KADİR HAS UNIVERSITY
SCHOOL OF GRADUATE STUDIES
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LABOR MARKET OUTCOMES OF MINIMUM WAGE INCREASES: A CASE STUDY

ENES IŞIK

SUPERVISOR: PROF.DR. ÖZGÜR ORHANGAZİ

MASTER'S THESIS

İSTANBUL, MAY, 2019

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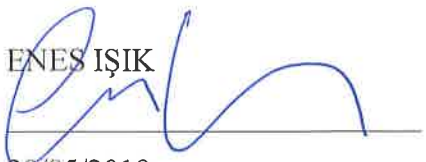
Submitted to the School of Graduate Studies of Kadir Has University in partial fulfillment of the requirements for the degree of Master's in the Discipline Area of Economics under the Program of Economics.

İSTANBUL, MAY, 2019

I, ENES IŞIK;

Hereby declare that this Master's Thesis is my own original work and that due references have been appropriately provided on all supporting literature and resources.



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ACCEPTANCE AND APPROVAL

This work entitled **LABOR MARKET OUTCOMES OF MINIMUM WAGE INCREASES: A CASE STUDY** prepared by **ENES IŞIK** has been judged to be successful at the defense exam held on **20.05.2019** and accepted by our jury as **MASTER'S THESIS**

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LABOR MARKET OUTCOMES OF MINIMUM WAGE INCREASES: A CASE STUDY

ABSTRACT

There is an ongoing controversy surrounding the minimum wage policy. On the one hand, proponents argue that minimum wage can support employment in the presence of a labor market monopsony; opponents, on the other hand, argue that minimum wage has adverse impact on employment outcomes. In this study, using the 33% minimum wage increase in 2016 in Turkey as a quasi-experiment and utilizing the regional variation in the fraction of workers affected by minimum wage increases, I examine the impact of the minimum wage policy on wages,employment, and informality. I illustrate that young workers and less than high school educated workers are disproportionally represented among minimum wage workers. Armed with this finding, I show wage gains for less educated workers and no adverse impact on employment outcomes. I find, however, relatively large positive informality effects on young workers.According to the findings presented in this study, an additional 10 percent of potential minimum wage workers affected by the 2016 minimum wage increase rises young workers' informality by 12 to 17 percent.

Keywords: Minimum wage, labor market institutions, employment, unemployment

ASGARİ ÜCRET ARTIŞLARI İŞGÜCÜ PİYASASI SONUÇLARINI NASIL ETKİLER? BİR VAKA ÇALIŞMASI

ÖZET

Asgari ücretin işgücü piyasasında yarattığı sonuçlar tartışmalıdır.Asgari ücret politikasını destekleyenler işgücü piyasasında tekel alıcı konumunda bulunan işverenlerin yoğun olduğu durumlarda ücret tabanının istihdamı destekleyici bir etki yarattığını öne sürerken asgari ücrete karşı çıkanlar emek piyasasının rekabetçi olması durumunda ücret tabanının istihdamı olumsuz etkilediğini savunmaktadır.Bu çalışmada Türkiye'de asgari ücret düzeyinde 2016 yılında meydana gelen %33'lük etkili artışın istisnailiğinden faydalanarak ve asgari ücret artışlarından etkilenmesi beklenen grupların oranlarındaki bölgesel farklılıkları dikkate alarak asgari ücret politikasının ücret, istihdam ve kayıtdışılık üzerindeki etkisini inceliyorum.Genç işçiler ile lise eğitimi olmayan işçilerin asgari ücretli çalışan işçilerin kaydadeğer bir oranını temsil ettiğini gösterdikten sonra, 2016 yılındaki asgari ücret artışının lise eğitimi olmayan işçilerin ücretlerinde bir artış meydana getirdiğini ancak bu grubun istihdamında asgari ücret artışından kaynaklanan negatif bir etki bulunmadığını gösteriyorum. Öte yandan bu çalışmada sunulan bulgular, genç işçilerin kayıtdışılığında asgari ücret artışından kaynaklanan önemli bir artış bulunduğunu gösteriyor. Bu sonuçlara göre, 2015'te 2016 yılında meydana gelen asgari ücret artışından etkilenmesi beklenen genç işçilerin oranında meydana gelen her %10'luk artış, 2016'daki genç kayıtdışılık oranını %12 ila %17 oranında artırmıştır.

Anahtar Sözcükler: Asgari ücret, işgücü piyasası kurumları, işsizlik

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LIST OF SYMBOLS/ABBREVIATIONS

F_{ijt-1}	Fraction of affected workers by minimum wage increase within demographic group i in region j in year $t-1$
W_{ijt}	Average wages of demographic group i in region j in year t
Y_{ijt}	Labor market outcomes of demographic group i in region j in year t
J_j	Region fixed effect
T_t	Year fixed effect
X_{jt-1}	log GDP in region j in year $t-1$
MW_{1t}	Minimum wage level of the first half of year t
MW_{2t}	Minimum wage level of the second half of year t
HLFS	Household Labor Force Survey
HBS	Household Budget Survey
TE	Tertiary Educated Workers
LTH	Less Than High School Educated Workers
NUTS	Nomenclature of Territorial Units for Statistics
CPI	Consumer Price Index

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1. INTRODUCTION

There is an ongoing controversy surrounding the minimum wage policy. Some argue that an increase in minimum wage has an expansionary effect on the economy; others, on the other hand, argue that the minimum wage has an adverse impact on employment outcomes. The debate mainly originates in the standard textbook model predicting a negative relationship between above equilibrium minimum wage and employment. In his seminal paper, Stigler (1946) elaborates on this prediction by arguing that adverse employment effects of minimum wage are substantial and certain (p.361). In their extensive review of the empirical minimum wage literature, Neumark & Wascher (2008) support Stigler and show that majority of the minimum wage studies find negative employment effects.

In the case of Turkey, business owners and large business organizations often complain about the minimum wage being too high. Following the announcement of the sharp minimum wage increase in 2016 in Turkey, for example, an employer in textile sector complained that "I rented a new facility. I was planning to increase my production by hiring 500 workers. In response to announcement [of the minimum wage increase], however, I dropped the idea" (Hurriyet 2015). Similarly, a CEO in textile manufacturing business argued that "the labor intensive sector is not able to cope with a 30% increase in minimum wage. Some factories will be liquated." (ibid.). But complaints were not limited to the textile sector. Before the enactment of the increase, the vice chairman of *the Independent Industrialists' and Businessmen's Association* (MÜSİAD) maintained that "business world is very sensitive to such costs" (IHA 2015).

But Lester (1946)'s seminal field survey shows that business executives may be

interested in market demand rather than wage level in determining employment.A number of prominent case studies (Card 1992*a*,*b*, Katz & Krueger 1992, Card & Krueger 1994) and empirical studies conducted in 2000s (Dube et al. 2010, 2013, Allegretto et al. 2011, 2017) support Lester, suggesting that there is no consensus on the effects of the minimum wage policy.

I contribute to this debate by using the regional variation in the fraction of the potential minimum wage workers in Turkey to show how the 33% increase in the minimum wage in 2016 impacted average wages, which groups were most likely to benefit from the increase, and how this increase changed the employment and informality dynamics of the mostly affected workers.

There are few studies on the impact of minimum wages on labor markets for the case of Turkey. These studies examine different time periods and use different methods. For example, Güven et al. (2011) use a time-series framework to examine the employment effects of minimum wage. Papps (2012) exploits the variation of the individual level labor costs in order to detect the employment effects of the social security taxes and minimum wage. Using a fixed-effect model, Pelek (2015) explores the minimum wage's effects on youth employment. More recently, Yüncüler & Yüncüler (2016) use the variation in the fraction of the affected workers across industry and occupation interactions. They adopt a difference-in-differences approach to examine the labor market effects of the dramatic increase in minimum wage in 2004. Gürsel et al. (2018) focus on the low-wage sectors to explore the effects of minimum wage increase in 2016 on informality. Acar et al. (2019) examine how the increase in minimum wage in 2016 affected firm's exit rates from the formal economy.

I make three contributions to this limited literature. First, I utilize the quasi-experimentality of the sharp minimum wage increase in 2016 to capture the effects of minimum wage on wage and employment dynamics. Past minimum wage studies focusing on this increase are interested in only one aspect (i.e., informal job) of the

minimum wage's effects. However, minimum wage could potentially affect many labor market outcomes, especially wages. Without considering these effects altogether, it is hard to understand the general effects of an increase in minimum wage on affected groups' welfare. For this reason, I examine the effects of the dramatic minimum wage increase in 2016 on wage, informality, and employment outcomes.

Second, following the recent developments in the literature, I explicitly addresses the time-varying heterogeneities across regions. A well-known fact is that the results of the studies which utilizes the variation of the national minimum wage/regional average wages ratio or the regional variation in the fraction of the minimum wage workers are vulnerable to time-variant unobservable heterogeneities across regions. If an unobservable region-specific shock coinciding with the minimum wage increase, the regional identification strategy is not able to capture the causal effects of the minimum wage increase. This study handles this issue by following Aksu et al. (2018) who use *year x 5 regions* interaction terms to capture the unobservable time-variant changes in regional labor market outcomes.

Third, this study also discusses the important confounders such as Russian attack aircraft shootdown by Turkey on 25 Nov. 2015, and coup d'etat attempt on 15 July. 2016. Since these political events which were likely to have important effects on labor market outcomes were experienced in a period in which the sharp minimum wage increase in 2016 became effective, more importantly, in sectors where considerable share of minimum wage workers are employed; studies relying on sectoral identification strategy may falsely attribute the effects of this observable confounders to minimum wage increase in 2016.

This is especially important, because the increase in the minimum wage in 2016 followed a series of striking political events. First of all, 2015 was an election year for Turkey. After the June 7 general election, ruling Justice and Development Party (AKP) lost its parliamentary majority receiving 258 seats, fewer than the bare minimum (276 seats) to keep the majority. Following unsuccessful coalition negotiations,

Table 1.1: Minimum wage level and its annual deviation

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	**2016**	2017
Real (2003=100)														
Real Net Minimum Wage Level (TL)	**288**	299	296	293	317	328	329	336	348	358	359	373	**467**	452
Annual Change(%)	**28**	3	-1	0	8	3	0	2	3	2	0	3	**25**	-3
Real Gross Minimum Wage Level (TL)	**403**	418	414	409	401	416	417	427	441	453	456	474	**592**	572
Annual Change (%)	**31**	3	0	-1	-1	3	0	2	3	2	0	3	**24**	-3
Real Minimum Wage Cost (TL)	**511**	508	503	497	488	505	507	519	514	529	534	557	**695**	672
Annual Change (%)	**19**	0	0	-1	-1	3	0	2	0	2	0	4	**24**	-3
Nominal														
Net Minimum Wage Level (TL)	**310**	350	380	411	492	536	587	643	720	788	868	974	**1300**	1404
Annual Change(%)	**37**	12	8	8	19	8	9	9	11	9	10	12	**33**	8
Gross Minimum Wage (TL)	**433**	488	531	573	623	679	744	816	913	999	1102	1237	**1647**	1777
Annual Change(%)	**41**	12	8	7	8	8	9	9	11	9	10	12	**33**	7
Minimum Wage Cost (TL)	**549**	593	645	696	757	825	904	991	1063	1165	1289	1453	**1935**	2088
Annual Change(%)	**28**	8	8	7	8	8	9	9	7	9	10	12	**33**	7

Notes: Own calculations based on Turkstat's CPI and Labour and Social Security Ministry of Turkey's mini mum wage data.All values reflect the annual averages for years in which more than one minimum existed.

Turkey held a second election resulting in AKP's overhauled parliamentary majority on 1 Nov. 2015.

During the June 7 election campaigns, major parties' election promises were mostly based on economic pledges and a dramatic increase in minimum wage was the most popular one. The minimum wage changing race started with the main opposition Republican People's Party's (CHP) election promise, pledging to raise the monthly minimum wage from 949TL in 2015 to 1500TL in 2016. Following the CHP, Nationalist Movement Party (MHP) and People's Democratic Party (HDP) raised the bar by pledging 1400TL and 1800TL minimum wages, respectively. Although the ruling AKP did not promise an increase in the minimum wage during the June 7 election campaigns, after its unsuccessful election results on June 7, it got in the minimum wage running by promising 1300TL minimum wage during November 1 election campaigns. It regained its parliamentary majority in this election and its minimum wage promise went into effect on 1 January 2016.

Table 1.1 shows that this is one of the most dramatic increase in minimum wage in Turkey during the 2000s. Although a similar increase took place in 2004, the increase in the minimum wage cost to employer, which is sum of unemployment premium,

social security tax, and net minimum wage,was less dramatic in 2004 compared to the increase in 2016. Considering significance of the increase, government thus temporarily reduced the social security premiums paid by the employers for the already employed for 2016. In other words, the total labor cost increase (nominal) accruing to the employers was less than 33% increase in net minimum wage but still significant at 26%. Moreover, this temporary reduction was only valid for the number of employees who were employed in 2015 full-time. It did not cover any increase in employment. For these reasons, the increase in 2016 can be seen as a quasi-experiment.

The exogeneity of the minimum wage increase also corroborates this argument. Because, although economic growth rose from 5.16% in 2014 to 6.08% in 2015 (see Figure A.1) , decision for the increase in minimum wage was not due to the overall performance of the economy. The government had no announced plans to increase the minimum wage. However, faced with intense electoral competition in which the rival parties all made promises to increase the minimum wage, the ruling party was forced to make a similar move. Therefore, this increase in the minimum wage originated mostly due to exogenous political competition rather than the dynamics of the economy itself.

Nonetheless, the increase coincided with another important political event. A Turkish F-16 attack jet shot down a Russian attack bomber on 24 November 2015, immediately before the minimum wage increase on 1 January 2016. Following the political turmoil, Russia started to impose economic sanctions on Turkey. The import of Turkish fruits and vegetables was banned. The permit-to-work of Turkish construction companies doing business in Russia was rescinded. Due to the sanctions, clothing exports to Russia slumped. A shopkeeper in Laleli, where Russians who buy clothing have a central place in the economic activity, complained for example that"It's very difficult to work at the moment. A lot of shops are closed. There are no customers" (BBC 2016). Yet the shootdown's actual effects were mostly felt in the tourism sector, since Russia prevented Russian tour operators from organizing

tours in Turkey. The sanction resulted in 95% decrease in the number of Russian tourists who have a substantial place in the tourism sector.

It is important to note that the sectors affected by this event have also a considerable share of the minimum and sub-minimum wage workers. Since both the shootdown and the sharp minimum wage increase occurred almost instantaneously, the minimum wage studies based on a sectoral identification strategy are incapable of dealing with such a confounder. Relying on an identification strategy based on the regional variation in the potential minimum wage workers, this study shows that the regions with a higher share of the minimum wage workers are not necessarily most affected by the shootdown. It is thus able to separate the effects of the minimum wage increase from that of the shootdown.

A second concern is that the minimum wage increase preceded the coup d'etat attempt on 15 July 2016. Following the event, government declared state of emergency. More than 150,000 state employees were discharged after the event. Trustees were appointed to the companies accused of being linked to the attempted coup. Consequently, the turmoil caused the contraction of the economy in the third quarter of 2016.It is thus possible to falsely attribute the effects of this turmoil to the minimum wage's effects. In this study, I discuss this issue and show that my regional identification strategy is robust to such observable confounders. In other words, regions with a higher fraction of the workers affected by the minimum wage increase are not systematically affected by coup attempt.

With these in mind, the results presented in this study document that youth (15-24) workers and less than high school educated workers are disproportionally represented among the minimum wage workers. Following the minimum wage increase in 2016, the growth in the wage of these groups positively differed from that of other groups in which overwhelming majority worked at higher than minimum wage level.However, this study does not support a negative effect of the minimum wage increase on employment. But, an important rise in the informality of young workers potentially

due to the minimum wage increase is illustrated. Accordingly, an additional 10 percent of workers affected by the 2016 minimum wage increase rises young workers' informality by 12 to 17 percent. Positive informality finding is in line with the findings of Gürsel et al. (2018) and Acar et al. (2019) who look at effects of the sharp minimum wage increase in 2016 on informal jobs.

In the chapter 2, I review the literature. I mainly focus on the U.S. literature, since the state-level variation in minimum wage regulation has allowed researchers to discuss main methodological problems in examining the effects of minimum wage policy (Neumark, 2017,p.2). After showing the main methodological problems discussed in the U.S. context, I discuss their relevance for other developed countries, for developing countries, and for Turkey.

