereducated by 7%, with the impact being smaller on women and larger on men. One possible explanation is that being married is associated with an earlier entrance to the labor market and a smaller number of years spent in education, with an early entrance enabling one to accumulate enough human capital to be matched with a job requiring a higher number of years of education. Since data like number of working years or years of marriage are not available, it is not possible to substantiate such an idea.

Another result is that the likelihood of an individual being adequately educated increases for individuals who work in an organization that has a number of employees between 11 and 49, and increases even more for firms with 50 or more employees relative to those who work in an organization has a number of employees less than 10.

Working in a firm has more than 50 employees increases the probability of being adequately educated by 8% relative to the working in a firm which has less than 10 employees. It can be conjectured that larger firms have more institutionalized hiring practices and possibly human resources departments which improve the job-worker match.

Table B2 in Appendix B presents the effect of the compulsory schooling law on the likelihood of mismatch using the dependent variable mismatch by mean newisco. The policy variable does not have a significant effect on the likelihood of any type of mismatch for women. It has nearly zero effect on the likelihood of being overeducated for men and for the combined sample of men and women. For the entire sample, the policy variable increases the probability of being adequately educated by 3% and decreases the likelihood of undereducation by 3%. Similar to results of the regression run with the mismatch by OLS 2 years, the probability of being adequately educated increases for individuals who work in a firm that has a number of employees between 11 and 49, and more than 50 number of employees relative to who work in an organization has a number of employees less than 10. Working in a firm has more than 50 employees increases the probability of being adequately educated by 8% relative to the working in a firm which has less than 10 employees, and decreases the probability of being undereducated by 8%. Being married has significant and negative effect on the likelihood of being adequately educated. It decreases by 4% for the entire sample. These results are consistent with outcomes obtained from regression with dependent variable of mismatch by OLS 2 years. The only difference between them is in magnitude of policy variable coefficients. These arise because of the differences in the measurement of

mismatch, but all results point to similar changes in the labor market matching outcomes.

Table B3 in Appendix B shows the effect of the compulsory schooling law on the likelihood of mismatch status with the dependent variable mismatch by mode newisco. The results are consistent with the other two models. There is evidence that the probability of being adequately educated is positively and significantly affected by the schooling policy for both women and men as well as for the entire sample. The likelihood of being undereducated decreases by 5% for men while the likelihood of undereducation for women declines by 3%. Also, being married increases the likelihood of being undereducated by 7% in all samples. Again, the likelihood of an individual being undereducated decreases for individuals who work in an organization that has a number of employees between 11 and 49, and more than 50 number of employees relative to those who work in an organization has a number of employees less than 10. For the entire sample, these show similar results to the regression with dependent variable of mismatch by mean newisco.

To summarize, the results in Tables B1-B3 indicate that increasing compulsory years of education from five to eight had a negligible effect on the probability of being overeducated, a negative effect on the probability of being undereducated with the effect on men being more pronounced than women, and increased the probability of being adequately educated. Any apprehensions about too much education for the Turkish labor market as a result of the law are not substantiated by the results, and undereducation problems seem to have decreased. These provide evidence that labor market efficiency was positively affected by the increase in the years of compulsory education in terms of education-occupation mismatch.

## 6.2 Policy Effect on College Degree Attainment

The analysis in this subsection examines if the compulsory education law had an effect on the probability of college degree attainment. If the compulsory education law affects the probability of college degree attainment, then some of the individuals who are affected by the policy would not participate the labor market and the sample would exclude these individuals. Aydemir and Kırdar (2017) follow a similar strategy. The policy effect is estimated by using the following equation for women and men separately in OLS regressions:

$$C_i = \alpha_0 + \alpha X'_i + \delta D_i + \varepsilon_i \quad (4)$$

In this regression,  $C_i$  is a dummy variable that takes the value 1 if an individual has a college degree and 0 otherwise.  $D_i$  is a binary dummy variable for those affected by the policy.  $X'_i$  presents a vector of individual controls, namely the number of employees at the current job, the main occupational category, gender, marital status, age, survey year, and NUTS-1 level regions. Table B4 in Appendix B shows results of these regressions. There is no significant effect of policy on the college degree attainment for men and women. The absence of such a spillover effect of the law shows that the sample used in the regressions does not leave out those who chose to go to college as a result of the law.

## 6.3 Policy Effect on Employment Status

The compulsory schooling policy could have an effect on the employment status of individuals. In this way, it could affect the selection of the sample. In order to evaluate this possible issue, I investigate the effects of compulsory schooling on the probability

of being employed, being a full-time employed, being a full-time wage worker, and being an employed wage worker for the sample. The OLS regressions are run for each dependent variable by controlling the policy dummy, age, year, and NUTS-1 level regions. Standard errors are clustered at the year of births level. Aydemir and Kırdar (2017) follow a similar strategy in their study. Table B5 (Appendix B) shows the policy effect on the labor force participation outcomes for women and men. There is no statistically significant evidence that policy has effects on the employment status, being a full-time wage worker, and being an employed wage worker for women. However, the policy has a positive significant effect on being full-time employed for women. The policy increases the probability of being full-time employed by 1.4 percentage points for the sample. According to the results in Table B5, the policy has a negative and significant effect on being employed for men. However, the estimated effect is nearly zero. Also, the schooling reform has no significant effect on probability of the being full-time employed, being a full-time wage worker, and being a wage worker for men.

Overall, these results show that the policy does not have significant effects on the probability of being a full-time wage worker for both women and men. In the analysis, the sample is restricted to individuals who are full-time employed wage-workers. Thus, this effect does not create a selection problem.

#### 6.4 Robustness Check

In order to see the sensitivity of the results to the measurement of the education-occupation mismatch, the dependent variables are replaced with three other dependent variables. Mismatch by OLS 1.5 years is generated by using the designed ISCO categories, the OLS estimation method, and a 1.5-year bandwidth instead of a 2-year

one. Details about the definition of mismatch by OLS 1.5 years are provided in Table A10 in Appendix A. From the results, we can obtain pairwise comparisons according to education-occupation mismatch measurement methods. Mismatch by mean is generated with the actual ISCO classification and the mean measurement method. With the actual ISCO classification and the mode measurement method, mismatch by mode is created. The results are shown in Table B6-B7 in Appendix B. These give a control for the results with the newly designed occupational categories compared to actual occupational categories in this thesis.

Using the alternative OLS measurement, mismatch OLS 1.5 years which narrows down the bandwidth to 1.5 years, the effect of the policy on the likelihood of being overeducated is positive and significant. The results show that the new law increased the likelihood of being overeducated by about 2% for an individual. Details can be seen from Table B8 in Appendix B. This result raises some concern about the new law imposing too much education on both men and women.