In Chapter 3, I discuss the data. Drawing on the descriptive results, I also identify the minimum wage workers and show the pre-existing trends in their labor market outcomes. This enable to conduct an eyeball test to control whether a detectable change in the labor market outcomes of the mostly affected groups took place following the minimum wage increase in 2016.

In Chapter 4, I discuss the identification strategy and model. I analyze the validity of the identification strategy, and discuss the identifying assumptions. The results and their robustness analysis are also presented in this section. In Chapter 5, I conclude the study.

2. LITERATURE REVIEW

The literature on minimum wage mostly focuses on its effects on employment.[1] The main reason behind this is that testable and precise predictions on the employment effects of minimum wage arising from the neoclassical model of wage and employment determination encourage empirical studies which seek to test these predictions (Card & Krueger 1995*a*). Therefore, I begin by discussing the textbook labor market model in this section and show the roots of the ongoing debate on the employment effects of minimum wage. Then, I review empirical studies for the U.S., for other developed countries, and for some developing countries. I discuss their relevance for Turkey and for this study.

In the perfectly competitive labor market model, wages (marginal cost of hiring an additional labor) must be equal to the marginal productivity of labor (marginal revenue from hiring an additional labor) (Cahuc & Zylberberg 2004) just as a firm's marginal cost must be equal to the marginal revenue of the firm in a competitive goods market. This is because an employee who faces an employer offering a wage which fall behind the employee's marginal productivity of labor can always find another employer who offers a higher wage, since there is an"attrition war" among employers who want to take the advantage of the additional revenue from the additional production which is spawned by an additional labor. Under these conditions, any wage floor exceeding the equilibrium wage level decreases the employment as there is no reason for employers to hire additional labor whose marginal productivity falls behind introduced wage floor, i.e. minimum wage.

An overwhelming majority of the empirical studies for the US economy verifies

[1]For a detailed discussion of the literature see Neumark & Wascher (2008). Table B.2 presented in Appendix presents a brief summary of the literature.

this proposition until the 1980s. In their extensive review of the literature on the effects of minimum wage on employment, Brown et al. (1982) show that the general finding of this literature is that a 10% increase in minimum wage rises teenage unemployment rates somewhere between 0 and 0.75%. Following Addison et al. (2015)'s classification of the literature, this early consensus, which generally relies on time-series evidence, can be categorized as the first stage of the minimum wage research. Studies in this circle generally construct an identification strategy based on the comparison of years in which minimum wage increased and years in which it did not. However, the problem stems from the relatively low variation in minimum wage level and employment level in time series.

Moreover, Card & Krueger (1995*b*) suggest that the consensus conclusion is sensitive to preferred specification and time period by showing that there is a negative relationship between observation number and t-ratio in the time-series models. Furthermore, they maintain that to control for the other explanatory variables which can affect employment over time is a monumental task in the time-series framework, because there can be important structural changes affecting employment over such long-time periods.

To address these problems, a number of studies in the 1990s (Card 1992*a*,*b*, Katz & Krueger 1992, Card & Krueger 1994) adopt a new identification strategy. The novelties of these studies include finding a quasi-experiment which is engendered by a minimum wage policy shock, identification of the precise control group unaffected by the minimum wage shock and of treatment group affected by the minimum wage shock, and use of difference-in-differences estimator to estimate the employment differences between identified control groups and treatment groups. Using this methodology for example, Card (1992*a*) utilizes California's minimum wage increase from $3.35 to $4.25 in 1988 as a quasi-experiment. He focuses on the differences between California's teenagers' employment and employment of teenagers in other states in which state level minimum wage did not rise during the same period. He finds that although the minimum wage increase in California caused a 5-10%rise

in low-skilled workers' wages, it did not decrease the employment of teenage workers. Similarly, Katz & Krueger (1992), adopting the federal minimum wage increase in 1991 as the case, design a survey for the fast-food restaurants in Texas where state-level minimum wage in 1990 was lower than new federal minimum wage in 1991. They find that employment increased relatively in the fast food restaurants experienced the sharpest increase in wages. In a more prominent case-study, Card & Krueger (1994) conduct a survey for fast-food restaurants in New Jersey, where minimum wage increased from $4.25 to $5.05 in 1992, and for the fast-food restaurants in Pennsylvania in which there was no increase in minimum wage during the same period. By comparing the unaffected restaurants which were paying more than new minimum wage in New Jersey, affected restaurants which were paying less than new minimum wage in New Jersey, and totally unaffected restaurants in Pennsylvania; they conclude that there was no relative reduction in the employment of affected restaurants in New Jersey. However, case studies done by this method do not always find no employment effects. For example, in a more recent case study of New York minimum wage increase in 2004-2006, Sabia et al. (2012) find very large negative employment effects for those aged 16-24. Taking the minimum wage hike in Seattle in 2015-2016 as a quasi-experiment, Jardim et al. (2018) show that there were considerable working hour reductions stemming from the increase.

All in all, contrary to the earlier literature which found negative employment effects for minimum wage increases, these new case studies show that the impact of minimum wage increases on employment vary. However, all these studies focus on the short-run effects of minimum wage increases on employment. When the long-run effects of minimum wages increases on employment is considered, drawbacks of the case-study approach stand out. These studies focus on very-short time periods whereas it can take time to adjust the employment of minimum wage workers following a minimum wage rise (see Meer & West 2016, Sorkin 2015). In this regard, there is another strand in the literature focusing on the state-level panel data, hence utilizing the state-level variation in minimum wage level, and adopting an empirical strategy based on fixed effect models. Neumark & Wascher (1992),Zavodny (2000),

Neumark (2001), Couch & Wittenburg (2001), Sabia (2009), and Lordan & Neumark (2018) are important examples. All of them find that there is a negative relationship between minimum wage level and employment. Main reason for different findings in these studies is that they focus on cross-state variation in employment and minimum wage levels over a relatively long-time period, while previously mentioned case studies utilize variation in employment and minimum wage level between two states over a short-time period. However, the panel studies' main assumption is the absence of the state-specific trends in outcome variable. Dube et al. (2010) argue that this assumption is violated, because states in which an increase in minimum wage takes place may already have negative employment trends, and that fixed-effect models without state-specific trends which cannot capture these time-varying heterogeneities across states may be biased. In order to address this problem, Dube et al. (2010) and Allegretto et al. (2011) include state-specific linear time trends. By doing so, they are able to show that pre-existing trends absorb the employment effects of minimum wage increases.

In addition to the possibility of such state-specific variation in time trends, Dube et al. (2010) also point out the possibility that neighboring states may not be good control groups for each other. In order to construct more robust control groups, they generalize the case study approach using a local identification strategy based on contiguous county pairs. Their suggestion is that contiguous county pairs imitate each other better in terms of demographic factors and labor market dynamics, and that instead of comparing all states, or neighboring states such as New Jersey and Pennsylvania, it is more proper to compare contiguous county pairs. Adopting this approach, they find no employment effects in line with the conclusions arising from previous case studies.

In sum, inclusion of state-specific employment trends and a generalized case study approach based on contiguous county pairs can be seen as a paradigm shift in the minimum wage-employment debate. Yet, a number of question rise on the shift. First, is there a valid reason to include state-specific linear time trends? Although

Dube et al. (2010) and Allegretto et al. (2011) argue that states in which there has been important minimum wage increases experience time-varying heterogeneity corroborating the inclusion of state-specific time trends, Neumark et al. (2014) emphasize that a related problem lies behind order structure of the included time trends. They point out that the bias stemming from the inclusion of linear time trends can be illustrated in the deviation of time-trends' residuals for the interested time period including two recessions. For this reason, they suggest that the higher-order time trends are more suitable for a time period including these recessions. When they correct Allegretto et al. (2011)'s specification in line with this proposition, they find negative employment effects. In a follow-up research, Allegretto et al. (2017) pay regard to Neumark et al. (2014)'s criticisms. They expand their time period by including non-recessionary 1979 and 2014 and using high-order time trends. However, they show that insignificant employment results persist, suggesting that their previous results are not sensitive to order structure of the included time trends and to "end-point bias".

Another question related to this shift, is an identification strategy based on contiguous county pairs more preferable than an identification relying on cross-state variation as in Neumark & Wascher (1992), or on regional variation as in the case-studies? To show that notion that geographic proximity ensures robust control and treatment regions are not plausible, Neumark et al. (2014) use synthetic control approach. They maintain that if a county in which there is no minimum wage increase replicates the structural characteristics of its contiguous county, where there is a minimum wage increase, in the absence of treatment effect, then synthetic control approach should bring about higher weights for this contiguous county pair. Their analysis, however, suggests that this is not the case. They thus conclude that an identification strategy based on contiguous county pairs "throws out the baby with the bathwater" by "throw[ing] away so much potential identifying information" (p. 30). Because, they propose, any county is as good control group as contiguous counties, whereas Dube et al. (2010) wrongly focuses only on contiguous county pairs. But Dube et al. (2013) shows that contiguous county pairs are much more compa-

rable in terms of structural variables such as overall private-sector employment, log population, private-sector employment to population ratio, log of average private sector earnings, overall turnover rate, and teen share of population.

Overall, my review of the U.S literature suggests some methodological conclusions which are important for the empirical strategy of this study. First, traditional time series approach has serious drawbacks in analyzing the relationship between minimum wage and employment. Second, although the case-study approach is based on a more robust identification strategy, it ignores the medium and long-run employment effects of minimum wage. Third, fixed-effect models relying on national variation can capture the long-run effects, though they can be biased if there are time-varying heterogeneities across states, which can be addressed including the state-specific time trends.

The conclusions arising from the above-mentioned studies relying generally on the identifying information coming from the variation in the cross-state minimum wage statute may be seen, on first glance, as irrelevant to discuss the employment effects of minimum wages in Turkey since Turkey has a national minimum wage statute. However, for countries like Turkey, one can still adopt an identification strategy based on the regional differences drawing on the geographical variation in minimum wage "bites". Studies adopting this strategy expect that an increase in national minimum wage level should have more impact on regions with a higher share of the workers whose wages are lower than introduced minimum, but equal or surpass old minimum wage. In addition to studies used this methodology to examine the effects of the United States' federal minimum wage (e.g. Card 1992*b*, Currie & Fallick 1993), some examples come from other developed countries. In their analysis of the minimum wage's employment effects in Canada, Campolieti et al. (2006) use differences in the fraction of affected workers across provinces for a period of 1981-1997. They find substantial negative elasticities. Dolton et al. (2015), on the other hand, use an "incremental differences-in-differences" estimator based on variation in incremental changes in national minimum wage and on variation in national

minimum wage/regional wage averages ratio (Kaitz index). What they find is small negative employment effects due to minimum wage introduction. In their analysis of the introduction of minimum wage in Germany in 2015, Caliendo et al. (2018)exploit the regional variation in the fraction of affected workers whose wages lag behind the introduced minimum wage. They find small negative effects on overall employment due to sharp declines in the employment of those whose monthly earnings are lower than 450 Euro.

There are also some examples for developing countries. For instance,Khamis (2013) utilizes the regional variation in the fraction of affected workers for Argentina and finds no employment effects. Rama (2001) uses it to detect the employment effects of sharp minimum wage increases in Indonesia in 1990s and shows that there was 0-5% decrease in employment stemming from the increases. Lemos (2009) analyzes the employment effects of minimum wage in Brazil using fixed-effect models. In Turkey, a number of studies focusing on effects of minimum wage use the regional variation in the fraction of affected workers. To capture the school enrolment effects of sharp minimum wage increase in 2004 in Turkey for example, Bakış et al. (2015) use regional differences in the proportion of affected workers whose wages fall behind new minimum wage. Pelek (2015) uses a fixed-effect model to detect the employment effects of minimum wage making use of the regional variation in Kaitz index.

However, an empirical strategy based on the regional differences in minimum wage bite is not the only way to capture the effects of minimum wage in countries with a national minimum wage. Lack of representative regional data, or presence of the individual-level panel data, or more explicit variation in the fraction of affected workers across demographic groups based on ages and sectors over time encourage researchers to adopt different identification strategies. For example, Machin et al. (2003) look at employment effects of the introduction of minimum wage in UK in 1999 by focusing on residential home care industry in which one third of workers earned less than new minimum wage before the introduction of the new minimum. They find evidence verifying a decrease in working hours and employment due to the

introduction of minimum wage. Similarly, Bossler & Gerner (2016) assess the employment effects of statutory minimum wage introduced in 2015 in Germany. They use firm-level micro-data and adopt an empirical method based on the variation in the fraction of affected workers with an hourly wage below the new statutory minimum wage. Their evidence verifies a 1.9% decrease in the employment of affected firms following the introduction of the statutory minimum wage. Likewise, in their analysis of the change in the minimum wage law in Spain in 1995, which closed the gap between minimum wage level for workers aged 16-17 and minimum wage level for older workers, Anton & de Bustillo (2010) show a considerable decrease in the teenage employment after the introduction of the law. Ham (2018) uses the variation stemming from the changes in the number of minimum wage categories in Honduras, and illustrates the presence of a reduction in employment. Dinkelman & Ranchhod (2012) analyze the effects of labor market regulation which introduced a minimum wage for domestic workers in South Africa in 2002. Utilizing the variation in intensity of the law, they find no employment effects. In their analysis of the substantial increase in minimum wage in 2004 in Turkey, Yüncüler & Yüncüler (2016) exploit the variation in the fraction of affected workers across industry-occupation interactions.

I have reviewed the literature in the context of the identification issue up to this point. It has turned out that the identification strategies relying on the differences in regional and demographic characteristics are common in the literature, and that the importance of addressing time-varying heterogeneities across regions takes center stage. Yet another concern for a study focusing on the effects of minimum wage in a developing country is informality. This is because it is known that labor market policies' enforcement power is lower in the developing countries, and that some neoclassical models (e.g. Welch 1976, Gramlich 1976) in which there are two sectors covered and uncovered by minimum wage law predict that an increase in minimum wage causes a labor flow from covered (formal) sectors to uncovered (informal) sectors. Thus, although an overall employment effect due to minimum wage may not be discerned, an increase in minimum wage can still decrease the share of formal

employment in a developing country. Indeed, some studies focusing on the minimum wage's employment effects in developing countries find corroborating evidences for this argument (e.g. see Ham, 2018 for Honduras; Comola and De Mello, 2011 for Indonesia) (for an extensive review of the relationship between informality and minimum wage in developing countries see Pelek 2014)

Contrary to other developing countries, however, the minimum wage literature in Turkey is very limited. This is surprising as Turkey has the highest national minimum wage/average wage ratio among OECD countries (Pelek, 2014, p.196); it has witnessed two dramatic increases in the minimum wage level within last decade (see Table 1.1), and new job formation lags behind economic growth (see Yeldan 2011, Orhangazi 2019). Minimum wage can be responsible for this weak labor market performance. But only a number of studies test this hypothesis. Using Pesaran cointegreation test, Güven et al. (2011) examine the relationship between employment and minimum wage in manufacturing industry for the period of 1969-2008 and find no employment effects. However, their long sample period includes four recessions and a continuous structural transformation contaminating the actual employment effects expected to arise from the increase in minimum wage. This validates the above-mentioned criticism of the time-series approach. Papps (2012) adopts a different approach by exploiting the "variation over time among low-wage workers in the ratio of total labor costs to the gross wages" (p.686). His main argument is that social security system and minimum wage together bring higher cost for lower-wage workers relative to higher-wage workers. Using household-level panel data for 2002-2005, he finds a negative relationship between minimum wage and employment.

By contrast, using a region-level panel data for a longer period of 2004-2014, and focusing only on 15-29 age cohort, Pelek (2015) shows that there is no negative correlation between minimum wage and employment, but that minimum wage has a considerable positive impact on informality. Yunculer and Yunculer (2016) using the fraction of minimum wage workers across different industries and occupations as key variables find a positive relationship between minimum wage and average

wages, working hours, informality; and no relationship between minimum wage and employment. They utilize the substantial increase in minimum wage in 2004 as a quasi-experiment. It is worth noting, however, that GDP growth was as high as 8.8% in 2004. One thus can expect that the sharp increase in minimum wage in this year was endogenous to macroeconomic conditions, and that high growth rate over-rode the minimum wage's effects.

In this study, I exploit the sharp minimum wage increase in 2016 as a quasi-experiment. As I argued in Chapter 1, the minimum wage increase was an exogeneous shock. A few studies exploits this policy experiment to detect the effects of minimum wage on various outcomes. Guney et al. (2017) capture its effects on consumer loans. Gürsel et al. (2018) focus on its effects on informality. Acar et al. (2019) examine its impacts on firms' exit rates from the formal economy. To my knowledge, however, there is no any study focusing on its effects on wage and employment dynamics of the mostly affected groups. In order to quantify the effects of the dramatic increase in minimum wage on affected individuals' welfare, it is important to examine the wage and formal- informal employment dynamics together.

Using Dolton et al. (2015) incremental difference-in-differences approach and following Card (1992*b*)'s and Caliendo et al. (2018)'s empirical methodology, this study adopts an identification strategy based on the regional variation in the mostly affected groups by the minimum wage increase. As distinct from the similar studies adopted the similar methodologies, it addresses the observable confounders and the unobservable heterogeneities across regions.

3. DATA AND DESCRIPTIVE ANALYSIS

3.1 DATA

I use Annual Household Labor Force Survey (HLFS) for 2004-2016. HLFS is a cross-sectional micro data gathered by Turkstat to produce official labor market indicators. It provides information about demographic characteristics, employment status, income, past work experience of households' members.

Turkstat also provides more comprehensive cross-sectional Household Budget Survey (HBS) data with additional variables related to households' incomes in kind. Using HBS, I could detect also minimum wage's effects on these incomes, since it is reasonable to expect that an increase in wages generated by a rise in minimum wage can be compensated by a decrease in wages in kind as a discount in transportation, mass transportation, utility bills, and in travel services, dinner, kinder garden fees, cloth benefits. In other words, an increase in minimum wage can encourage employers to reduce these benefits. However, HBS lacks the regional information which is essential for the empirical strategy of this study. Moreover, HBS brings about a trade-off between observation number and variable number (Tekgüç et al. 2017). As it is vital to disaggregate data set by age, education, and regions to build an empirical strategy based on the variation in the share of the minimum wage workers by various demographic groups and regions, I prefer HLFS with higher observation number.

Gürsel et al. (2018) emphasize that quarterly HLFS is more informative than annual HLFS, since the latter can mislead when two or more minimum wage levels exist in a year. I discuss this issue in the following sub-section.

Last, I focus on wage employment by including only following groups unless indicated otherwise:

- Those aged 15-64
- Those who are in employment
- Those who declare an earning
- Those who are wage or salaried employees, or casual workers

3.2 IDENTIFICATION OF THE MINIMUM WAGE WORKERS

Who are the minimum wage workers? This section tries to answer this question. Heterogeneous workers models predict that the minimum wages' effects on the labor market outcomes of the demographic groups with a higher share of the minimum wage workers will be more severe (Brown et al. 1982). In this respect, the most studied groups in the U.S. minimum wage literature are teenagers (13-19 years), young adults (20-24 years), retail trade workers, and workers in restaurants. Studies seeking to discern the effects of minimum wage in Turkey generally focus on youth (e.g. Bakış et al. 2015, Pelek 2015), conduct an industry-occupation based analysis (e.g. Yüncüler & Yüncüler 2016), or examine manufacturing workers (e.g. Güven et al. 2011). But demographic characteristics in labor markets in Turkey have changed during 2000s (see Orhangazi 2019). I thus try to show the trends in the fraction of the minimum wage workers by various demographic groups and regions and to understand which groups and regions are most likely to be affected by the minimum wage increases.

Gürsel et al. (2018) emphasize that identification of minimum wage workers using annual HLFS is not easy, since it requires a number of identification assumptions. The reason is that some years have two different minimum wage levels due to minimum wage changes within that year, and annual HLFS with no survey month information is simply not able to capture minimum wage workers. Take 2015 for instance, net minimum wage was 949 TL in the first half of the year, and 1,000 TL in the second

half of the year. Which observations in 2015-wave should be considered as minimum wage workers? This issue induces the determination of a general threshold capturing all possible minimum wage workers during the entire wave. Taking the minimum wage level in the first half of the year as minimum threshold and the minimum wage level in the second half of the year as maximum threshold, and allowing a 5% error margin, possible minimum wage workers are discernible. This approach yields 902TL as minimum threshold and 1050TL as maximum threshold in 2015 for example. In other words, a worker earning a wage between these thresholds can be considered as a minimum wage worker in 2015. Generalization of the approach yields the following wage condition of the minimum wage workers:

$$MW_{1t} - (MW_{1t} * 0.05) < W_{it} < MW_{2t} + (MW_{2t} * 0.05) \tag{3.1}$$

where MW_{1t} is the minimum wage level of the first half of the year t, MW_{2t} is the minimum wage level of the second half of the year t, W_{it} is the wage of minimum wage worker i in year t. Indeed, the condition captures the possible minimum wage workers, and does not allow to treat individuals with wages 5% higher than minimum wage level of the second half of the interested year, and with wages 5% lower than minimum wage level of first half of the interested year as a minimum wage worker. All in all, when I refer to minimum wage worker in this section, I imply the workers whose wages satisfy this condition.

With these in mind, first, I explore which skill groups work generally at the minimum wage level and are potentially more affected by increases in minimum wage. Figure 3.1 shows the fraction of those whose wages fall behind the minimum wage (dashed line), at minimum level (solid line), and exceed minimum wage level (two-dashed line) by education group and informality status.[2]

[2]Workers not registered in the Social Security Institution are defined as informal workers. Note also that in figures excluding informal workers, a minority declaring lower than minimum wage earning is always detectable. In Turkey, however, formal workers cannot work at lower than minimum wage level. Thus, this minority can be seen as a measurement error. The error is the largest among less than high school group and younger cohorts, and smallest among college-educated workers and adult cohorts. Increasing in crisis years, the error is non-randomly distributed. Although it is hard to justify, anecdotal evidence suggests that some employees are supposed to pay back a fraction of their formal earnings to their employers, as a way to circumvent minimum wage statute.

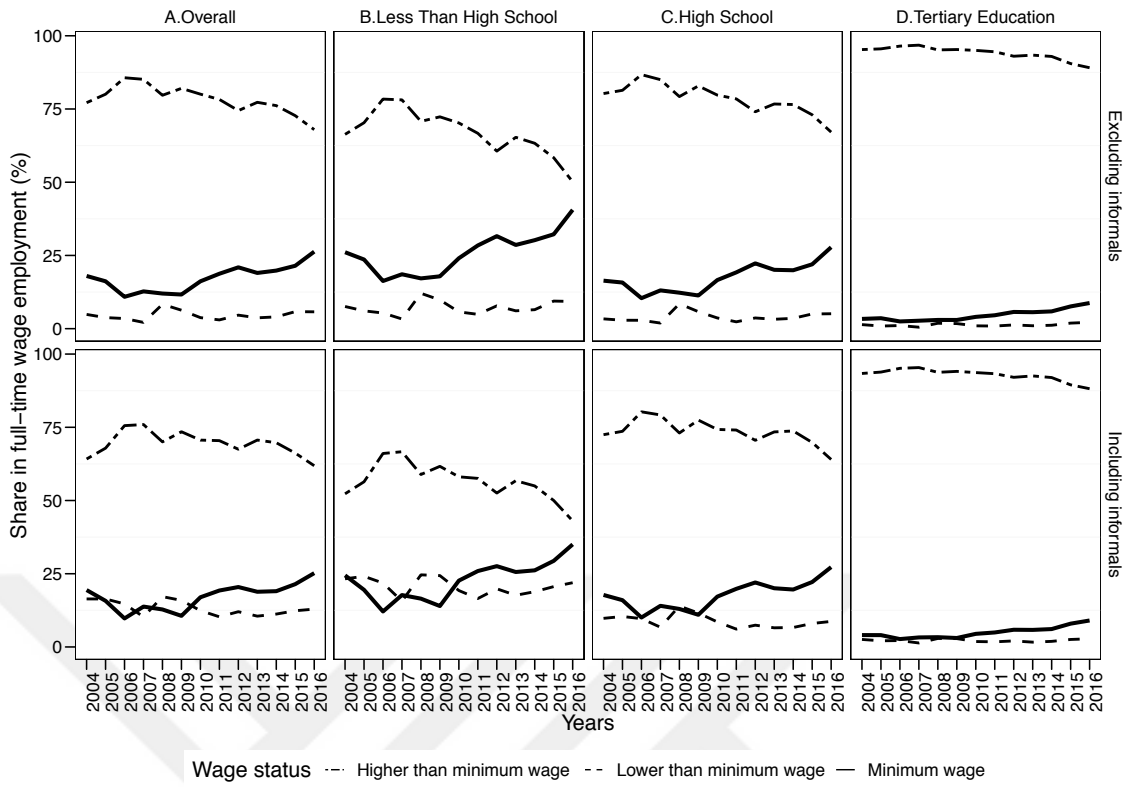


Figure 3.1: Share of minimum wage workers by education group

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, whose wages satisfy the wage condition (3.1) are defined as minimum wage workers.

The figure displays that the share of minimum wage workers is the highest within less than high school group and the lowest among college-educated workers. Although the proportion of minimum wage workers are considerably high within high-school group either, the share of minimum wage workers among less than high school educated workers noticeably differs from the share of minimum wage workers within remaining skill groups. Considering only formal workers, for example, 32% of workers with less than high school education earned minimum wage in 2015, while the same figure was 22% for high school group, and 7.6% for tertiary-education group. Also, the share of minimum wage workers has increased considerably over time among less than high school and high school educated workers worked both formally and informally. Altogether, these figures point out that an increase in minimum wage is most likely to affect less than high school group.

In Figure 3.1, we also see that the sharpest rise (28% for less than high school group,

21% for high school group) in the fraction of minimum wage workers within less than high school group and high school group took place from 2015 to 2016. This is true even if we include informal workers. This suggests that, other things being equal, dramatic increase in minimum wage in 2016 had a noticeable enforcement power.

Inclusion of informal workers increases the fraction of workers earning lower than minimum wage level. This increase is especially dramatic within less than high school group. Proportion of workers whose wages fall below minimum wage level within less than high school group was 21% in 2015, whereas it was 8% for high school group and 2.6% for college educated workers. Informality and non-compliance does not change the picture that less than high school educated workers are disproportionally represented among minimum wage workers.For this reason, Figure 3.1 suggests that a study focusing on the effects of minimum wage increase can rely on an identification strategy based on the variation in share of minimum wage workers among various skill groups.

Teenagers (13-19 years old) and young adults (20-24 years old) are also prime suspects which are most likely to be affected by an increase in minimum wage. Indeed, Neumark & Wascher (2008)'s extensive review of the literature shows that vast majority of minimum wage literature studied the effects of minimum wage on teenagers and young adults. I thus look at the fraction of minimum wage workers by age cohorts in Figure 3.2 considering also informality. The figure shows that, in both panel, the share of minimum wage workers within 15-24 age cohort dramatically differs from that of other age cohorts. Among formal workers, the share of minimum wage workers within 15-24 age cohort was 36.5% in 2015. By contrast, it was around 20% within remaining cohorts.

Inclusion of informal workers increases the variation in the share of affected workers between age cohorts. For instance, in 2015, nearly two third of those aged 15-24 worked at or lower than minimum wage level. Whereas the same figure was, on average, 30% within 25-34, 35-44, 45-54 cohorts, and 40% within 55-64 cohort. But

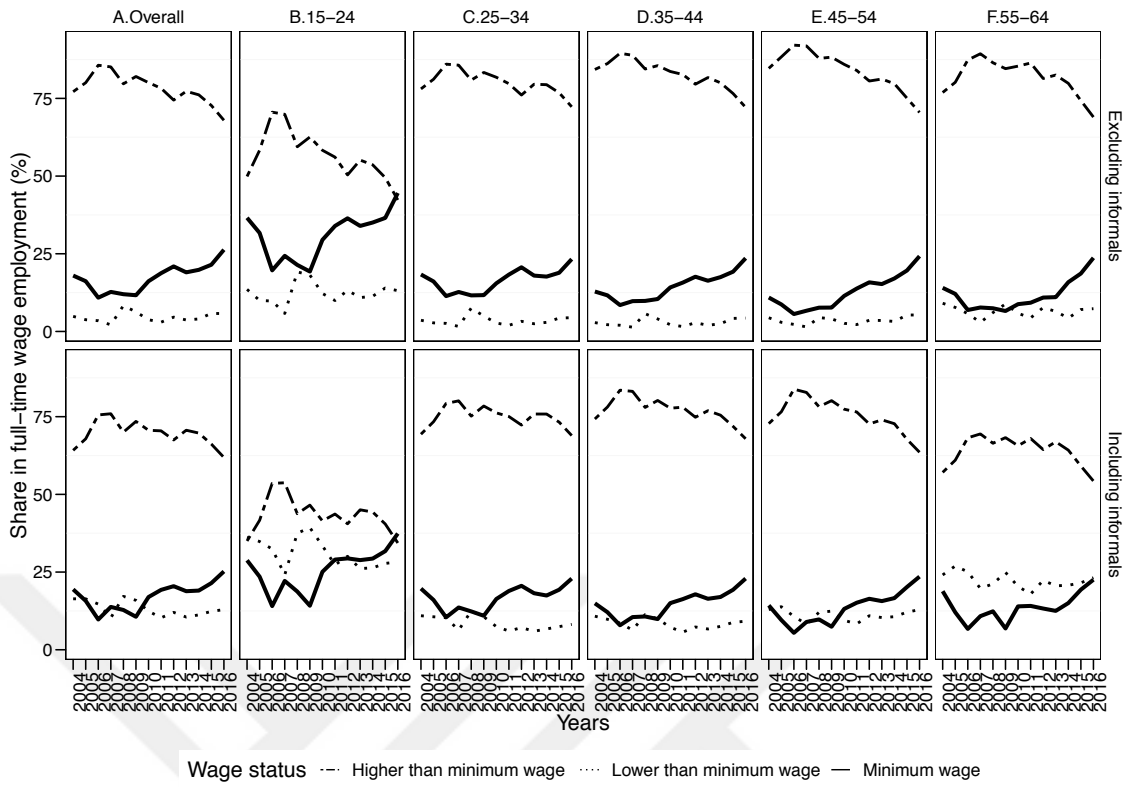


Figure 3.2: Share of minimum wage workers by age-cohort

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, whose wages satisfy the wage condition (3.1) are defined as minimum wage workers.

these figures increased noticeably in 2016. The increase was the sharpest among those aged 15-24 and worked formally. These figures, together, show that minimum wage is more binding for youth cohort.

To complete the picture of the minimum wage workers, I show their regional distribution and regional Kaitz index, namely the ratio of national minimum wage level to regional average wages. This is especially important, because the consensus in media discussions about the minimum wage in Turkey is that living costs differ across regions and national minimum wage statute ignoring these differences undermines employment in regions with a higher share of minimum wage workers.

Figure 3.3 shows that there are some regions with a higher fraction of minimum wage workers over a longer time period of the sample. For example, in TR33 region (Manisa, Afyonkarahisar, Kütahya, and Uşak), the share of minimum wage workers

has been persistently higher, though 2008-2009 and 2015-2016 interrupted this trend. In TRB1 (Malatya, Elazığ, Bingöl, and Tunceli) and TRC1 (Gaziantep, Adıyaman, and Kilis) regions, the fraction of minimum wage workers has been also higher. On the other hand, there are some regions, such as Istanbul (TR10) and Ankara (TR51), where fraction of minimum wage workers has been consistently lower. In addition to fraction of minimum wage workers, Figure 3.3 also shows the ratio of the national minimum wage level to regional averages of wages, i.e. Kaitz ratio. Its trend across regions over time shows that South Eastern region as a whole have generally higher Kaitz ratio. And regions with the higher fraction of minimum wage workers have generally higher regional Kaitz ratio.

In conclusion, analysis in this section trying to identify the minimum wage workers indicates that i) majority of minimum wage workers are less educated or younger than average; ii) the share of minimum wage workers in regions such as TR33 (Manisa, Afyonkarahisar, Kütahya, and Uşak), TRB1 (Malatya, Elazığ, Bingöl, and Tunceli) and TRC1 (Gaziantep, Adıyaman, and Kilis) has been persistently higher. Although differences in the fraction of minimum wage workers across these groups are only "noisy proxies" (see Jardim et al., 2018; Cengiz, 2019), considerable differences in the share of minimum wage workers across demographical groups and regions suggest that a study trying to detect minimum wage's labor market outcomes can exploit the variation in the fraction of minimum wage workers across regions, skill groups, and age cohorts over time.