For both dependent variables constructed using the OLS measure, the policy has significant positive and negative effects on the likelihood of being adequately educated and undereducated, respectively. The probability of being undereducated decreases by 4% with the dependent variable *mismatch OLS 1.5 years* whereas policy decreases the likelihood of undereducation by 9% with the dependent variable *mismatch OLS 2 years*. (Table B3 and Table B8 in Appendix B). The 1.5-year bandwidth gives rise to higher numbers of overeducated and undereducated workers by definition, and this explains the changes in coefficients of undereducated, overeducated and adequately-educated. Also, being married increases the likelihood of being undereducated by 10% for the entire sample. In addition, the likelihood of an individual being undereducated decreases for

individuals who work in an organization that has a number of employees between 11 and 49, and more than 50 number of employees relative to who work in an organization has a number of employees less than 10.

As shown in Table B2 and Table B6 in Appendix B, the two dependent variables constructed using the mean measurement method, namely mismatch by mean, and mismatch by mean newisco, yield the result that the policy has no effect on the likelihood of being overeducated. In each model, eight years of compulsory schooling has significant negative and positive effects on the likelihood of being undereducated and adequately educated, respectively. In both models, policy decreases the likelihood of being undereducated for an individual by 3%. The results of the policy variable are significant and are consistent with each other. In addition, being married has significant effects on for the entire sample. In total, being married increases the likelihood of being undereducated by 5%. Also, the likelihood of an individual being undereducated decreases for individuals who work in an organization that has a number of employees between 11 and 49, and more than 50 number of employees relative to who work in an organization has a number of employees less than 10. According to results driven by mismatch by mean dependent variable, working in organizations has number of employees between 11-49 decreases the probability of being undereducated by 4% relative to the working in a firm which has less than 10 employees. Age variable has no significant effect on mismatch the status of individuals.

The mismatch variables constructed using the mode measurement method, mismatch by mode, and mismatch mode by newisco, show no evidence that the policy has an effect on the probability of overeducation. Table B3 and B7 in Appendix B present the details for the two models. In each model, the compulsory schooling reform

has significant positive and negative effects on the likelihood of being adequately educated and undereducated, respectively. In both models, policy increases the likelihood of being adequately educated for an individual by 4%. In overall sample, the age variable has no significant effect on the mismatch status of individuals for the regression with mismatch by mode. Also, being married has a negative and significant effect on the probability of being adequately educated by 6%. Working in a firm which hire employees more than 50 decreases the likelihood of being undereducated by 11% relative to working in a firm has less than 10 employees. In terms of all measurement methods, the results are significant and are consistent with each other.

## CHAPTER 7

### CONCLUSION

This thesis tries to find the impact of increasing compulsory education from five to eight years on the education-occupation mismatch in Turkey. The eight years of compulsory schooling reform was made in 1997, and enrollment rate in grades 6-8 almost doubled as a result of it. There was a significant increase in workers' education years which may or may not impact efficiency in terms of education-occupation mismatch. Using three different measurement methods to depict the education-occupation mismatch, consistent results are found that differ in magnitudes by the nature of the education-occupation mismatch definitions.

The empirical analysis finds that the schooling reform has a negligible effect on the likelihood of being overeducated for both women and men, except for one specification in which the measurement of mismatch yields a larger number of mismatched individuals. The likelihood of undereducation, on the other hand, is negatively affected by the policy for both women and men. Also, the compulsory schooling reform has a significant positive effect on the likelihood of being adequately educated for both women and men. It is observed that the effect of the policy on men is about twice that on women in using all three education-occupation mismatch measurements. However, the results are consistent across different education-occupation mismatch definitions.

Additionally, being married has a significant but nearly zero effect on the likelihood of being overeducated. However, being married increases the probability of being undereducated by 4-7%. The other empirical findings indicate that as the number

of employees at the workplace increases the likelihood of being adequately educated increases. This can be interpreted that as the size of the firm is larger, processes of recruitment are managed more professionally than small size firms, resulting in better matches.

This thesis contributes to the literature that estimates the impact of the compulsory schooling law on the education-occupation mismatch in a developing country. The main findings of this thesis support that the compulsory schooling reform contributed to the efficiency of human resource allocation in Turkey in terms of the education-occupation mismatch.

In April 2012, a new compulsory education law came into force in Turkey. The compulsory education duration was increased from eight to twelve years. With the twelve years of compulsory education, the diploma given at the end of grade 8 was canceled and changed with one given upon completing twelfth grade. Repeating the analysis in this thesis for the 2012 law when enough data accumulates would be enlightening in terms of seeing how much labor market efficiency was compromised or improved because of insufficient compulsory education. The 1997 law seems to have improved efficiency, but whether the 2012 law overshoot or not remains to be seen.

## APPENDIX A

### TABLES FOR DESCRIPTIVES

Table A1. The Cohorts Affected by the Law in the Sample

Year/Age	21	22	23	24	25	26	27	28	29	30	31	32
2006	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974
2007	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975
2008	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976
2009	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977
2010	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978
2011	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979
2012	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
2013	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
2014	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982
2015	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983
2016	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984
2017	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985
2018	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986

Note: Shaded cells are affected by the Compulsory Schooling Law of 1997

Table A2. Codes and Definitions of International Standard Classification of Occupations (ISCO 88) and (ISCO 08)

International Standard Classification of Occupations (ISCO 88)		International Standard Classification of Occupations (ISCO 08)	
Code	Description	Code	Description
11	Legislators and senior officials	11	Chief executives, senior officials and legislators
12	Corporate managers	12	Administrative and commercial managers
13	Managers of small enterprises	13	Production and specialised services managers
21	Physical, mathematical and engineering science professionals	14	Hospitality, retail and other services managers
22	Life science and health professionals	21	Science and engineering professionals
23	Teaching professionals	22	Health professionals
24	Other professionals	23	Teaching professionals
31	Physical and engineering science associate professionals	24	Business and administration professionals
32	Life science and health associate professionals	25	Information and communications technology professionals
33	Teaching associate professionals	26	Legal, social and cultural professionals
34	Other associate professionals	31	Science and engineering associate professionals
41	Office clerks	32	Health associate professionals
42	Customer services clerks	33	Business and administration associate professionals
51	Personal and protective services workers	34	Legal, social, cultural and related associate professionals
52	Models, salespersons and demonstrators	35	Information and communications technicians
61	Market-oriented Skilled agricultural and fishery workers	41	General and keyboard clerks
62	Subsistence agricultural and fishery workers	42	Customer services clerks
71	Extraction and building trades workers	43	Numerical and material recording clerks
72	Metal, machinery and related trades workers	44	Other clerical support workers
73	Precision, handcraft, craft printing and related trades workers	51	Personal service workers
74	Other craft and related trades workers	52	Sales workers
81	Stationary plant and related operators	53	Personal care workers
82	Machine operators and assemblers	54	Protective services workers
83	Drivers and mobile plant operators	61	Market-oriented skilled agricultural workers
91	Sales and services elementary occupations	62	Market-oriented skilled forestry, fishery and hunting workers
92	Agricultural, fishery and related labourers	63	Subsistence farmers, fishers, hunters and gatherers
93	Laborers in mining, construction, manufacturing and transport	71	Building and related trades workers, excluding electricians
		72	Metal, machinery and related trades workers
		73	Handicraft and printing workers
		74	Electrical and electronic trades workers
		75	Food processing, wood working, garment and other craft and related trades workers
		81	Stationary plant and machine operators
		82	Assemblers
		83	Drivers and mobile plant operators
		91	Cleaners and helpers
		92	Agricultural, forestry and fishery labourers
		93	Laborers in mining, construction, manufacturing and transport
		94	Food preparation assistants
		95	Street and related sales and service workers
		96	Refuse workers and other elementary workers