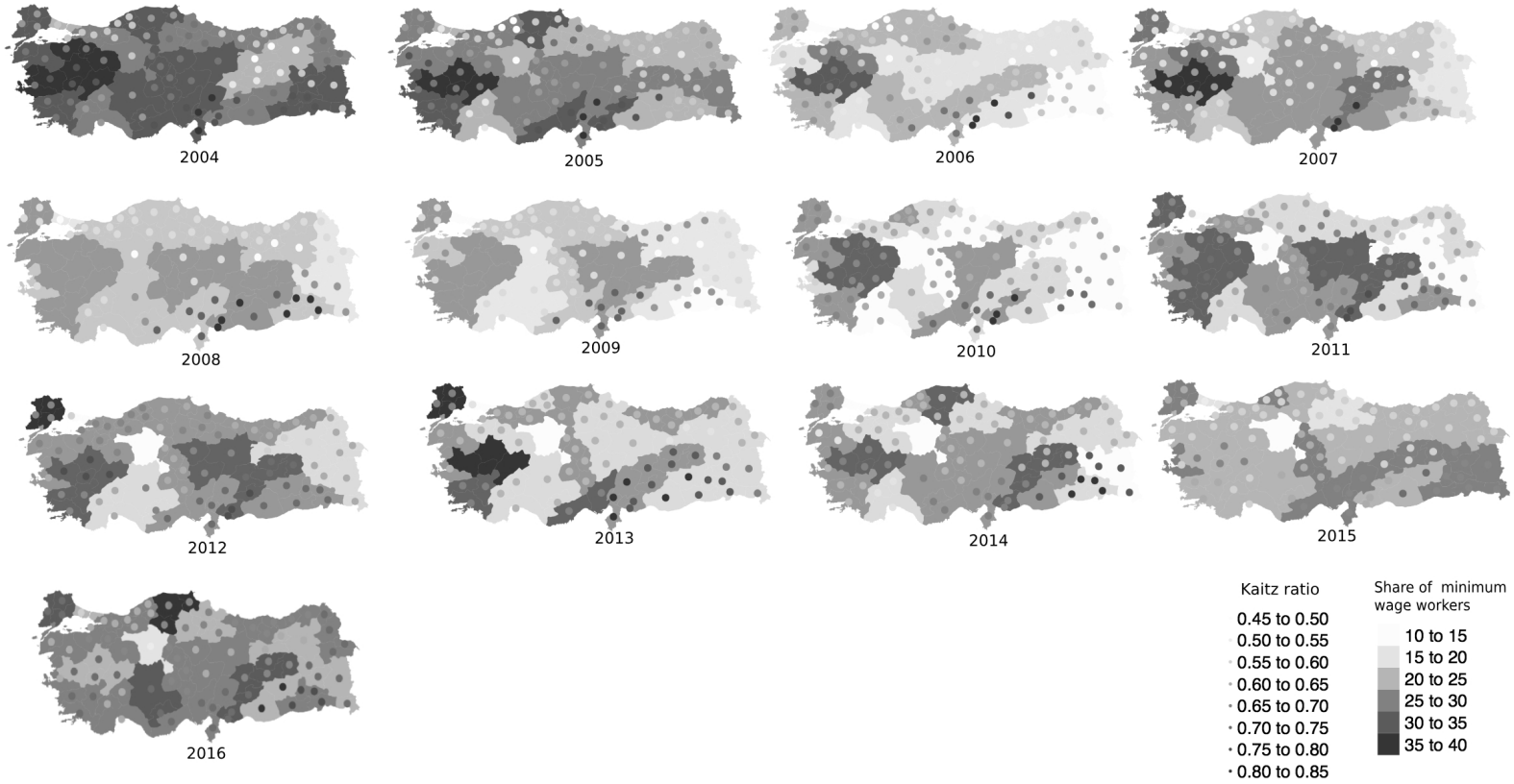


Figure 3.3: Share of minimum wage workers by regions (NUTS-2)

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, whose wages satisfy the wage condition (3.1) are defined as minimum wage workers.

3.3 PRE-EXISTING TRENDS IN LABOR MARKET OUTCOMES

I show in this section how wage, employment, and informality dynamics of the mostly affected groups has changed during the period of 2004-2016. I illustrate the pre-existing trends in these variables, which are likely to absorb the effects of minimum wage increase in 2016, providing a useful information for econometric analysis. Moreover, I especially focus on years in which real minimum wage level increased significantly, then conduct an eyeball test to understand whether considerable changes in outcome variables in these years took place.

3.3.1 Wages

In Figure 3.4, I look at growth in the various skill groups' monthly wages. Both panels reveals that one of the most dramatic increases in wages within all education groups took place in 2016, and that this increase was the sharpest within less than high school group in which nearly one third of workers worked at minimum wage level in 2015.

Figure 3.5 confirms this relative increase by showing that there was a sharp decline in 2016 in the relative wages of college educated workers measured as the ratio of college educated workers' median wages to less than school educated workers' median wages. It is thus possible to contend that, other things being equal, minimum wage policy is capable of influencing the wage growth. Light-shaded region in Figure 3.5 shows the year (2008) in which the other considerable increase (8%) in real minimum wage level took place support the argument, because it shows that there was a considerable decrease in the relative wages of college educated workers following the noticeable minimum wage increase in 2008.[3]

[3]I present an additional evidence in Figure A.6 showing changes in wage distribution from 2013 to 2016. We observe that the density of workers earning new minimum wage (vertical lines) is higher within less than high school group. More importantly, the most dramatic shift to right in the wage distribution of this group occured from 2015 to 2016. The right column of the figure indicates that informal workers' wages were also affected by the minimum wage increase, because the second hump in the wage distribution is at the minimum wage level in 2016 (vertical line). This supports the "lighthouse effect" implying

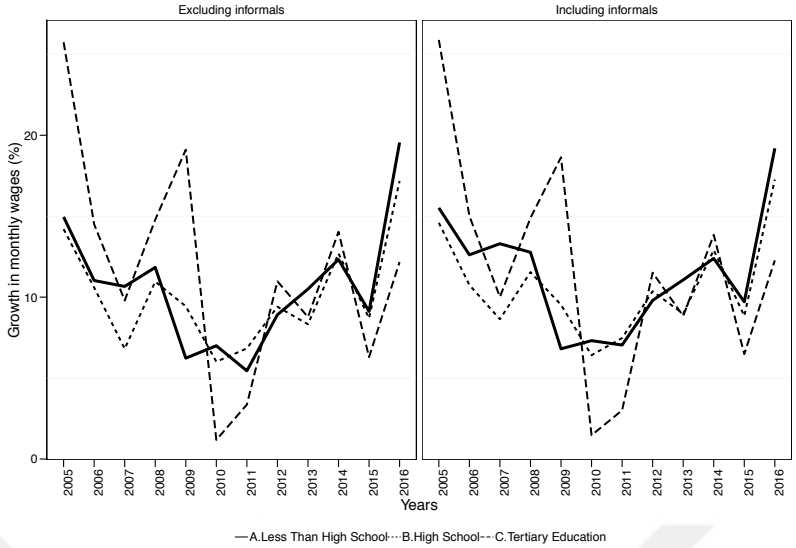


Figure 3.4: Average wage (nominal) growth by education

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, and declare an earning are included. Sharp fluctuations in the wage growth in 2009-2010 may be due to selection bias. It is likely that increasing unemployment in 2009 financial crisis caused the selection of higher skilled workers, rising wage growth in this year.

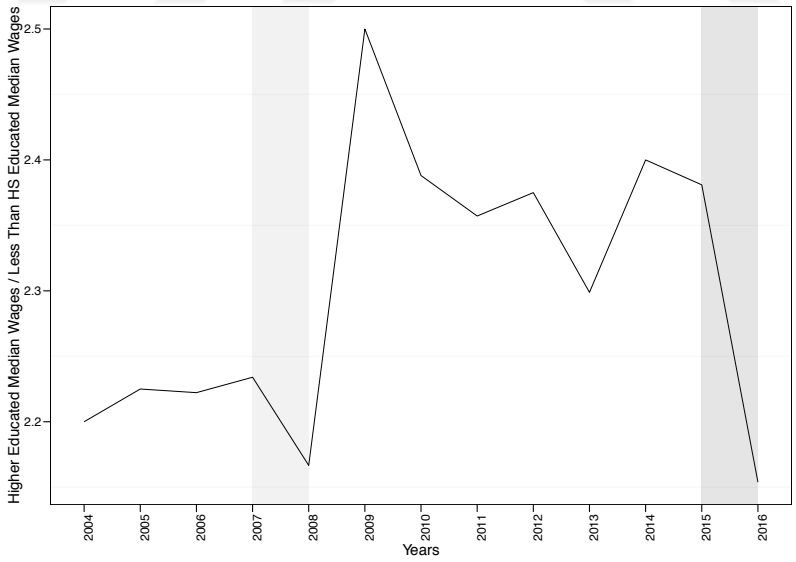


Figure 3.5: Median wage (nominal) of college educated workers / median wage (nominal) of less than high school educated workers

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, and declare an earning are included. The college educated workers' median wages are divided by the less than high-school educated workers' median wage. Medians are weighted.

Variation in the share of minimum wage workers across different age groups can strength this result. In this respect, I show how wage growth differs across age cohorts over time. Figure 3.6 displays that, on average, the growth in wages of 15-24 group is similar to that of other age cohorts during the sample period. But, in both panel, the wage growth of 15-24 group in which about two third of workers earned at typically minimum wage level or at lower than minimum wage level in 2015 was steeper in 2016, which support the argument that minimum wage increase in 2016 had a positive impact on wages of these more affected workers.Figure 3.7 shows the same picture from a different perspective. In years experiencing the noticeable real increases in minimum wage, there were declines in relative wages of adult workers measured as ratio of median wages of 35-44 age group to median wages of 15-24 age group.[4] [5]

3.3.2 Employment

Since nearly one third of less than high school group worked at minimum wage level in 2015 (Figure 3.1) and wage growth in 2016 was more noticeable (Figure 3.4, Figure 3.5), employment effects of the minimum wage increase is expected to be evident for this skill group. To investigate this argument, I present the employment

that minimum wage has also positive impact on informal workers' wages.

[4]The evidence presented in Figure A.7 to Figure A.9 supports this positive wage effect, because it illustrates that there is a hump in formal young workers' wage distribution at the minimum wage level in 2016. We also observe that the most dramatic shift to right in the wage distribution of this group occured from 2015 to 2016. The right column of the figure indicates that there was a lighthouse effect, since informal young workers' wages were also affected by the minimum wage increase in 2016. This is because there was a second hump in wage distribution at the minimum wage level in 2016 (vertical line).

[5]We can also expect that regions with a higher fraction of minimum wage workers experience more noticeable wage growth following considerable minimum wage increases. In this regard, Figure A.2 shows the wage growth figures by region. It illustrates that regions such as TR21 (Edirne, Tekirdağ, and Kırklareli), TR62 (Adana and Mersin), TR33 (Manisa, Afyonkarahisar, Kütahya, and Uşak), TRB1 (Malatya, Elazığ, Bingöl, and Tunceli) and TRC1 (Gaziantep, Adıyaman, and Kilis) with higher fraction of the minimum wage workers in 2015 witnessed steeper increase in wages in 2016. But a steeper increase in monthly wages was not limited to regions with a higher fraction of minimum wage workers. For example, regions such as Istanbul (TR10) and Ankara (TR51) which had lower fraction of minimum wage workers also experienced noticeable increases in wage growth in 2016.

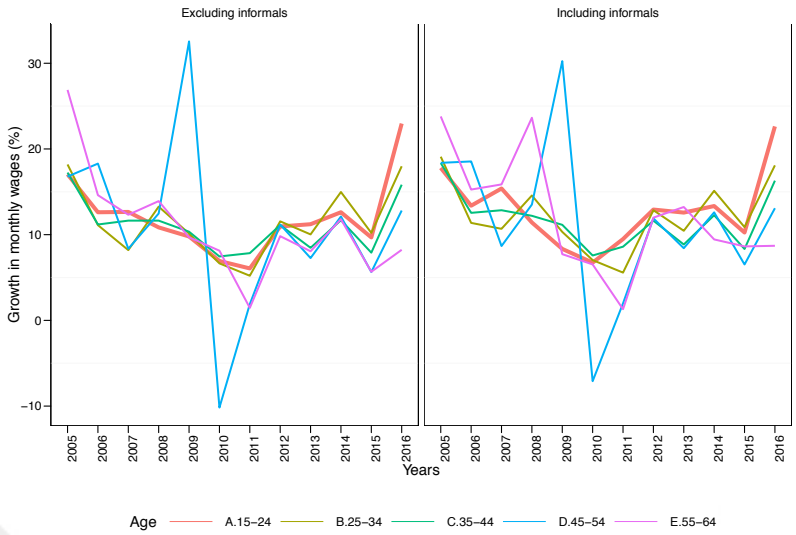


Figure 3.6: Average wage growth by age

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, and declare an earning are included. Sharp fluctuations in the wage growth in 2009-2010 may be due to selection bias. It is likely that increasing unemployment in 2009 financial crisis caused the selection of higher skilled workers, rising wage growth in this year.

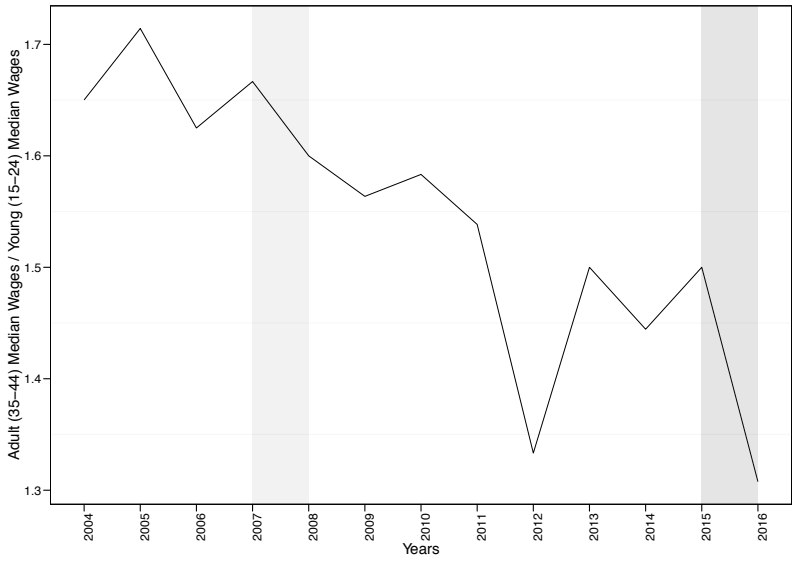


Figure 3.7: Median wage within 35-44 group/ median wage within 15-24 group

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, and declare an earning are included. The adult (35-44 ages) workers' median wages are divided by the young (15-24 ages) workers' median wage.

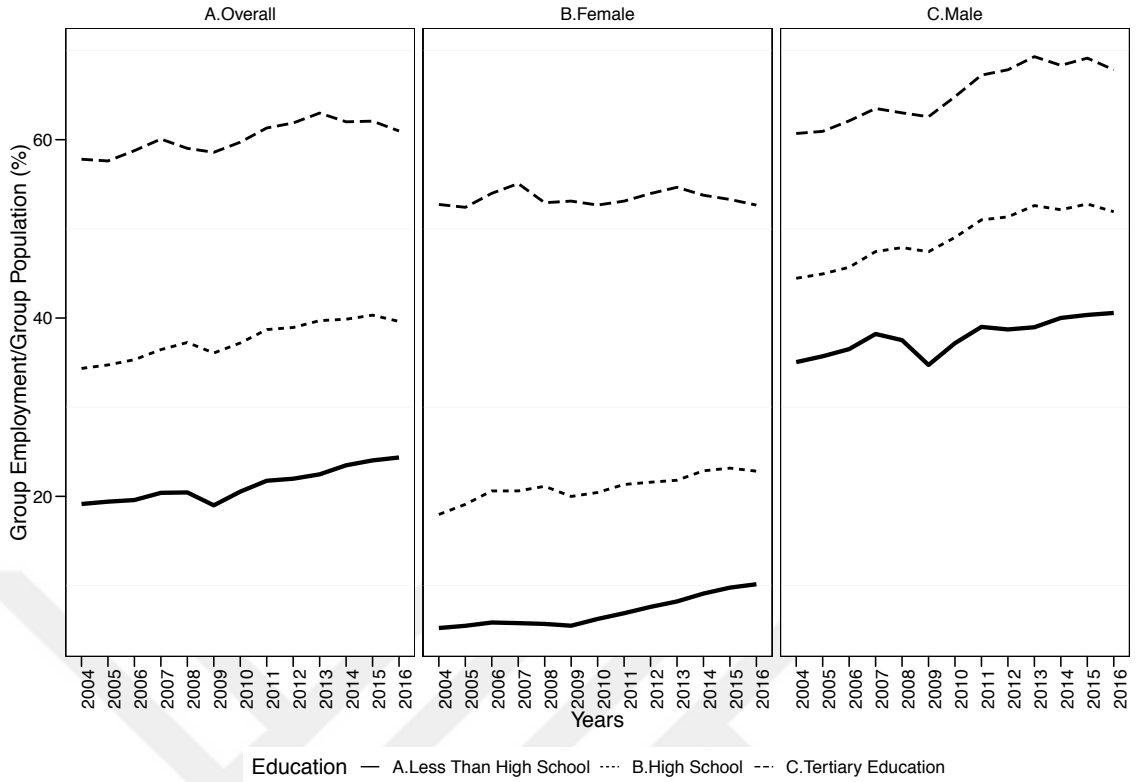


Figure 3.8: Full time wage employment/population ratio by education and gender

Notes: The author's calculations based on annual HLFS. Observations are grouped by gender, year, and education. Number of workers who are full time wage, salaried, or casual workers is divided by population.

trends by education groups and gender in Figure 3.8. In all three panels, however, there is no evidence suggesting a decrease in less than high school group's employment following the sharp minimum wage increase in 2016. Although the high school group experienced a decrease in employment, college-educated group in which overwhelming majority earned higher than minimum wage also faced a significant decline in employment in 2016. These figures show that the most affected group did not experience a relative decrease in employment in 2016.