Table A3. Distributions According to ISCO-88 and ISCO-08 Classification for the Sample of Individuals Aged 21-32

Codes	ISCO-88 (%)			Codes	ISCO-08 (%)		
	Women	Men	Total		Women	Men	Total
11	0.06	0.07	0.07	11	0.17	0.27	0.24
12	1.38	1.22	1.26	12	0.6	0.56	0.57
13	1.23	6.25	4.78	13	0.44	1.21	0.96
21	1.29	1.26	1.27	14	0.55	1.63	1.29
22	1.44	0.6	0.85	21	2	2.03	2.02
23	9.37	2.8	4.72	22	3.83	0.81	1.77
24	2.23	2.13	2.16	23	11.12	2.64	5.35
31	1.73	2.47	2.25	24	1.69	2.13	1.99
32	4.3	0.67	1.73	25	0.24	0.41	0.35
33	0.6	0.04	0.2	26	2.01	1.1	1.39
34	4.36	3.77	3.94	31	0.74	2.54	1.96
41	11.13	4.53	6.46	32	1.94	0.64	1.06
42	4.78	1.83	2.69	33	3.54	2.46	2.8
51	4.37	9.11	7.72	34	0.97	0.88	0.91
52	6.58	7.77	7.42	35	0.18	0.48	0.39
61	19.22	7.68	11.06	41	4.9	1.59	2.64
62	2.17	0.5	0.99	42	3.67	1.41	2.13
71	0.09	6.12	4.36	43	4.54	3.01	3.5
72	0.31	7.14	5.14	44	1.15	0.65	0.81
73	2.84	0.9	1.47	51	3.75	5.68	5.06
74	2.85	5.37	4.63	52	11.32	10.63	10.85
81	0.1	1.28	0.93	53	2.88	0.28	1.11
82	4.37	6.43	5.83	54	0.96	4.88	3.63
83	0.04	5.61	3.98	61	14.73	7.03	9.49
91	4.03	5.87	5.33	62	0.01	0.14	0.1
92	6.72	2.48	3.72	63	0.37	0.09	0.18
93	2.39	6.11	5.02	71	0.07	6.08	4.16
				72	0.19	5.51	3.81
				73	2.55	0.96	1.47
				74	0.06	2.68	1.84
				75	2.3	4.25	3.63
				81	3.21	4.94	4.39
				82	0.19	0.98	0.73
				83	0.04	5.59	3.82
				91	2.76	2.25	2.41
				92	6.48	2.61	3.84
				93	2.76	6.29	5.16
				94	0.82	0.95	0.91
				95	0.13	0.46	0.35
				96	0.15	1.27	0.91

Note: Data from Turkish HLFS.

Table A4. Alternative of International Standard Classification of Occupations

Alternative of International Standard Classification of Occupations	
Code	Description
11	Chief executives, senior officials and legislators
12	Administrative and commercial managers
13	Managers of small enterprises
21	Science and engineering professionals
22	Health professionals
23	Teaching professionals and associate professionals
24	Other professionals
31	Science and engineering associate professionals
32	Health associate professionals
34	Other associate professionals
41	Office clerks
42	Customer services clerks
51	Personal and protective services workers
52	Sales workers
61	Market-oriented Skilled agricultural and fishery workers
62	Subsistence agricultural and fishery workers
71	Building and related trades workers, excluding electricians
72	Metal, machinery and related trades workers
73	Handicraft and printing workers
74	Other craft and related trades workers
81	Stationary plant and related operators
83	Drivers and mobile plant operators
91	Sales and services elementary occupations
92	Agricultural, forestry and fishery laborers
93	Laborers in mining, construction, manufacturing and transport

Table A5. Distribution of New Isco Codes for All Sample and a Restricted Sample of Aged 21-32

New Isco Code	Full time Employed and Wage-Workers			New Isco Code	All Employed		
	Women	Men	Total		Women	Men	Total
11	0.18%	0.22%	0.21%	11	0.12%	0.17%	0.16%
12	1.40%	1.03%	1.13%	12	0.95%	0.87%	0.90%
13	0.81%	1.13%	1.04%	13	1.10%	4.47%	3.44%
21	2.38%	1.96%	2.08%	21	1.69%	1.66%	1.67%
22	3.94%	0.81%	1.67%	22	2.76%	0.71%	1.34%
23	13.58%	3.16%	6.04%	23	10.60%	2.74%	5.15%
24	4.01%	3.38%	3.55%	24	3.17%	2.92%	3.00%
31	1.78%	3.20%	2.81%	31	1.18%	2.51%	2.10%
32	4.55%	0.85%	1.87%	32	3.00%	0.66%	1.37%
34	6.43%	4.20%	4.81%	34	4.54%	3.80%	4.03%
41	15.14%	5.85%	8.42%	41	10.19%	4.56%	6.29%
42	7.13%	2.42%	3.72%	42	4.80%	1.95%	2.82%
51	7.74%	11.90%	10.75%	51	6.14%	10.01%	8.82%
52	10.74%	8.52%	9.13%	52	9.20%	9.26%	9.24%
61	0.24%	0.77%	0.63%	61	16.75%	7.41%	10.28%
71	0.10%	6.61%	4.81%	62	1.18%	0.29%	0.56%
72	0.40%	8.62%	6.35%	71	0.08%	6.10%	4.25%
73	0.61%	1.07%	0.94%	72	0.28%	7.69%	5.41%
74	3.22%	5.44%	4.83%	73	2.68%	0.93%	1.47%
81	5.69%	8.55%	7.76%	74	2.55%	4.79%	4.10%
83	0.05%	5.78%	4.20%	81	3.88%	6.78%	5.89%
91	4.12%	5.65%	5.23%	83	0.04%	5.60%	3.90%
92	2.10%	1.26%	1.49%	91	3.93%	5.38%	4.94%
93	3.66%	7.64%	6.54%	92	6.59%	2.55%	3.79%
				93	2.59%	6.20%	5.10%
Number of Observations	116,353	304,752	421,105	Number of Observations	178,693	403,867	582,560

Note: Data from Turkish HLFS.