Was there a relative decline in youth employment following the steeper increase in youth wage in 2016? Figure 3.9 indicates that upward trend in youth employment stopped in 2016 and that there was a noticeable relative decrease in young females' and young males' employment. Meanwhile, overall employment of those aged 45-54 and 55-64 followed upward trend, while 25-34 and 35-44 age groups' positive employment trend also stopped in 2016.

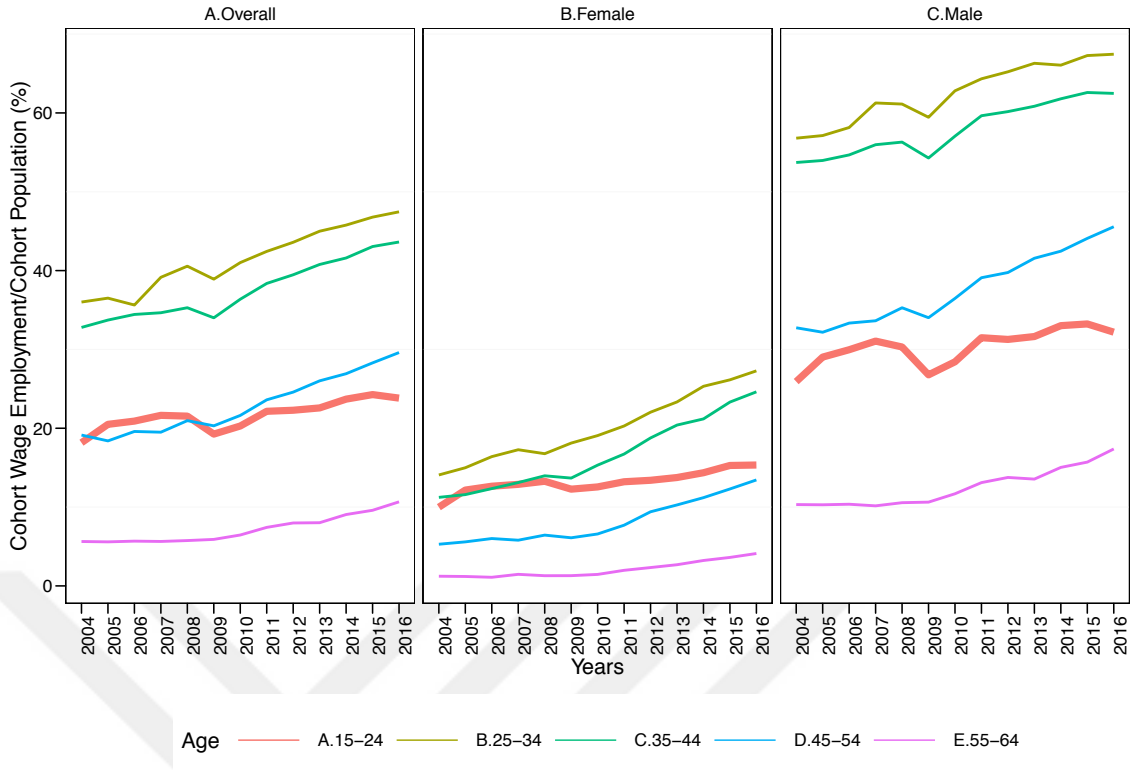


Figure 3.9: Full time wage employment/population ratio by age and gender

Notes: The author's calculations based on annual HLFS. Observations are grouped by gender, year, and age-cohort. Number of workers who are full time wage, salaried, or casual workers is divided by population.

Before interpreting these indicators, it is important to consider that there was a slowdown in the economy in the third quarter of 2016, confounding "pure" minimum wage effects. However, overall employment in the economy sustained its growth from 2015 to 2016 (see Figure A.1). Thus, other things being equal, significant decrease in youth employment in 2016 may be interpreted as negative employment effects of minimum wage on youths.[6]

[6]Figure A.3 shows the full-time wage employment/population ratio by region for the period of 2004-2016. Employment in high impacted regions such as TR21 (Edirne, Tekirdağ, and Kırklareli), TR62 (Adana and Mersin), TRB1 (Malatya, Elazığ, Bingöl, and Tunceli), in which fraction of minimum wage workers was around 30% in 2015, decreased in 2016. However, since the other high impacted regions such as TR33 (Manisa,Afyonkarahisar, Kütahya, and Uşak), and TRC1 (Gaziantep, Adıyaman, and Kilis) experienced an increase in employment in the same year, such a decrease does not identify the an effect of the minimum wage increase on employment.

3.3.3 Informality

Welch (1976)'s and Gramlich (1976)'s two sector models predict that there will be a labor flow from covered (formal) sectors to uncovered sectors (informal) following the minimum wage increase. This is because, according to these models, individuals not employed in formal sectors due to minimum wage increase can have a reservation wage lower than formal wages. To investigate this prediction, an analysis of informal employment trends of the various skill groups is illustrated in Figure 3.10. The figure suggests that negative trends in informality among less than high school and high school educated workers came to stop in 2016. For example, the share of informal workers within high school group increased from 27.73% to 27.77% in 2016, whereas it had declined from 29.06% in 2014 to 27.73% in 2015. Similarly, the share of informal workers among less than high school educated workers rose from 8.92% to 9.08% in 2016, while there had been consistent decrease in the share of informal workers within this group until this year.

By contrast, tertiary education group maintained its decrease in informality in 2016. In short, one might tempted to argue that, other things being equal, presence of a 2016 reversion in negative informality trends for most affected groups is due to minimum wage increase.

We see informality trends by age in Figure 3.11. To confirm the positive effects of minimum wage on informality shown in Figure 3.10, Figure 3.11 should illustrate an increase in the share of informal workers within 15-24 age cohort. This is because the share of minimum wage workers in 2015 was the highest within this age group. However, the figure shows mixed results. There was no relative increase in the share of informal workers within 15-24 age group, but 55-64 group experienced noticeable rise in informality. Recall that (Figure 3.2) the share of workers earning minimum wage or lower than minimum wage level was 40% in 2015 within 55-64 group, while it was nearly 60% within 15-24 group.[7]

[7]Figure A.4 indicates the share of informal workers by region. There are high impacted regions such as TR21 (Edirne, Tekirdağ, and Kırklareli), TR33 (Manisa, Afyonkarahisar,

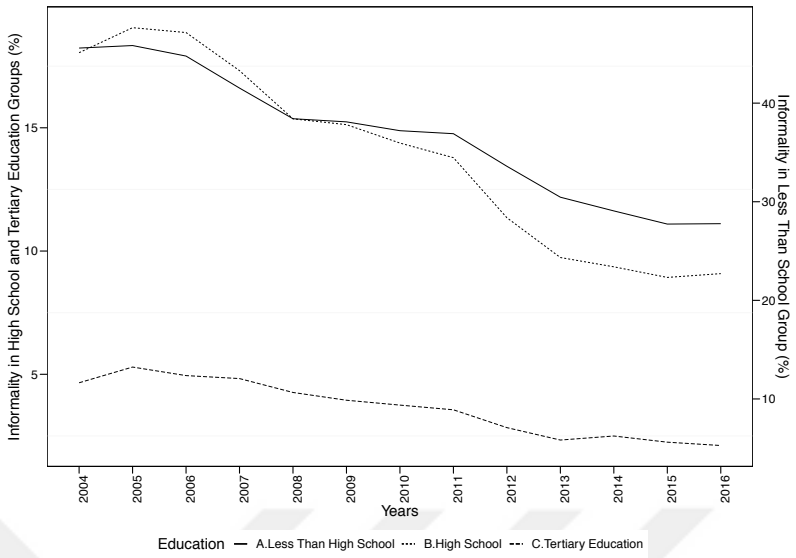


Figure 3.10: Informal workers/Employment ratio by education

Notes: The author's calculations based on annual HLFS. Observations are grouped by education. Number of full-time informal workers who are full time wage, salaried, or casual workers is divided by the number of employed full time wage, salaried, or casual workers.

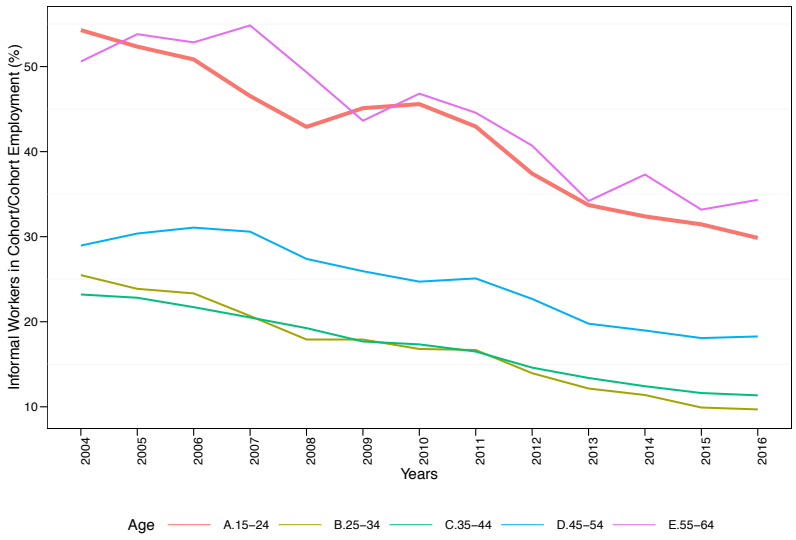


Figure 3.11: Informal workers/Employment ratio by age

Notes: The author's calculations based on annual HLFS. Observations are grouped by age-cohorts. Number of full-time informal workers who are full time wage, salaried, or casual workers is divided by the number of employed full time wage, salaried, or casual workers.

3.4 SUMMARY

In this chapter, I illustrated that the share of minimum wage workers is the highest within the less than high school educated group and the 15-24 age cohort. This implies that a sharp increase in minimum wage should rise the relative wages of these groups. The evidences presented in Figure 3.4 to Figure 3.7, and Figure A.5 to Figure A.9, indicated that this was the case in 2016. This finding signifies that the employment and informality effects of the minimum wage increase in 2016 should be evident for these groups. However, Figure 3.8 to Figure 3.11 gave mixed results. Although a decrease in the employment of young-cohorts is detectable following the minimum wage increase in 2016, less than high school educated workers did not experience a decrease in their employment even though there was 2016 reversion of the downward trend in their informality.

These findings, however, do not imply a causal relationship between the minimum wage increase in 2016 and the labor market outcome variables of the more affected groups. In other words, "other things being equal" assumption does not hold, since the minimum wage increase coincided with Russia's economic sanctions which were likely to affect the sectors in which noticeable share of the minimum wage workers employed in this period. Second, the economy witnessed another political turmoil on 15 July 2016. Without decoupling the effects of these events, it is hard to identify the causal effects of the minimum wage increase. In the following section, I thus relax this assumption and try to deal with these issues.

Kütahya, and Uşak), and TR63 (Hatay, Kahramanmaraş, and Osmaniye), which experienced considerable increases in share of the informal workers in 2016. On the other hand, there are high impacted regions such as TRB1 (Malatya, Elazığ, Bingöl, and Tunceli), TRC1 (Gaziantep, Adıyaman, and Kilis) and East as a whole,where there was no increase in the share of informal workers following the minimum wage increase in 2016.

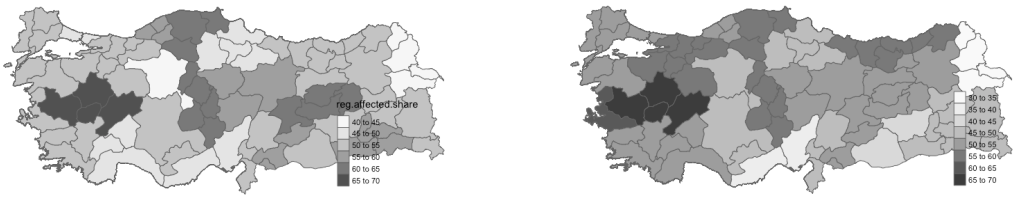
4. EMPIRICAL APPROACH AND MODEL

4.1 IDENTIFICATION STRATEGY

Many studies focused on the minimum wage in US examine the effects of minimum wage policy by exploiting the state-level variation in the minimum wage statute. However, in countries with a national minimum wage level, an identification strategy based on the variation in region-specific minimum wage regulation is inapplicable. But a regional identification strategy still can be a valuable asset for such countries, because the effects of a national minimum wage level can differ across regions. Card (1992*b*), for example, captures the effects of the federal minimum wage increases in 1990 and 1991 in the U.S. by utilizing the state-level variation in the fraction of the workers affected by the increases. Dolton et al. (2015), and Caliendo et al. (2018) use same methodology to examine the effects of the minimum wage introduction in the U.K. in 1999 and in Germany in 2015, respectively.

I follow these studies and exploit the regional variation in the fraction of affected workers whose wages fall below the new minimum wage level in t, but equal or surpass the 75% of the minimum wage level in $t-1$. The idea is that if an increase in minimum wage affects the labor market outcomes of the mostly affected groups such as less than high school educated workers or young workers, then the regions with a higher fraction of affected workers within these groups in year $t-1$ should experience a *relative* change in these groups' outcomes in year t when the increase in minimum wage takes place.

HLFS provides spatial information at NUTS-1 and NUTS-2 levels. The provinces are classified into 12 and 26 regions according to their geographical, demographic,



(a) Workers with no high school degree **(b)** Young (15-24) workers

Figure 4.1: Regional fraction of workers potentially affected by the minimum wage increase in 2016

Notes: The author's calculations based on annual HLFS. The map shows the regional distribution of workers earning higher than 711TL (75% of the lowest minimum wage level in 2015) but less than 1300TL (the minimum wage level in 2016). Hence, it displays the regions most affected by the minimum wage increase in 2016.

economic, and socio-cultural proximity. I use NUTS-2 level (26-regions) classification to utilize a higher variation and define the fraction of affected workers in each NUTS-2 region in year t as the following:

$$\frac{n_{ijt}}{E_{ijt}} \tag{4.1}$$

where n_{ijt} is the number of affected workers, whose wages are equal to or higher than the 75% of the minimum wage level in year t, but lower than the minimum wage level in year $t+1$, in demographic group i in NUTS-2 region j in year t; E_{ijt} is the employment rate of salaried, waged, and casual workers in demographic group i in region j in year t. I have two demographic groups: youngers (15-24), and less than high school educated (LTH) workers, which are expected to be mostly affected by an increase in minimum wage (see section 3.2).