Table A6. Distribution of Mismatch Status According to Mean Measurement Method

New ISCO Codes and Definitions	Overeducated	Undereducated	Adequately Educated	Number of Observations
11) Chief executives, senior officials and legislators	0%	19%	81%	873
12) Administrative and commercial managers	0%	21%	79%	4757
13) Managers of small enterprises	10%	17%	73%	4400
21) Science and engineering professionals	0%	3%	97%	8740
22) Health professionals	0%	10%	90%	7049
23) Teaching professionals and associate professionals	0%	3%	97%	25430
24) Other professionals	0%	18%	82%	14965
31) Science and engineering associate professionals	6%	12%	81%	11832
32) Health associate professionals	0%	13%	87%	7871
34) Other associate professionals	7%	11%	82%	20271
41) Office clerks	17%	12%	71%	35437
42) Customer services clerks	4%	22%	73%	15657
51) Personal and protective services workers	19%	19%	62%	45271
52) Sales workers	19%	17%	64%	38462
61) Market-oriented Skilled agricultural and fishery workers	19%	14%	68%	2635
71) Building and related trades workers, excluding electricians	22%	8%	71%	20245
72) Metal, machinery and related trades workers	9%	16%	74%	26723
73) Handicraft and printing workers	11%	16%	73%	3963
74) Other craft and related trades workers	18%	9%	74%	20329
81) Stationary plant and related operators	18%	10%	72%	32686
83) Drivers and mobile plant operators	14%	20%	65%	17670
91) Sales and services elementary occupations	18%	10%	72%	22023
92) Agricultural, forestry and fishery laborers	14%	26%	60%	6271
93) Laborers in mining, construction, manufacturing and transport	19%	9%	72%	27545
Number of Observations	55206	55423	310476	421105

Table A7. Distribution of Mismatch Status According to Mode Measurement Method

New ISCO Codes and Definitions	Overeducated	Undereducated	Adequately Educated	Number of Observations
11) Chief executives, senior officials and legislators	0%	28%	72%	873
12) Administrative and commercial managers	0%	25%	75%	4757
13) Managers of small enterprises	10%	34%	56%	4400
21) Science and engineering professionals	0%	3%	97%	8740
22) Health professionals	0%	10%	90%	7049
23) Teaching professionals and associate professionals	0%	3%	97%	25430
24) Other professionals	0%	21%	79%	14965
31) Science and engineering associate professionals	6%	44%	50%	11832
32) Health associate professionals	12%	35%	53%	7871
34) Other associate professionals	7%	42%	51%	20271
41) Office clerks	20%	28%	52%	35437
42) Customer services clerks	4%	42%	54%	15657
51) Personal and protective services workers	19%	43%	38%	45271
52) Sales workers	19%	35%	46%	38462
61) Market-oriented Skilled agricultural and fishery workers	29%	24%	47%	2635
71) Building and related trades workers, excluding electricians	37%	17%	46%	20245
72) Metal, machinery and related trades workers	32%	29%	39%	26723
73) Handicraft and printing workers	43%	18%	39%	3963
74) Other craft and related trades workers	38%	17%	45%	20329
81) Stationary plant and related operators	41%	19%	40%	32686
83) Drivers and mobile plant operators	35%	24%	41%	17670
91) Sales and services elementary occupations	43%	16%	42%	22023
92) Agricultural, forestry and fishery laborers	22%	34%	44%	6271
93) Laborers in mining, construction, manufacturing and transport	41%	18%	41%	27545
Number of Observations	95139	110531	215435	421105

Table A8. Coefficients Calculated from the OLS Estimation

New Isco Codes	Coefficients	Standard Errors	Survey Year	Coefficients	Year of Birth	Coefficients
11	13.95	0.12	2006	-0.725	1974	-0.733
12	14.57	0.08	2007	-0.664	1975	-0.726
13	12.75	0.08	2008	-0.587	1976	-0.642
21	15.27	0.08	2009	-0.574	1977	-0.602
22	14.95	0.08	2010	-0.560	1978	-0.481
23	15.40	0.07	2011	-0.495	1979	-0.409
24	14.50	0.08	2012	-0.402	1980	-0.337
31	12.90	0.08	2013	-0.303	1981	-0.375
32	13.50	0.08	2014	-0.295	1982	-0.322
34	13.05	0.07	2015	-0.169	1983	-0.278
41	12.75	0.07	2016	-0.097	1984	-0.274
42	13.34	0.08	2017	-0.027	1985	-0.273
51	10.21	0.07	2018	0	1986	-0.127
52	10.69	0.07			1987	0.116
61	7.05	0.09			1988	0.252
71	7.80	0.07			1989	0.348
72	9.37	0.07			1990	0.456
73	8.78	0.09			1991	0.293
74	7.88	0.07			1992	0.174
81	8.54	0.07			1993	0.218
83	8.95	0.07			1994	0.161
91	8.30	0.07			1995	0.124
92	5.88	0.08			1996	0.132
93	8.08	0.07			1997	0

Note: These coefficients are calculated by regressing actual years of schooling on each occupation dummy variables, year of births, and survey years without constant term. 2018 and 1997 are taken as reference categories.

Table A9. Distribution of Mismatch Status According to OLS Estimation Method with 2 Years Bandwidth

New ISCO Codes and Definitions	Overeducated	Undereducated	Adequately Educated	Number of Observations
11) Chief executives, senior officials and legislators	7%	26%	67%	873
12) Administrative and commercial managers	0%	25%	75%	4757
13) Managers of small enterprises	45%	19%	37%	4400
21) Science and engineering professionals	0%	3%	97%	8740
22) Health professionals	0%	10%	90%	7049
23) Teaching professionals and associate professionals	0%	3%	97%	25430
24) Other professionals	0%	21%	79%	14965
31) Science and engineering associate professionals	39%	18%	43%	11832
32) Health associate professionals	33%	21%	46%	7871
34) Other associate professionals	35%	20%	45%	20271
41) Office clerks	39%	14%	47%	35437
42) Customer services clerks	30%	22%	48%	15657
51) Personal and protective services workers	21%	31%	48%	45271
52) Sales workers	19%	29%	52%	38462
61) Market-oriented Skilled agricultural and fishery workers	20%	16%	64%	2635
71) Building and related trades workers, excluding electricians	24%	21%	55%	20245
72) Metal, machinery and related trades workers	30%	25%	45%	26723
73) Handicraft and printing workers	35%	30%	35%	3963
74) Other craft and related trades workers	25%	24%	51%	20329
81) Stationary plant and related operators	35%	35%	30%	32686
83) Drivers and mobile plant operators	30%	27%	42%	17670
91) Sales and services elementary occupations	31%	34%	35%	22023
92) Agricultural, forestry and fishery laborers	29%	26%	44%	6271
93) Laborers in mining, construction, manufacturing and transport	31%	33%	37%	27545
Number of Observations	105733	100167	215205	421105