For example, the left panel of Figure 4.1 shows that the ratio of the number of less than high school educated workers whose wages equal or exceed 711TL (75% of the minimum wage level in the first half of 2015) but lag behind 1300TL (minimum wage level in 2016) in TR33 region (Manisa, Afyonkarahisar, Kütahya, and Uşak) to number of all salaried, waged, and casual workers with less than high school education in the same region was around 0.7 in 2015. If the minimum wage increase in 2016 caused a noticeable change in the labor market outcomes of less than high school educated workers in that region, then we should observe a considerable change in their labor market outcomes in that region. However, it is important to note that

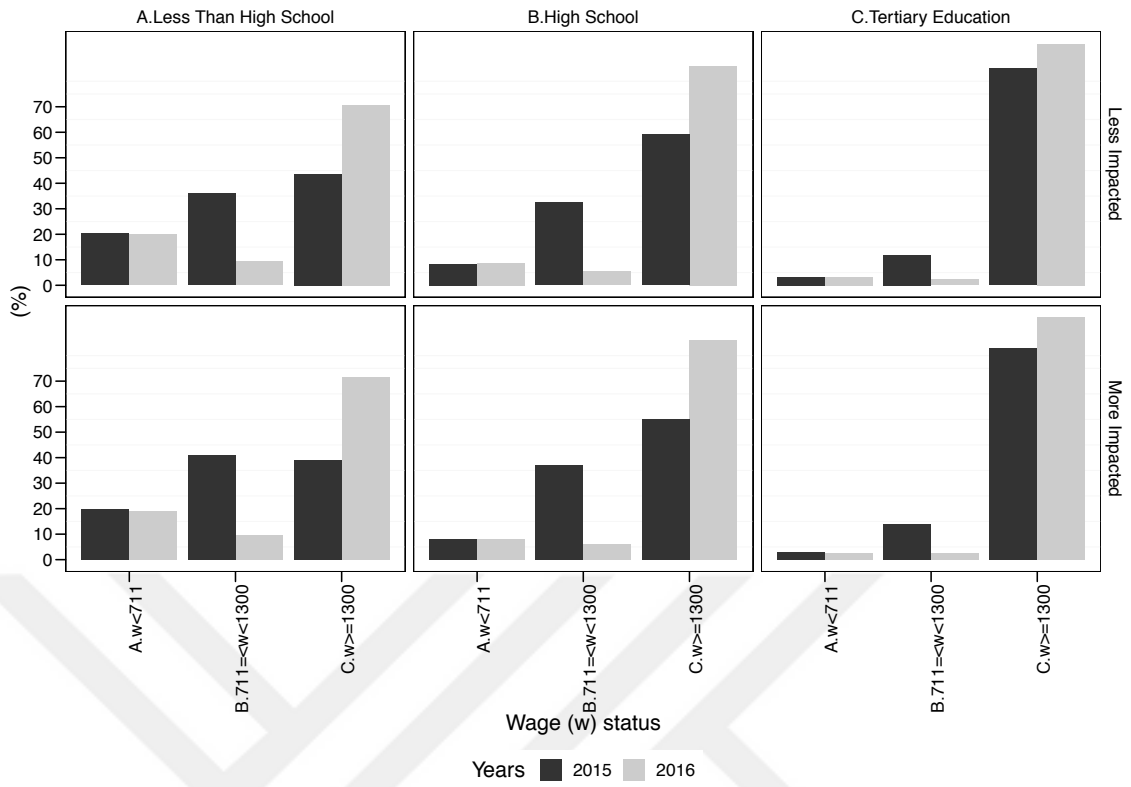


Figure 4.2: Change in the proportion of workers with various wage status by regions and education groups

Notes: The author's calculations based on annual HLFS. For interpretation see text. Proportions are calculated in the following way: Salaried, waged, or casual workers' wage status is determined. Observations are grouped by year, region, wage status, and education groups. Finally, number of workers within each skill and wage group in more impacted and less impacted regions is divided by total wage employment within these groups.

the regions with a lower fraction of affected workers are not necessarily least affected regions. Table B.1 illustrates that the regions with a lower fraction of affected workers can have a higher fraction of subminimum wage workers. By focusing on only the fraction of affected workers, I assume that the subminimum wage workers do not become minimum wage workers even if an increase in minimum wage takes place. Below, I discuss the validity of this assumption.

Armed with these and Card (1992*b*)'s illustration, this identification idea can be generalized in:

$$\Delta W_{ijt} = \alpha + \beta_1 F_{ijt-1} + u_{1ij} \tag{4.2}$$

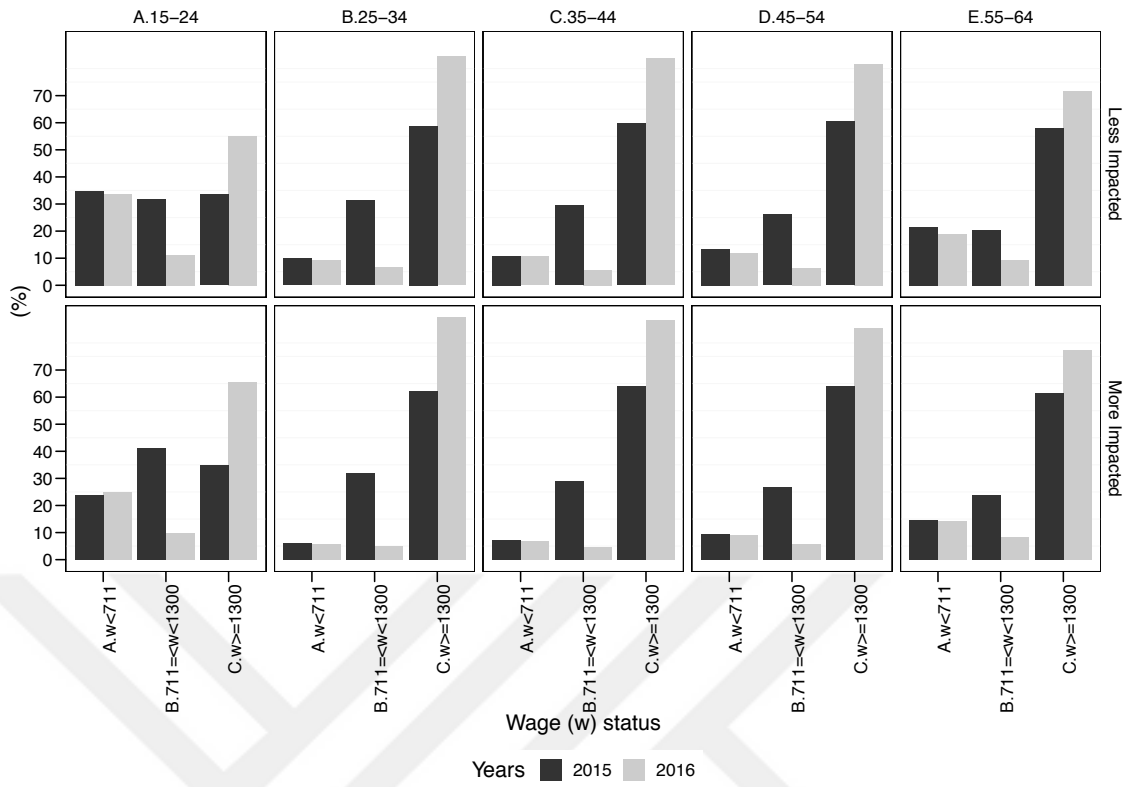


Figure 4.3: Change in the proportion of workers with various wage status by regions and age groups

Notes: The author's calculations based on annual HLFS. For interpretation see text. Proportions are calculated in the following way: Salaried, waged, or casual workers' wage status is determined. Observations are grouped by year, region, wage status, and age groups. Finally, number of workers within each skill and wage group in more impacted and less impacted regions is divided by total wage employment within these groups.

where ΔW_{ijt} is the change in the average wages of group i in region j in year t; F_{ijt-1} is the fraction of affected workers within group i in region j in year $t-1$, and u_{1ij} captures the unobservable factors playing a role in change in the average wages of group i in region j. The model quantifies the effects of minimum wage increase from $t-1$ to t on average wages of group i in region j in year t. Then the minimum wage's impact on other labor market outcomes such as employment and informality can be captured in:

$$\Delta Y_{ijt} = \delta + \beta_2 \Delta W_{ijt} + u_{2ij} \tag{4.3}$$

where ΔY_{ijt} is the change in employment/population ratio or share of informal workers in group i in region j in year t; u_{2ij} are unobservable factors, and ΔW_{ijt} comes from the preceding model. Since β_2 implies the labor demand elasticity, $\beta_1\beta_2$

identifies the causal effects of minimum wage on the labor market outcomes Y_{ijt}.

To examine whether such identifying wage differences owing to the minimum wage increase exist, I classify the NUTS-2 regions into less impacted regions in which the fraction of less than high school educated workers affected by the minimum wage increase in 2016 is lower than the median fraction, and more impacted regions with higher than the median fraction.

Figure 4.2 displays the share of the workers whose wages fall below 711TL (A-the subminimum workers), equal or exceed 711TL but lag behind 1300TL (B-the potential new minimum wage workers), and finally equal or surpass 1300TL (C-the new minimum workers and others), within each skill group in more impacted regions and less impacted regions in 2015 and 2016. To read the graph, the top-left corner panel shows that in less impacted regions, the average share of the subminimum workers (A) within less than high school educated group, whose wages are lower than 711TL, is nearly 20% of all less than high school educated workers in these regions in 2015 and 2016.The figure shows that the decrease in the share of the potential new minimum workers (from nearly 40% in 2015 to 10% in 2016) is higher within less than high school group in more impacted regions.[8]

In Figure 4.3, I classify the regions into less impacted regions where the fraction of affected young (15-24) workers in 2015 are lower than the median fraction, and more impacted regions where the fraction of affected young workers in the same year is higher than the median fraction. The figure illustrates that there is a steeper decrease in the share of the potential new minimum workers within 15-24 age cohort in more impacted regions. To put it from a different perspective, the increase in 2016 in the share of workers whose wages are equal to or higher than 1300TL is the

[8]However, the figure also shows that there is a very low difference between the decrease in the more impacted regions and the decrease in the less impacted regions. This is possibly because I "throw away so much potential identifying information" by grouping NUTS-2 regions into more impacted and less impacted regions. When I use a continuous treatment variable in the following subsection, however, the regional differences become more evident.

highest among young workers in more impacted regions. All in all, Figure 4.2 and Figure 4.3 reveal that there was a relative positive change in the wage outcomes of the mostly affected groups in more impacted regions in 2016.[9] The figures also show that the minimum wage increase does not affect the subminimum workers (there is no considerable change in the share of the workers earning less than 711TL from 2015 to 2016), implying that the share of subminimum wage workers across regions are not concern for this study's identification strategy, because an increase in minimum wage simply does not affect these workers' wage outcomes.

4.2 MODEL

If regions with a higher fraction of affected workers experience relative changes in the labor market outcomes of mostly affected groups such as less than high school educated workers and young workers, Dolton et al. (2015)'s following incremental difference-in-difference (IDID) model is able to capture these changes by decoupling the effects of time-invariant regional characteristics, time-variant regional economic activity, and year specific effects.

$$Y_{jt} = J_j + \gamma_t \sum_{k=2014}^{t} T_{k(t)} + \theta_0 F_{jt-1} + \theta_t^{IDID} \sum_{k=2014}^{t} T_{k(t)} F_{jt-1} + \delta X_{jt-1} + \epsilon_{jt} \qquad (4.4)$$

where Y_{jt} is labor market outcomes, i.e., mean wages, employment ratio, and informality ratio of less than high school educated workers or of young workers in region j in year t. J_j is a dummy variable for region j, capturing the effect of the time-invariant characteristics of the region on dependent variables. $T_{k(t)}$ is the set of year dummy variables starting from 2014 (for a discussion of base year, see below), which are 1 when $k = t$, 0 otherwise, showing that coefficients should be interpreted relative to 2014. F_{jt-1} is the fraction of affected less than high school educated workers or of affected youth workers in region j in year $t-1$. $T_{k(t)}F_{jt-1}$ is the interaction of year fixed effect and the fraction. Coefficient of interest θ_t^{IDID}

[9]The evidence presented in Figure A.5 to Figure A.9 complements this analysis. These figures show that there is a hump in the wage distribution at the the minimum wage level in 2016, meaning that the minimum wage increase affected the wage distribution of the mostly affected groups. In other words, ΔW_{i2016} is positive.

shows the effect of minimum wage change from $t-1$ to t, what is left from the year specific effects, the effects of time-invariant regional characteristics, the effects of time-variant regional economic activity in preceding year which is captured by log GDP (X_{jt-1}) and unobservable changes in regional activity (ϵ_{jt}). *The coefficient thus quantifies how regions with a higher fraction of affected workers within mostly affected groups such as less than high school educated workers or young workers in* $t-1$ *experience a relative change in average outcomes of these groups in t.*

This interpretation, however, requires satisfying the assumption that the error term ϵ_{jt} is not correlated with F_{jt-1}. This is because if some explanatory variables which are correlated with the fraction of affected workers in year $t-1$ are omitted, the effects of the interaction term $T_{k(t)} * omittedvariable$ is falsely attributed to the effects of interaction term $T_{k(t)}F_{jt-1}$, nullifying the causal effects of the minimum wage increase. Indeed, Baskaya & Rubinstein (2012) argue that the fraction of affected workers is procyclical and it is correlated with macroeconomic conditions.

Figure 4.4 shows that Baskaya & Rubinstein (2012)'s procyclicality concern is valid. Because there was a considerable decrease in the fraction of affected less than high school educated workers in 2009, a recession year in Turkey. It also shows that the fraction increased in the high growth years 2010 and 2011. This is possibly due to the procyclicality of the wages. It is likely that high growth rates allow subminimum wage workers to become minimum wage workers, causing a spurious increase in the fraction of affected workers independently of the minimum wage increase (Table 1.1 shows that the real increases in minimum wage in 2010 and 2011 were 0% and 2%, respectively). However, there has been no positive relationship between economic growth and the fraction since 2013. Following this year, the average growth rate has decreased while the fraction has increased. This divergence can be interpreted as evidence showing that considerable increase in the fraction after 2013 is associated with the real minimum wage increases in 2015 (3%) and 2016 (25%). Thus, the omitted variable correlated with macroeconomic activity does not affect the robustness of the analysis after 2013. I thus limit my time period

to the years following 2013. Yet, I conduct a time-period sensivity test in robustness analysis.

Up to this point, I have suggested that there are regional differences which can identify the effects of the minimum wage increase and that these differences are not correlated with any omitted variable during the period of 2014-2016. However, the violation of the parallel trend assumption is another concern. This assumption implies that there is parallel trend between the outcome of the mostly affected groups in more impacted regions and that of the mostly affected groups in less impacted regions in the absence of the sharp minimum wage increase in 2016. If the assumption is satisfied, then a difference between labor market outcomes of more impacted regions and that of less impacted regions in 2016 can be attributed to the effects of the sharp minimum wage increase. The violation of the assumption is likely, however, because the regions with the lower fraction of affected workers are in the Northeast and Mediterranean regions (Figure 4.1). It is known that the Eastern regions of the country has been much more subjected to region-specific shocks such as armed conflict or a region-specific state of emergency. Since the fraction of affected workers are relatively low in these regions, a negative shock coincided with the minimum wage increase within these regions can create negative employment outcomes independently of the minimum wage increase, causing the spurious positive relationship between employment outcomes and the fraction. It is thus possible that I falsely attribute the effects of such time-variant unobservable heterogeneities to interaction term $T_{k(t)}F_{jt-1}$

To investigate this possibility, I define the regions in which the fraction of affected less than high school educated workers in 2015 was higher than the median fraction as more impacted regions. Figure 4.5 shows that the fraction has been higher in more impacted regions. The figure also illustrates that mean wages has followed a parallel trend between more impacted regions and less impacted regions since 2014. The divergence between regions in 2013, however, does not support the assumption that increase in mean wages of workers with no high school degree would have been

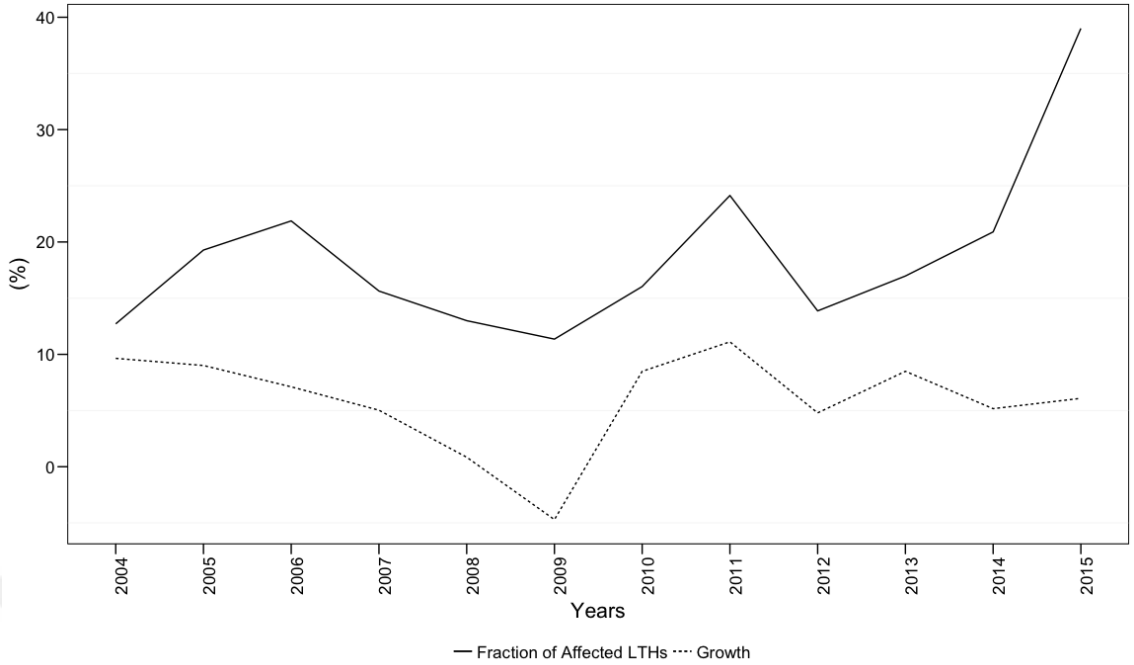


Figure 4.4: Fraction of affected less than high school educated workers and economic growth

Sources: World Bank (for growth figures) and the author's calculations based on annual HLFS (for the fraction)

similar between more impacted regions and less impacted regions in the absence of the minimum wage shock.