Table A10. Distribution of Mismatch Status According to OLS Estimation Method with 1.5 Years Bandwidth

New ISCO Codes and Definitions	Overeducated	Undereducated	Adequately Educated	Number of Observations
11) Chief executives, senior officials and legislators	35%	28%	37%	873
12) Administrative and commercial managers	12%	25%	63%	4757
13) Managers of small enterprises	51%	26%	23%	4400
21) Science and engineering professionals	0%	3%	97%	8740
22) Health professionals	1%	10%	89%	7049
23) Teaching professionals and associate professionals	0%	3%	97%	25430
24) Other professionals	8%	21%	71%	14965
31) Science and engineering associate professionals	49%	26%	25%	11832
32) Health associate professionals	41%	38%	21%	7871
34) Other associate professionals	50%	27%	23%	20271
41) Office clerks	43%	25%	32%	35437
42) Customer services clerks	47%	32%	21%	15657
51) Personal and protective services workers	34%	37%	29%	45271
52) Sales workers	21%	34%	45%	38462
61) Market-oriented Skilled agricultural and fishery workers	26%	20%	54%	2635
71) Building and related trades workers, excluding electricians	25%	38%	37%	20245
72) Metal, machinery and related trades workers	40%	31%	29%	26723
73) Handicraft and printing workers	37%	30%	33%	3963
74) Other craft and related trades workers	26%	41%	33%	20329
81) Stationary plant and related operators	35%	35%	30%	32686
83) Drivers and mobile plant operators	37%	27%	35%	17670
91) Sales and services elementary occupations	31%	36%	32%	22023
92) Agricultural, forestry and fishery laborers	35%	26%	38%	6271
93) Laborers in mining, construction, manufacturing and transport	31%	37%	32%	27545
Number of Observations	127980	125141	167984	421105

Table A11. Distribution of Mismatch Status According to Mean and Mode Estimation

Methods

(%)	Mismatch by mean	Mismatch by mode	Mismatch by mean new isco	Mismatch by mode newisco
Overeducated	12.56	22.45	13.11	22.59
Undereducated	13.35	25.82	13.16	26.25
Adequately Educated	74.09	51.74	73.73	51.16
Number of Observations	421105	421105	421105	421105

Note: Sample is restricted to the age between 21 and 32 in the 2006-18 Turkish HLFS. The results are obtained from mean and mode level measurement methods for original occupational categories and newly designed occupational categories.

Table A12. Ratio of the Dependent Variables Across the Years for All Sample

Dependent Variables/Year	Total												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mismatch by mean newisco													
Overeducated	18%	21%	19%	17%	16%	15%	10%	9%	8%	9%	10%	10%	10%
Undereducated	11%	12%	13%	15%	14%	14%	14%	13%	12%	13%	12%	14%	14%
Adequately Educated	71%	67%	68%	68%	70%	71%	77%	78%	79%	77%	78%	76%	76%
Mismatch by mode newisco													
Overeducated	30%	33%	30%	27%	25%	23%	20%	17%	16%	17%	19%	20%	20%
Undereducated	18%	15%	18%	25%	26%	31%	31%	34%	34%	31%	26%	24%	23%
Adequately Educated	52%	53%	51%	49%	48%	46%	48%	49%	51%	52%	54%	56%	57%
Mismatch by OLS 2 years													
Overeducated	25%	25%	26%	26%	26%	27%	27%	27%	26%	25%	23%	22%	21%
Undereducated	25%	25%	26%	25%	25%	25%	25%	24%	24%	23%	22%	21%	21%
Adequately Educated	49%	50%	48%	49%	49%	49%	49%	49%	50%	52%	55%	58%	58%
Mismatch by mean													
Overeducated	17%	20%	19%	17%	16%	15%	12%	9%	9%	7%	8%	8%	8%
Undereducated	11%	12%	13%	15%	14%	15%	15%	13%	12%	13%	12%	14%	14%
Adequately Educated	71%	67%	68%	68%	70%	71%	73%	77%	79%	80%	81%	78%	78%
Mismatch by mode													
Overeducated	29%	32%	29%	26%	25%	23%	21%	19%	19%	16%	17%	18%	19%
Undereducated	19%	15%	19%	25%	27%	31%	29%	31%	30%	31%	27%	25%	23%
Adequately Educated	53%	53%	52%	49%	48%	46%	49%	50%	52%	53%	55%	57%	58%
Mismatch by OLS 1.5 years													
Overeducated	31%	31%	31%	30%	30%	31%	30%	30%	30%	31%	31%	30%	30%
Undereducated	35%	34%	33%	32%	32%	31%	29%	29%	28%	28%	26%	26%	25%
Adequately Educated	34%	35%	36%	38%	38%	38%	40%	41%	42%	42%	43%	44%	46%

Note: This table constructed using the mean, mode and OLS estimation measurement methods with the actual and newly designed occupation groups for entire sample.

Table A13. Ratio of the Dependent Variables Across the Years for Women

	Women												
Dependent Variables/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mismatch by mean newisco													
Overeducated	16%	20%	17%	13%	14%	15%	7%	6%	6%	7%	7%	9%	9%
Undereducated	10%	11%	11%	10%	10%	13%	12%	11%	10%	12%	12%	14%	13%
Adequately Educated	74%	69%	72%	76%	76%	72%	81%	83%	84%	80%	81%	77%	77%
Mismatch by mode newisco													
Overeducated	24%	27%	20%	17%	18%	18%	16%	11%	10%	11%	11%	13%	13%
Undereducated	16%	13%	19%	25%	22%	25%	26%	29%	30%	28%	25%	22%	21%
Adequately Educated	60%	60%	60%	57%	60%	56%	59%	60%	60%	61%	64%	64%	66%
Mismatch by OLS 2 years													
Overeducated	25%	24%	25%	26%	26%	27%	25%	25%	25%	23%	21%	21%	19%
Undereducated	19%	19%	20%	19%	20%	20%	20%	20%	20%	20%	19%	18%	18%
Adequately Educated	56%	56%	55%	55%	54%	52%	55%	55%	55%	57%	60%	61%	63%
Mismatch by mean													
Overeducated	16%	20%	17%	13%	14%	15%	11%	7%	6%	7%	6%	8%	9%
Undereducated	10%	11%	11%	10%	10%	13%	11%	10%	10%	11%	10%	12%	12%
Adequately Educated	74%	69%	72%	76%	76%	72%	78%	84%	84%	83%	84%	79%	79%
Mismatch by mode													
Overeducated	24%	27%	20%	17%	18%	18%	17%	12%	11%	12%	12%	14%	14%
Undereducated	16%	13%	19%	25%	22%	25%	25%	28%	28%	27%	25%	22%	20%
Adequately Educated	60%	60%	60%	57%	60%	56%	58%	60%	60%	61%	64%	65%	66%
Mismatch by OLS 1.5 years													
Overeducated	31%	29%	29%	29%	29%	30%	28%	29%	29%	30%	30%	31%	29%
Undereducated	25%	25%	25%	25%	27%	28%	26%	25%	26%	25%	24%	22%	21%
Adequately Educated	44%	46%	47%	46%	45%	42%	46%	45%	45%	44%	46%	47%	51%

Note: This table constructed using the mean, mode and OLS estimation measurement methods with the actual and newly designed occupation groups for entire sample.

Table A14. Ratio of the Dependent Variables Across the Years for Men

Dependent Variables/Year	Men												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mismatch by mean newisco													
Overeducated	18%	21%	20%	19%	17%	15%	11%	10%	9%	10%	11%	10%	11%
Undereducated	11%	12%	13%	16%	15%	15%	15%	14%	13%	14%	12%	15%	14%
Adequately Educated	70%	67%	67%	65%	67%	71%	75%	77%	78%	76%	77%	75%	75%
Mismatch by mode newisco													
Overeducated	32%	35%	34%	30%	28%	24%	22%	19%	18%	19%	23%	23%	24%
Undereducated	18%	15%	18%	25%	28%	33%	34%	37%	35%	33%	27%	25%	24%
Adequately Educated	50%	50%	48%	45%	44%	43%	45%	45%	47%	48%	50%	52%	52%
Mismatch by OLS 2 years													
Overeducated	25%	26%	27%	26%	26%	27%	27%	27%	26%	26%	24%	22%	22%
Undereducated	27%	27%	28%	27%	26%	26%	26%	26%	25%	24%	23%	22%	22%
Adequately Educated	47%	48%	46%	47%	48%	47%	46%	47%	48%	50%	53%	56%	57%
Mismatch by mean													
Overeducated	18%	21%	19%	18%	17%	15%	13%	10%	9%	8%	8%	7%	7%
Undereducated	12%	13%	14%	17%	16%	15%	16%	14%	13%	14%	12%	15%	15%
Adequately Educated	71%	67%	67%	65%	68%	70%	71%	75%	77%	78%	80%	78%	78%
Mismatch by mode													
Overeducated	31%	34%	33%	29%	27%	24%	23%	22%	21%	18%	20%	20%	21%
Undereducated	20%	16%	19%	25%	29%	33%	31%	32%	30%	32%	29%	26%	25%
Adequately Educated	50%	50%	49%	46%	44%	43%	46%	46%	48%	50%	52%	54%	54%
Mismatch by OLS 1.5 years													
Overeducated	31%	32%	31%	31%	30%	31%	31%	30%	30%	31%	31%	30%	30%
Undereducated	38%	37%	36%	35%	34%	32%	30%	31%	29%	28%	27%	27%	26%
Adequately Educated	31%	32%	33%	34%	36%	37%	38%	39%	41%	40%	42%	43%	43%

Note: This table constructed using the mean, mode and OLS estimation measurement methods with the actual and newly designed occupation groups for entire sample.

Table A15. Demographic Characteristics of Individuals by Years in the Sample

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mean of Age	26.81	26.85	26.88	27.02	27.05	27.01	27.07	27.04	26.97	26.95	26.99	27.02	27.02
Gender													
Men	0.75	0.74	0.74	0.73	0.74	0.74	0.72	0.72	0.72	0.71	0.71	0.70	0.69
Women	0.25	0.26	0.26	0.27	0.26	0.26	0.28	0.28	0.28	0.29	0.29	0.30	0.31
Marital Status													
Married	0.56	0.55	0.55	0.55	0.53	0.52	0.51	0.49	0.49	0.48	0.48	0.47	0.47
Formality													
Formal	0.73	0.76	0.79	0.78	0.79	0.80	0.84	0.86	0.86	0.87	0.88	0.88	0.88
Informal	0.27	0.24	0.21	0.22	0.21	0.20	0.16	0.14	0.14	0.13	0.12	0.12	0.12
Educational Attainment													
Illiterate	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Literate with No Diploma	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03
Primary School	0.30	0.29	0.26	0.24	0.21	0.18	0.15	0.12	0.11	0.09	0.07	0.05	0.03
Secondary School	0.13	0.13	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.24	0.25	0.26	0.26
High School	0.33	0.33	0.33	0.33	0.32	0.32	0.31	0.30	0.29	0.28	0.28	0.27	0.27
College and Above	0.21	0.23	0.24	0.26	0.26	0.27	0.30	0.32	0.32	0.35	0.37	0.39	0.40
Policy													
Affected	0.00	0.04	0.11	0.18	0.26	0.35	0.43	0.53	0.62	0.72	0.81	0.90	1.00
Unaffected	1.00	0.96	0.89	0.82	0.74	0.65	0.57	0.47	0.38	0.28	0.19	0.10	0.00
Number of Observations	30,378	30,226	30,617	30,974	33,538	35,138	34,955	34,530	33,495	32,977	31,852	31,465	30,960

Note: Data from 2006 - 2018 Turkish HLFS. The sample contains individuals who are age between 21 and 32. The data is restricted to only full-time wage worker.

## APPENDIX B

### TABLES FOR REGRESSION RESULTS AND ROBUSTNESS CHECK

Table B1. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by OLS 2 Years Dependent Variable

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by OLS 2 years									
Policy	-0.00274*** (0.000507)	-0.0893*** (0.00954)	0.0920*** (0.00984)	-0.000678*** (0.000124)	-0.0356** (0.0118)	0.0363** (0.0118)	-0.00401*** (0.00120)	-0.105*** (0.00999)	0.109*** (0.0108)
Number of Employee									
Between 11-49	0.00552*** (0.000656)	-0.0638*** (0.0118)	0.0583*** (0.0113)	0.000684*** (0.0000650)	-0.0753*** (0.0151)	0.0746*** (0.0151)	0.0130*** (0.00181)	-0.0665*** (0.0104)	0.0535*** (0.00895)
More Than 50	0.0161*** (0.00102)	-0.0991*** (0.00611)	0.0831*** (0.00582)	0.00125*** (0.000113)	-0.109*** (0.00862)	0.108*** (0.00858)	0.0429*** (0.00233)	-0.110*** (0.00471)	0.0667*** (0.00462)
Age	0.000814*** (0.000118)	0.000390 (0.00100)	-0.00120 (0.000912)	0.0000527** (0.0000160)	0.000671 (0.00125)	-0.000724 (0.00124)	0.00223*** (0.000301)	-0.000258 (0.00104)	-0.00197* (0.000809)
Married	-0.00999*** (0.000552)	0.0789*** (0.00535)	-0.0689*** (0.00547)	-0.000892*** (0.0000934)	0.0326*** (0.00641)	-0.0317*** (0.00638)	-0.0262*** (0.00141)	0.0982*** (0.00543)	-0.0720*** (0.00586)
Female	0.00110* (0.000474)	0.00458 (0.00756)	-0.00567 (0.00718)						
Pseudo R2	0.107	0.107	0.107	0.172	0.172	0.172	0.088	0.088	0.088
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