On employment side of the figure, we observe that female workers' employment (overall and LTH) has experienced diverging trends between more impacted and less impacted regions. Moreover, less than high school educated male workers' employment trend has been also slightly different between regions. In 2014, when there was no real increase in minimum wage, male workers' employment negatively differed in more impacted regions. In 2015, on the other hand, female workers' employment positively differed in less impacted regions. These figures illustrate that employment outcomes of workers with no high school degree can follow different trends between regions even in the absence of the minimum wage shock.

Panels D in Figure 4.5 indicate that the downward trend in informality of male workers stopped in more impacted regions while it remained same in less impacted regions. This evidence can be interpreted as a positive effect of the minimum wage

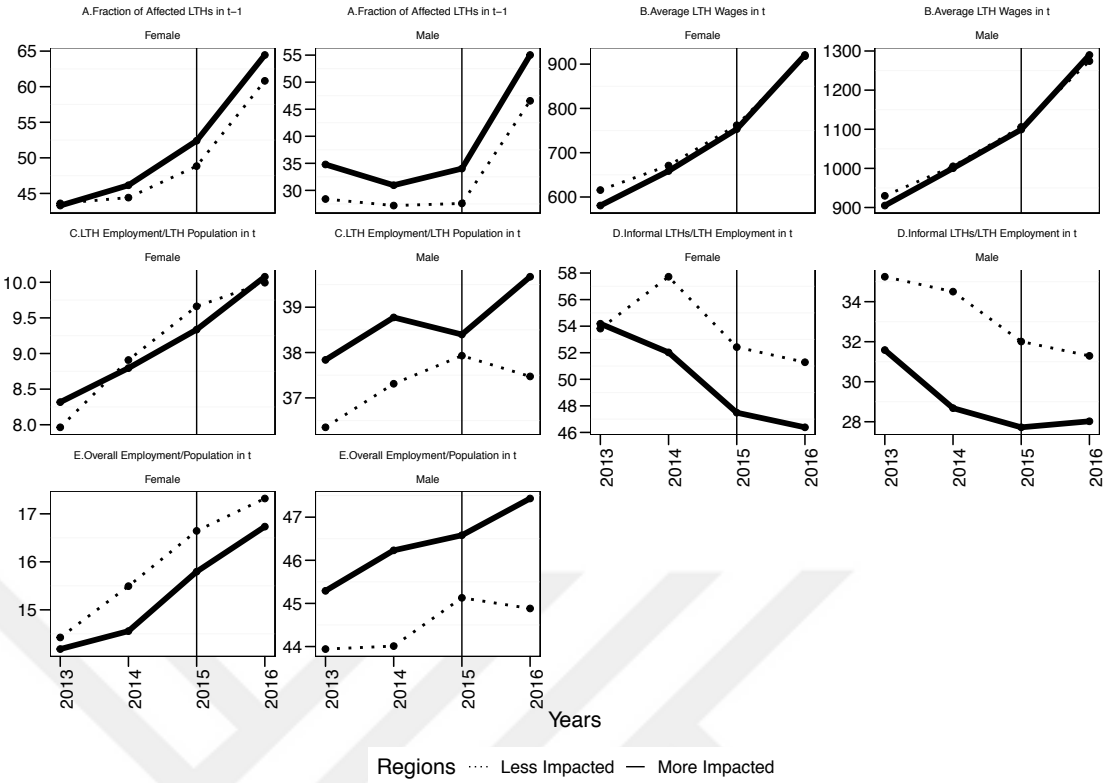


Figure 4.5: Investigating parallel trend assumption, less than high school educated workers

Notes: The author's calculations based on annual HLFS. The regions in which the fraction of affected LTH workers is higher than the median fraction is defined as the more impacted regions.

increase on informality in 2016 on less than high school educated male workers, since the regions with a higher fraction of affected male workers seem to experience a relative increase in the share of informal male workers within less than high school educated group after the minimum wage increase. However, such evidence should be read with caution because informality of men and women diverged between regions in pre-treatment period. For this reason, the figure suggests that the parallel trend assumption does not hold for informality outcomes of workers with no high school degree.

Does a change in the definition of more impacted and less impacted regions affect this picture? To answer this question, I classify the regions in which fraction of affected *young* workers in 2015 was higher than the median fraction as more impacted regions. Figure 4.6 indicates that the fraction of affected young workers has been steady until

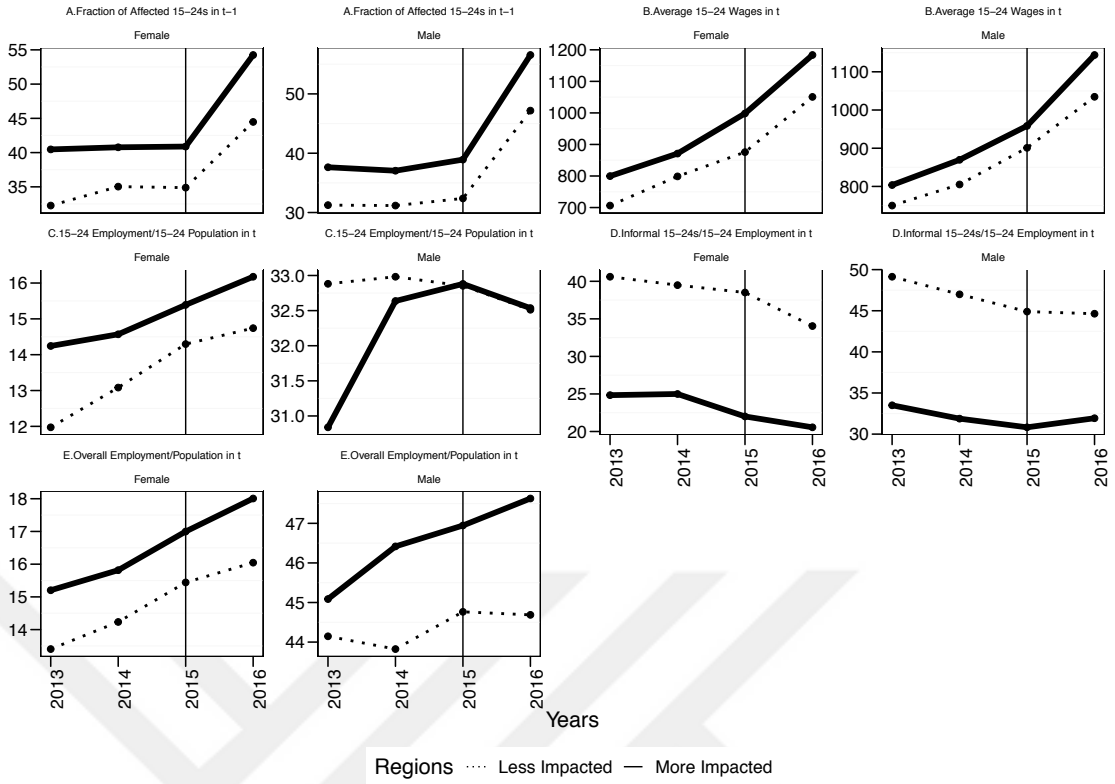


Figure 4.6: Investigating parallel trend assumption, young workers

Notes: The author's calculations based on annual HLFS. The regions in which the fraction of affected young workers is higher than the median fraction is defined as the more impacted regions.

2016. Moreover, there has been a considerable difference between the fraction of more impacted regions and less impacted regions.

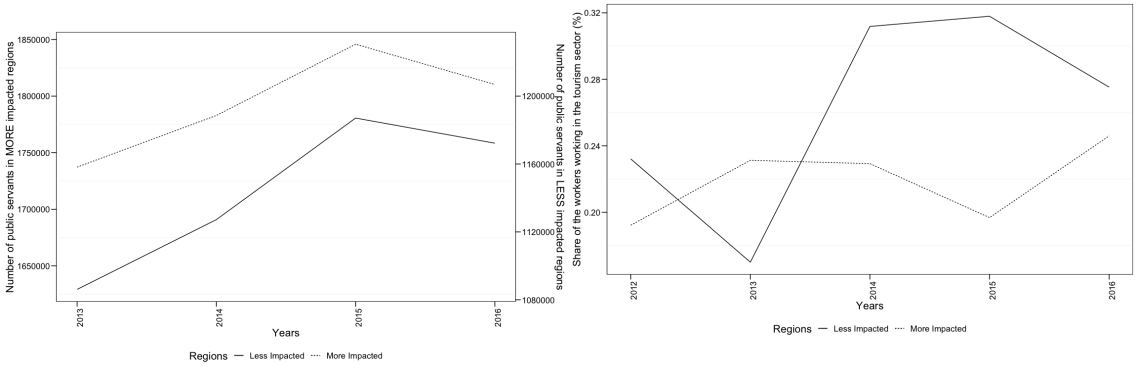
Looking at the young workers' average wages in panels B, we see that there has been no considerable divergence between more impacted regions and less impacted regions until 2016. But following this year, average wages of young male workers in more impacted regions positively differed even though average wages of young female workers in more impacted regions did not increase relatively. Altogether, these figures support both the parallel trend assumption and positive wage effects of the minimum wage increase in 2016 on young male workers.

To investigate whether the assumption that young workers' employment would have followed a common trend between regions in pre-treatment period holds, I look at employment trends. However, panels C in Figure 4.6 show that both female and

male young workers' employment trend has followed diverging trends between regions in the absence of the shock. The figure displays that the regions with a higher fraction of affected young workers could experience an important increase in young male workers' employment outcome while there has been steady decrease in employment of young male workers in less impacted regions in pre-treatment period. It is thus likely that time-variant heterogeneities across regions can lead to spurious positive employment effects of the minimum wage increase. By the same token, young female workers' informality trend has experienced a divergence between regions in pre-treatment period even though young male workers' informality has followed a similar trend between regions in the absence of the minimum wage shock. More importantly, there was a relative positive change in this group's informality following the minimum wage increase in 2016. Overall,Figure 4.6 shows that the assumption that young workers' labor market outcomes would have followed a similar trend between more impacted regions and less impacted regions in absence of the minimum wage shock generally does not hold.

In sum, both Figure 4.5 and Figure 4.6 indicate the importance of addressing the time-varying heterogeneities across regions when exploring the effects of the minimum wage increase in 2016. Thus, to capture the potential region specific shocks, I follow Aksu et al. (2018) who examine the effects of mass immigration in Turkey on labor market outcomes by exploiting the regional variation in immigrant/native ratio. They handle the violation of parallel trend assumption by including $year * 5regions$ interaction terms. These terms are also useful in my case, because, for example, if the Eastern region of the country experienced an armed conflict in 2016, $eastern * 2016$ dummy can capture this conflict's effects on labor market outcomes. By including these terms, I am thus able to decouple the effects of unobservable region-specific shocks.

Finally, in Figure 4.7 I show that the regions with a higher fraction of affected workers are not necessarily more impacted by 15 July coup attempt and Russia aircraft shotdoown. As I discussed in Introduction, the coup attempt's labor market



(a) Number of public workers by regions

(b) Share of workers in tourism sector by regions

Figure 4.7: Controlling for observable confounders

effects were mainly felt by public sector in which overwhelming majority work at higher than minimum wage level while the shootdown's effects were mainly felt by tourism sector. The left panel of the figure shows the number of public employees in less impacted regions and more impacted regions. The number of discharged public employees (i.e., the decrease in number of state employees following the coup in 2016) quantifies the coup's effects on labor markets. We observe in Figure 4.7 that there was no a relative difference between number of discharged state employees in more impacted regions and number of discharged state employees in less impacted regions in 2016.Moreover, more impacted regions did not experience a relative decrease in tourism employment in 2016 (the right panel). In conclusion, it is possible to argue that my regional identification strategy is robust to observable confounders such as Russia's economic sanctions and 15 July coup d'etat attempt.

The last potential problem stemming from a region-level analysis is the underestimation of standard errors. In my case, it is very likely that observations in the same regions are related, violating constant variance and identical distribution assumptions. For instance, some regions such as Istanbul, Ankara, and İzmir have higher variance of income. Hence, underestimated standard errors can overestimate the preciseness of wage coefficients. By clustering standard errors at year and region level, however, it is possible to overcome this problem (Angrist & Pischke 2009)

4.3 FINDINGS

I present my findings on the effects of the minimum wage increases in 2015 and 2016 on labor market outcomes of the mostly affected groups in Table 4.1. There are 78 observations (26 regions x 3 year from 2014 to 2016). For each outcome, I estimate two models with and without year x 5 region interaction terms. All models include year and region fixed effects. All standard errors are clustered at region and year level. The first panel shows the results for less than high school educated male (first six columns) and female (last six columns) workers, the second panel shows the results for young workers. Key variable of interest is D_{2016} *x Fraction of Affected LTH/YOUNG Workers in 2015*. All coefficients are interpreted relative to base year 2014.[10]

In the first panel, columns (1) and (2) present the average wage effects for less than high school educated male workers by iteratively including year x 5 regions interaction terms which control for unobservable region-specific shocks. D_{2015} *x Fraction of Affected LTH/ Workers in 2014* variable controls pre-treatment trend and shows the effects of the 3% increase in real minimum wage in 2015, also allowing us to make a comparison between 2015 and 2016. With these, both columns suggest that the minimum wage increase in 2016 impacted the average wages of male workers with no high school degree positively. After controlling unobservable heterogeneities across regions, the wage coefficient in column (1) becomes larger and more precise in column (2). Standard error (0.09) allows the coefficient to remain positive in sign. The suggestive evidence shows that 10% increase in the fraction of affected less than high school educated male workers in 2015 is associated with 1.7% increase in the average wages of this group in 2016. Since I control the effects of the year specific shocks, time-invariant regional characteristics, observable time-variant economic activity, unobservable time-varying heterogeneities across regions, and pre-treatment trends, this relatively small but positive wage effect on less than high school educated male workers is attributed to the sharp minimum increase in 2016.

[10]For a visual interpretation of the results, see Figure A.10 to Figure A.15

Columns (3) to (6) in the first panel sheds light on employment outcomes of less than high school educated male workers. The models show no effects on employment/population ratio and informal workers/employment ratio. Coefficients are small in magnitude, and their signs are sensitive to large standard errors. No employment findings are in line with my descriptive results which showed that less than high school educated workers' employment did not negatively differ from the college educated workers' employment after the minimum wage increase in 2016 took place. However, no informality effects contradict the descriptive findings presented in Figure 3.10.

Columns (7) to (12) in less than high school panel show the effects on labor market outcomes of female workers. Although wage coefficients are relatively large and negative, their standard errors are large, showing no suggestive or conclusive evidence. When we look at the employment and informality outcomes, we also see the same picture. Armed with these findings, the first panel in Table 4.1 show that the minimum wage increase in 2016 increased less than high school educated workers' average wages and that this increase comes from the increase in male workers' wages. However, there was no change in employment and informality outcomes of less than high school group.

The estimation results for young workers are presented in the second panel of Table 4.1. Column (1) and (2) report the wage outcomes of young male workers. We see that when I do not control time-varying heterogeneities across regions (first column) the wage effects on young male workers are larger than the wage effects on less than high school educated male workers. After controlling for these heterogeneities (second column) the effects become smaller and standard error becomes larger. Both models suggest neither conclusive nor suggestive evidence on wage outcomes of young male workers. In Column (3) and (4), we observe the effects on young male workers' employment. The coefficients are small in size and their signs are sensitive to high standard errors. These findings contradict my descriptive results, because evidence presented in Figure 3.9 showed that young workers' em-

ployment negatively differed from other age groups' employment in 2016 and that this decrease was mainly due to the decrease in young male employment. Such contradiction stems from the fact that year fixed effect for 2016 absorbs negative employment outcomes, implying that the decrease in young male employment was not due to minimum wage increase but due to year-specific effect.