Table B2. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mean Newisco Dependent Variable

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by mean newisco									
Policy	0.000676*** (0.000205)	-0.0319*** (0.00843)	0.0312*** (0.00837)	0.0000355 (0.0000415)	-0.0104 (0.00718)	0.0104 (0.00717)	0.00207*** (0.000528)	-0.0383*** (0.00920)	0.0363*** (0.00918)
Number of Employee									
Between 11-49	0.00200*** (0.000303)	-0.0494*** (0.00686)	0.0474*** (0.00670)	0.000215*** (0.0000266)	-0.0510*** (0.00958)	0.0508*** (0.00957)	0.00445*** (0.000806)	-0.0510*** (0.00611)	0.0465*** (0.00562)
More Than 50	0.00668*** (0.000450)	-0.0818*** (0.00299)	0.0752*** (0.00291)	0.000457*** (0.0000407)	-0.0835*** (0.00355)	0.0830*** (0.00354)	0.0169*** (0.00106)	-0.0841*** (0.00375)	0.0672*** (0.00363)
Age	0.000134** (0.0000515)	0.000886 (0.000728)	-0.00102 (0.000700)	-0.00000534 (0.00000624)	0.00123 (0.000723)	-0.00122 (0.000721)	0.000467** (0.000155)	0.000450 (0.000876)	-0.000917 (0.000819)
Married	-0.00469*** (0.000325)	0.0487*** (0.00360)	-0.0440*** (0.00374)	-0.000387*** (0.0000388)	0.0169** (0.00527)	-0.0165** (0.00526)	-0.0111*** (0.000878)	0.0626*** (0.00382)	-0.0515*** (0.00411)
Female	0.0000307 (0.000239)	-0.0112 (0.00848)	0.0112 (0.00831)						
Pseudo R2	0.087	0.087	0.087	0.128	0.128	0.128	0.078	0.078	0.078
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

Table B3. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mode Newisco Dependent Variable

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by mode newisco									
Policy	0.00338*** (0.000279)	-0.0412*** (0.00831)	0.0378*** (0.00836)	0.000248*** (0.0000556)	-0.0268** (0.00894)	0.0265** (0.00891)	0.0116*** (0.00104)	-0.0464*** (0.00868)	0.0349*** (0.00912)
Number of Employee									
Between 11-49	0.00306*** (0.000451)	-0.0825*** (0.00910)	0.0794*** (0.00876)	0.000367*** (0.0000370)	-0.0940*** (0.0108)	0.0937*** (0.0108)	0.00975*** (0.00163)	-0.0832*** (0.00905)	0.0734*** (0.00772)
More Than 50	0.0105*** (0.000601)	-0.124*** (0.00731)	0.114*** (0.00710)	0.000901*** (0.0000794)	-0.128*** (0.00652)	0.127*** (0.00650)	0.0356*** (0.00170)	-0.134*** (0.00776)	0.0983*** (0.00699)
Age	0.0000239 (0.0000826)	-0.00262** (0.000889)	0.00259** (0.000831)	-0.0000172 (0.0000109)	-0.00106 (0.00107)	0.00108 (0.00107)	0.000273 (0.000285)	-0.00366*** (0.000849)	0.00339*** (0.000724)
Married	-0.00654*** (0.000399)	0.0722*** (0.00522)	-0.0656*** (0.00527)	-0.000565*** (0.0000586)	0.0378*** (0.00686)	-0.0373*** (0.00684)	-0.0217*** (0.00142)	0.0914*** (0.00536)	-0.0697*** (0.00535)
Female	-0.00113** (0.000430)	-0.0519*** (0.00865)	0.0530*** (0.00834)						
Pseudo R2	0.141	0.141	0.141	0.159	0.159	0.159	0.132	0.132	0.132
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

Table B4. Policy Effect on College Degree Attainment

College Degree	Women	Men	Total
Policy	0.00458 (0.00799)	0.00980 (0.00643)	0.00806 (0.00578)
Number of Employee	0.109*** (0.00322)	0.0913*** (0.00273)	0.101*** (0.00286)
Occupations	-0.116*** (0.00118)	-0.0756*** (0.00160)	-0.0899*** (0.00159)
Marital Status	-0.0730*** (0.00969)	-0.101*** (0.00383)	-0.0945*** (0.00387)
Age	0.00764*** (0.00169)	0.00935*** (0.00114)	0.00782*** (0.00124)
Year	0.0128*** (0.00124)	0.00992*** (0.000941)	0.0114*** (0.000903)
Nuts-1	- 0.00460*** (0.000563)	0.000921* (0.000382)	-0.000973* (0.000411)
Constant	-25.06*** (2.492)	-19.69*** (1.871)	-22.45*** (1.803)
N	178693	403867	582560

Notes: \*\*\*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively. The dependent variable is the attainment of college degree. Sample is restricted to the age group 21–32 in the 2006-18 Turkish HLFS. The values in parentheses are standard errors, clustered at year of birth level.

Table B5. Policy Effects on Employment Outcomes

Dependent Variables	Women	Men
1) Employment	0.003 (0.004)	-0.005** (0.002)
2) Full-time Employment	0.014** (0.006)	-0.004 (0.003)
3) Full-time Wage Worker	0.008 (0.009)	-0.003 (0.006)
4) Employed Wage Worker	0.002 (0.008)	-0.004 (0.004)
Number of Observations	218,876	463,921

Notes: \*\*\*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively. The dependent variables are employment status, fulltime employment, fulltime wage worker, employed wage worker. Sample is restricted to the age 21–32 in the 2006-18 Turkish HLFS. The values in parentheses are standard errors, clustered at year of birth level.

Table B6. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mean Dependent Variable with Actual ISCO Codes

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by mean									
Policy	0.000239 (0.000159)	-0.0264*** (0.00792)	0.0261*** (0.00780)	-0.0000326 (0.0000508)	0.00202 (0.00625)	-0.00199 (0.00624)	0.00108* (0.000443)	-0.0354*** (0.00853)	0.0344*** (0.00828)
Number of Employee									
Between 11-49	0.00144*** (0.000258)	-0.0441*** (0.00646)	0.0426*** (0.00631)	0.000270*** (0.0000341)	-0.0411*** (0.00877)	0.0408*** (0.00877)	0.00327*** (0.000761)	-0.0478*** (0.00602)	0.0446*** (0.00558)
More Than 50	0.00457*** (0.000275)	-0.0757*** (0.00276)	0.0711*** (0.00267)	0.000549*** (0.0000572)	-0.0694*** (0.00351)	0.0688*** (0.00350)	0.0119*** (0.000580)	-0.0813*** (0.00351)	0.0694*** (0.00331)
Age	0.0000724 (0.0000438)	0.000224 (0.000827)	-0.000296 (0.000803)	-0.0000129 (0.00000973)	-0.000172 (0.000733)	0.000185 (0.000731)	0.000340* (0.000146)	0.000210 (0.00101)	-0.000551 (0.000952)
Married	-0.00503*** (0.000299)	0.0471*** (0.00384)	-0.0421*** (0.00388)	-0.000590*** (0.0000624)	0.0105 (0.00556)	-0.00989 (0.00555)	-0.0127*** (0.000857)	0.0627*** (0.00389)	-0.0500*** (0.00388)
Female	0.000683** (0.000228)	-0.0240** (0.00807)	0.0234** (0.00791)						
Pseudo R2	0.082	0.082	0.082	0.118	0.118	0.118	0.075	0.075	0.075
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

Table B7: The Effect of Policy on Likelihood of Mismatch Status with Mismatch by Mode Dependent Variable with Actual ISCO Codes

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by mode									
Policy	0.00303*** (0.000262)	-0.0433*** (0.00822)	0.0403*** (0.00817)	0.000221*** (0.0000489)	-0.0259** (0.00928)	0.0257** (0.00925)	0.0100*** (0.00104)	-0.0502*** (0.00830)	0.0402*** (0.00826)
Number of Employee									
Between 11-49	0.00279*** (0.000437)	-0.0731*** (0.00780)	0.0703*** (0.00751)	0.000309*** (0.0000389)	-0.0891*** (0.0107)	0.0888*** (0.0107)	0.00879*** (0.00149)	-0.0713*** (0.00760)	0.0625*** (0.00658)
More Than 50	0.00859*** (0.000451)	-0.112*** (0.00769)	0.103*** (0.00768)	0.000768*** (0.0000797)	-0.121*** (0.00713)	0.120*** (0.00713)	0.0276*** (0.00105)	-0.117*** (0.00800)	0.0895*** (0.00791)
Age	-0.0000732 (0.0000852)	0.0000469 (0.000706)	0.0000263 (0.000642)	-0.0000227* (0.0000113)	-0.000418 (0.00104)	0.000441 (0.00103)	-0.0000317 (0.000283)	-0.000115 (0.000593)	0.000147 (0.000469)
Married	-0.00723*** (0.000440)	0.0643*** (0.00433)	-0.0571*** (0.00424)	-0.000553*** (0.0000622)	0.0348*** (0.00604)	-0.0342*** (0.00601)	-0.0234*** (0.00155)	0.0808*** (0.00492)	-0.0573*** (0.00422)
Female	-0.000360 (0.000432)	-0.0478*** (0.00876)	0.0482*** (0.00847)						
Pseudo R2	0.127	0.127	0.127	0.155	0.155	0.155	0.116	0.116	0.116
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

Table B8. The Effect of Policy on Likelihood of Mismatch Status with Mismatch by OLS 1.5 Years Dependent Variable

Dependent Variable	Total			Women			Men		
	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education	Overeducation	Undereducation	Adequately Education
Mismatch by OLS 1.5years									
Policy	0.0180*** (0.00313)	-0.0368*** (0.00661)	0.0188* (0.00784)	0.0239** (0.00818)	0.0170 (0.00928)	-0.0409** (0.0143)	0.0188*** (0.00371)	-0.0562*** (0.00637)	0.0374*** (0.00773)
Number of Employee									
Between 11-49	0.0675*** (0.00500)	-0.0841*** (0.0102)	0.0166* (0.00660)	0.0553*** (0.00394)	-0.0964*** (0.0101)	0.0411*** (0.0111)	0.0720*** (0.00673)	-0.0871*** (0.0103)	0.0151** (0.00512)
More Than 50	0.162*** (0.00702)	-0.139*** (0.00660)	-0.0234*** (0.00410)	0.0966*** (0.00881)	-0.132*** (0.00968)	0.0349*** (0.00919)	0.187*** (0.00736)	-0.156*** (0.00530)	-0.0315*** (0.00391)
Age	0.00961*** (0.00107)	0.000734 (0.00118)	-0.0103*** (0.000483)	0.00733*** (0.00170)	-0.000254 (0.00133)	-0.00708*** (0.00132)	0.0105*** (0.00117)	0.000732 (0.00130)	-0.0112*** (0.000592)
Married	-0.0922*** (0.00388)	0.100*** (0.00482)	-0.00821 (0.00562)	-0.0681*** (0.00425)	0.0491*** (0.00704)	0.0190* (0.00882)	-0.107*** (0.00465)	0.118*** (0.00563)	-0.0110* (0.00557)
Female	-0.000965 (0.00497)	-0.00416 (0.00759)	0.00513 (0.00515)						
Pseudo R2	0.114	0.114	0.114	0.196	0.196	0.196	0.09	0.09	0.09
N	421105	421105	421105	116353	116353	116353	304752	304752	304752

Note: The sample is restricted to individuals age between 21 and 32 who are full-time employed wage workers in the 2006-2018 Turkish Household Labor Force Surveys. The main occupational categories, survey years, and NUTS-1 level regions are also controlled through the estimation of marginal effects. The first row in each segment corresponds to the marginal effect of the control variables. The values in parentheses are standard errors. \*, \*\*, and \* refer to 1%, 5%, and 10% significance levels, respectively.

## APPENDIX C

### DESCRIPTION OF VARIABLES

Schooling Years: The Turkish HLF survey data does not contain information about the exact years of education. It answers the highest completed educational degree. In the survey data, the educational degree is categorized as less than middle school, middle school, secondary school, vocational high school, general high school, 2-years or 4-years college degree, master's or doctoral degree. Master's and doctoral degree share nearly 4% of the population, thus this group involved in 2-years or 4-years college degree group. General and vocational high school graduates are grouped as high school graduates. Less than middle school and literates are combined and called literate with no diploma. The schooling years for each educational degree are determined by the usual years of schooling. The years of schooling variable is generated as 0 years for illiterates, 1 year for literate with no diploma, 5 years for primary school graduates, 8 years for secondary school graduates, 11 years for high school graduates, 15 years for college graduates.

Required Schooling: It is the years of schooling for an individual to work in an occupation.

Year of birth: Year of birth is calculated by subtracting the age from the survey year.

Marital status: Marital status is defined as a dummy variable that takes 1 if an individual is married and 0 otherwise.

Number of Employees: Number of Employees indicates that the number of employees in the institutions and organizations. The number of employees described

into three categories: less than 10 workers as group 1, between 11 and 49 workers as group 2, and more than 50 workers as group 3.

Main occupational categories: Occupations are classified according to the International Standard Classification of Occupation within two-digit codes in the data. The occupation is collected into 9 major groups: managers, professionals, technicians and associate professionals, clerical support workers, service and sales workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators, and assemblers, and elementary occupations.

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