The results for young male workers' informality are showed in column (5) and (6). Key coefficient of interest is larger in the former column, implying that there was a tiny positive informality effects arising from unobservable shocks. These results suggest that an additional 10 percent of affected young male workers in 2015 increases this group's informality by 4.54 percentage points in 2016. Since Table B.3 shows that young male workers' average informality during the sample period is 0.38, this represents 12 percent increase in young male's informality (0.1*0.454/0.38).

Columns (7) to (12) in the second panel of Table 4.1 present the results for young female workers. Wage and employment coefficients are small in size, and their standard errors are very large, suggesting no useful information. However, positive informality effects are conclusive in that the standard errors are low and the coefficients are considerably large. More importantly, controlling for unobservable region-specific shocks increases the informality effects. According to the last column of the second panel, a 10 percent increase in the fraction of affected young male workers in 2015 leads to 17 percent increase in young females' informality in 2016 (0.1*0.511/0.29). All in all, the results presented here show that the minimum wage increase affected average wages of male workers within less than high school group positively, with no employment or informality effects for this group. On the other hand, my findings suggest that the minimum wage increase in 2016 increased informality among young workers. Small and inconclusive wage effects for this group can be attributed this relatively large informality effects.

Table 4.1: Effects of the minimum wage increase in 2015 and 2016 on labor market outcomes of the mostly affected groups

	Dependent variable:											
	I.Less Than High School											
	Men						**Women**					
	Mean Wages		Employment/Population		Informal Workers/Employment		Mean Wages		Employment/Population		Informal Workers/Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Fraction of Affected LTH Workers in $t-1$	−0.068	−0.087	0.086	0.078	0.163	0.193	−0.124	−0.172	−0.017	−0.006	0.079	0.133
	(0.143)	(0.190)	(0.052)	(0.083)	(0.114)	(0.123)	(0.152)	(0.183)	(0.021)	(0.027)	(0.077)	(0.159)
log(Per capita GDP in $t-1$)	0.271	0.320	0.088	0.118	−0.365**	−0.302	0.027	0.156	−0.027	−0.039	−0.753***	−0.868***
	(0.238)	(0.258)	(0.086)	(0.075)	(0.164)	(0.190)	(0.397)	(0.412)	(0.061)	(0.068)	(0.221)	(0.308)
D_{2015} x Fraction of Affected LTH Workers in 2014	−0.008	0.009	−0.054	−0.063	0.028	0.019	−0.123	−0.207	0.020	0.024	0.137	0.092
	(0.097)	(0.115)	(0.039)	(0.054)	(0.063)	(0.083)	(0.166)	(0.184)	(0.015)	(0.020)	(0.085)	(0.113)
D_{2016} **x Fraction of Affected LTH Workers in 2015**	0.164	0.173*	0.023	0.019	0.009	0.074	−0.129	−0.338	0.033	0.032	0.085	0.056
	(0.106)	(0.096)	(0.029)	(0.035)	(0.088)	(0.079)	(0.199)	(0.271)	(0.024)	(0.035)	(0.077)	(0.135)
	II.15-24 Ages											
	Men						**Women**					
	Mean Wages		Employment/Population		Informal Workers/Employment		Mean Wages		Employment/Population		Informal Workers/Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Fraction of Affected YOUNG Workers in $t-1$	−0.414	−0.324	−0.090	−0.166**	−0.025	0.015	0.145	0.251	0.021	0.023	−0.177	−0.249*
	(0.314)	(0.274)	(0.057)	(0.078)	(0.245)	(0.244)	(0.245)	(0.399)	(0.033)	(0.032)	(0.115)	(0.146)
log(Per capita GDP in $t-1$)	−0.040	−0.181	0.164	0.105	−0.253	−0.144	1.203	1.924	0.143	0.133	−1.554*	−1.877**
	(0.570)	(0.510)	(0.145)	(0.145)	(0.368)	(0.352)	(1.238)	(1.215)	(0.096)	(0.126)	(0.793)	(0.860)
D_{2015} x Fraction of Affected YOUNG Workers in 2014	−0.050	0.015	−0.018	0.044	0.181*	0.118	0.051	−0.145	−0.081**	−0.075***	0.139	0.335***
	(0.143)	(0.199)	(0.064)	(0.092)	(0.102)	(0.089)	(0.317)	(0.374)	(0.035)	(0.027)	(0.104)	(0.087)
D_{2016} **x Fraction of Affected YOUNG Workers in 2015**	0.266	0.148	0.036	0.060	0.518**	0.454**	−0.004	−0.369	−0.054	−0.046	0.417***	0.511***
	(0.246)	(0.289)	(0.038)	(0.064)	(0.202)	(0.215)	(0.286)	(0.552)	(0.034)	(0.047)	(0.139)	(0.178)
Region and Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year x 5 Regions Interaction	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Observations	78	78	78	78	78	78	78	78	78	78	78	78
R^2	0.981	0.986	0.989	0.990	0.981	0.989	0.961	0.966	0.987	0.988	0.982	0.984
Adjusted R^2	0.968	0.972	0.982	0.980	0.969	0.979	0.935	0.930	0.978	0.975	0.970	0.967
Residual Std. Error	0.028 (df = 46)	0.026 (df = 38)	0.010 (df = 46)	0.010 (df = 38)	0.023 (df = 46)	0.019 (df = 38)	0.048 (df = 46)	0.050 (df = 38)	0.006 (df = 46)	0.007 (df = 38)	0.032 (df = 46)	0.034 (df = 38)

Note: Standard errors are shown in paranthesis. *p<0.1; **p<0.05; ***p<0.01. All models include year and region fixed effects. All standard errors are clustered at region and year level.For a visual interpretation of the results, see Figure A.10 to Figure A.15

4.4 ROBUSTNESS ANALYSIS

4.4.1 Placebo Test

If the results presented in Table 4.1 are robust to empirical strategy of this study, then we should observe different and contrary results for the least affected groups. Because, the change in the average labor market outcomes of the minimum wage workers within the least affected groups is less likely to govern these groups' labor market outcomes due to low share of the minimum wage workers. Since section 3.2 showed that vast majority of the adult (35-44) workers and college educated group work at higher than minimum wage level, in this section, I focus on these groups.

The first panel in Table B.4 presents the findings on the effects of the minimum wage increases on the tertiary educated workers' labor market outcomes. In other words, it shows the relationship between the fraction of affected college educated workers in $t-1$ in region j and labor market outcomes of college educated workers in year t. The panel indicates that all wage, employment and informality coefficients for D_{2016} *x Fraction of Affected College Educated Workers in 2015* are statistically insignificant and small; large standard errors prevent us from suggesting conclusive or suggestive evidence.

The second panel illustrates the findings on adult (35-44) workers. I have i) statistically insignificant, negative, and relatively small wage coefficients for adult male workers but statistically significant and large wage coefficients for adult female workers; ii) statistically significant, positive, and relatively large employment coefficients for both female and male adult workers; iii) and statistically insignificant informality effects. These findings suggest that the results presented in Table 4.1 are not spurious. Because, the effects of the minimum wage increase are clearly different for the least affected groups. In sum, I find no positive informality effects for these groups.

4.4.2 Alternative Time Periods

My baseline models' base year is 2014. There are three reasons for this. First, the fraction variable does not clearly identify the minimum wage in the years preceding 2014, since it is correlated with macroeconomic activity. But following 2014, it increases in parallel with increases in minimum wage, allowing us to capture the minimum wage's effects. The second reason for choosing 2014 as base year is that the violation of the parallel trend assumption is more likely when the sample period is longer. Third, and most importantly, I do not control individual-level characteristics such as education, experience etc. If I expand the time period, sample composition will be vulnerable to long-run structural changes in labor market.By controlling for economic activity and time-varying heterogeneities across regions, I can deal with the first two issues. The third one, however, requires an individual level analysis. Yet, I expand the time period through the years preceding 2014 to see how an alternative sample period affects the results presented in Table 4.1.

Table B.5 presents the results for the baseline models of Table 4.1, which control time-variant differences across regions, and for the follow-up models in which base years are 2005 (the first HLFS wave captures the fraction of affected workers in 2004) and 2010 (immediate after of the financial crisis). We observe that key finding (positive informality effects on young workers) is similar in two-thirds of alternative specifications.

In the first panel, Columns (2) and (3) show that the positive wage effect for male workers with no high school degree in baseline model becomes larger and more precise in follow-up models. Moreover, small and statistically insignificant positive employment and informality effects in baseline model on less than high school educated male workers becomes larger and statistically significant in models starting from 2005. These results suggest that the positive wage effects for less than high school educated male workers are robust to alternative sample periods but no informality and no employment effects on this group are not. I find small but positive

employment and informality effects on this group.

Column (10) to (18) of the first panel present the baseline and follow-up results for less than high school educated female workers. Similar to male workers within this education group, informality effects become larger and statistically significant as the time period expands. But no employment effect on less than high school educated female workers persists.

The results for young workers are presented in the second panel of Table B.5. At least one of two alternative sample periods gives positive and relatively large informality effects for both male and female young workers in line with the baseline model's findings.

It is important to note the negative and large wage coefficients for young workers in follow-up models. This is possibly due to fact that in follow-up models, the coefficients are interpreted relative to 2005 and 2010 when the labor market composition of female workers (education, experience etc.) was different. Since I do not control individual level characteristics such as education and experience, these omitted variables may cause biased and inconsistent estimates for female workers.

4.5 SUMMARY AND DISCUSSION

The findings presented in this study show the relatively small but positive wage effect on male workers with no high school degree. This effect is robust to alternative specifications with different sample periods. Second, there is a robust evidence showing that there was no negative employment effect of the minimum wage increase on the mostly affected groups. Third, suggestive evidence presented in this study show positive informality effects on young workers. Two of three alternative specifications with different time period give this result. Although the baseline results of this study does not show a positive informality effects on workers with no high school degree, alternative specifications and descriptive findings support the positive informality effects on male workers with no high school degree.

With these results, I suggest that a sharp increase in minimum wage does not have an adverse effect on employment outcomes. However, a labor flow from formal sectors to informal sectors is likely, meaning that non-compliance with the minimum wage law can be a way for employers to absorb increasing labor costs owing to an increase in minimum wage. Relatively small wage effects on male workers with no high school degree, and no wage effects on young workers can be attributed to this relatively large informality effect.

5. CONCLUSION

The question of how does a dramatic increase in minimum wage affect labor market outcomes of less skilled groups have important implications for both economic theory and economic policy. In this study, I try to answer this question in the context of 33% increase in nominal minimum wage in 2016 in Turkey.

I show that young (15-24 years) workers and less than high school educated employees are highly likely to be affected by minimum wage increases. Armed with this finding, my descriptive analysis illustrates that a decrease in youth employment is detectable following the minimum wage increase in 2016. The empirical specifications which are able to capture the effects of time-invariant regional characteristics, time-variant economic activity, region-specific shocks, and year specific effects, however, do not verify this finding. Moreover, both descriptive and empirical findings in this study indicate that there was no decrease in the employment of less than high school educated workers in 2016 even though their wage increased after the minimum wage increase. With these results, this study does not support the proposition that minimum wage increase has adverse effects on less skilled workers' employment outcomes.

However, it supports the positive informality effects of the minimum wage increase on young workers. I find that a 10% increase in the fraction of workers affected by the 2016 minimum wage increase leads to a 12%-17% increase in informality of young workers. Relatively small and statistically insignificant wage effects for young workers can be attributed to this large informality effect.

In this regard, I suggest two competing explanations for the positive effects of the

minimum wage increase on young workers' informality: i) the productivity of this group lag behind the wage increases, employers are thus reluctant to adopt the new minimum wage which exceed the returns created by these workers; ii) there is an unequal bargaining power between employers and workers stemming from the factors such as labor market monopsony, and characteristically high and persistent youth unemployment. Under the latter circumstances, it is very likely that workers are forced to accepting the old minimum wage by working informally. Given that a number of studies (e.g. Elgin & Kuzubaş 2012, Orhangazi 2019) document a stagnation of wages and increasing productivity of workers in Turkey (i.e., a widening "wage-productivity gap") and construct an empirical relationship between the eroding bargaining power of workers and the gap (i.e., increasing unemployment and decreasing union density is associated with the widening wage-productivity gap), the second scenario seems more likely. Due to ambiguity of marginal productivity concept and difficulties in measuring it, however, it is not possible to examine the first proposition empirically.It is also worth noting that this study focuses on short-run effects of the minimum wage policy. It is likely that employers can substitute capital for labor in the long-run due to increasing labor costs accruing from increasing minimum wage. In this situation, the short-run effects can differ from the long-run effects. Future studies capturing these long-run effects will complement the findings of this paper. Moreover, this study is based on the regional variation in the fraction of workers affected by minimum wage. An empirical strategy relying on individual-level longitudinal data could strength the robustness of these findings. As Jardim et al. (2018) and Cengiz (2019) suggest, minimum wage studies focusing on youth or less educated workers rely on "noisy proxies" and ignores a considerable share of minimum wage workers. In this respect, Turkstat's Income and Living Conditions Longitudinal Survey is very underexploited individual-level panel data which allows researchers to follow labor market outcomes of all minimum wage workers. Future studies relying on such an individual level identification strategy thus will be undoubtfully more informative.

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APPENDIX A: ADDITIONAL FIGURES

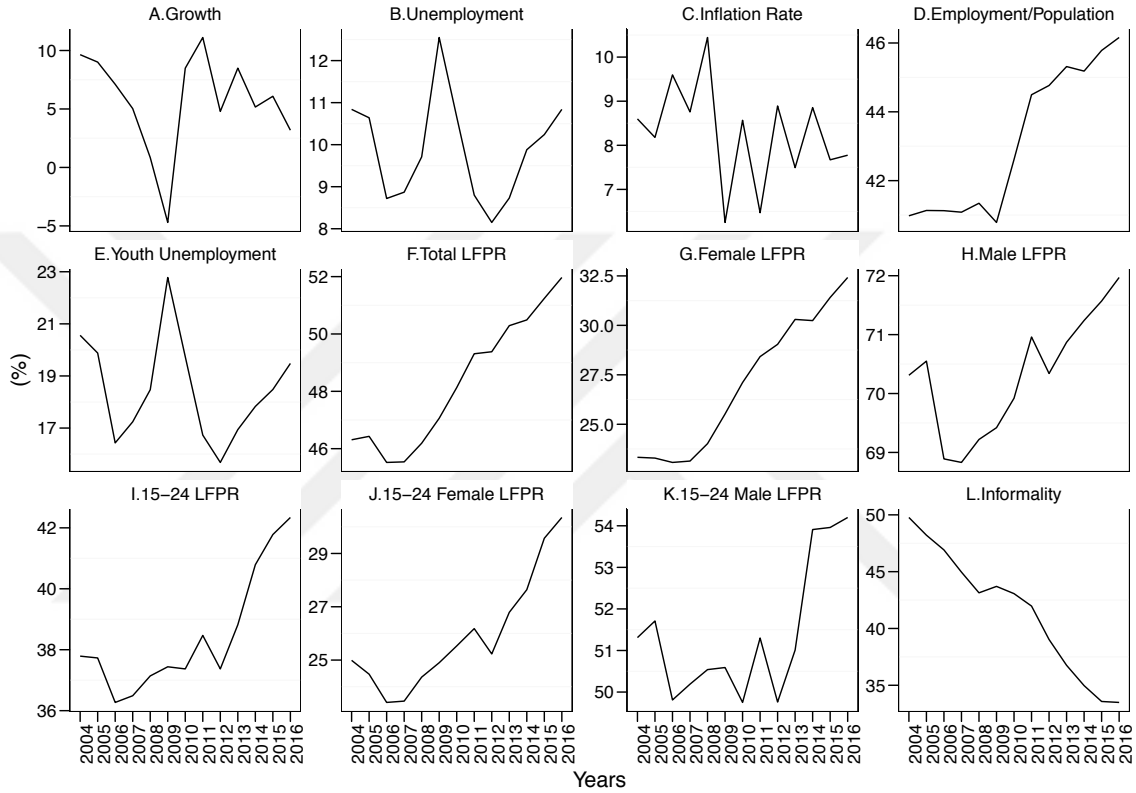

Figure A.1: Main macroeconomic trends during the 2000s

Notes: Informality figures are based on the author's HLFS calculations. The remaining data is coming from World Bank.

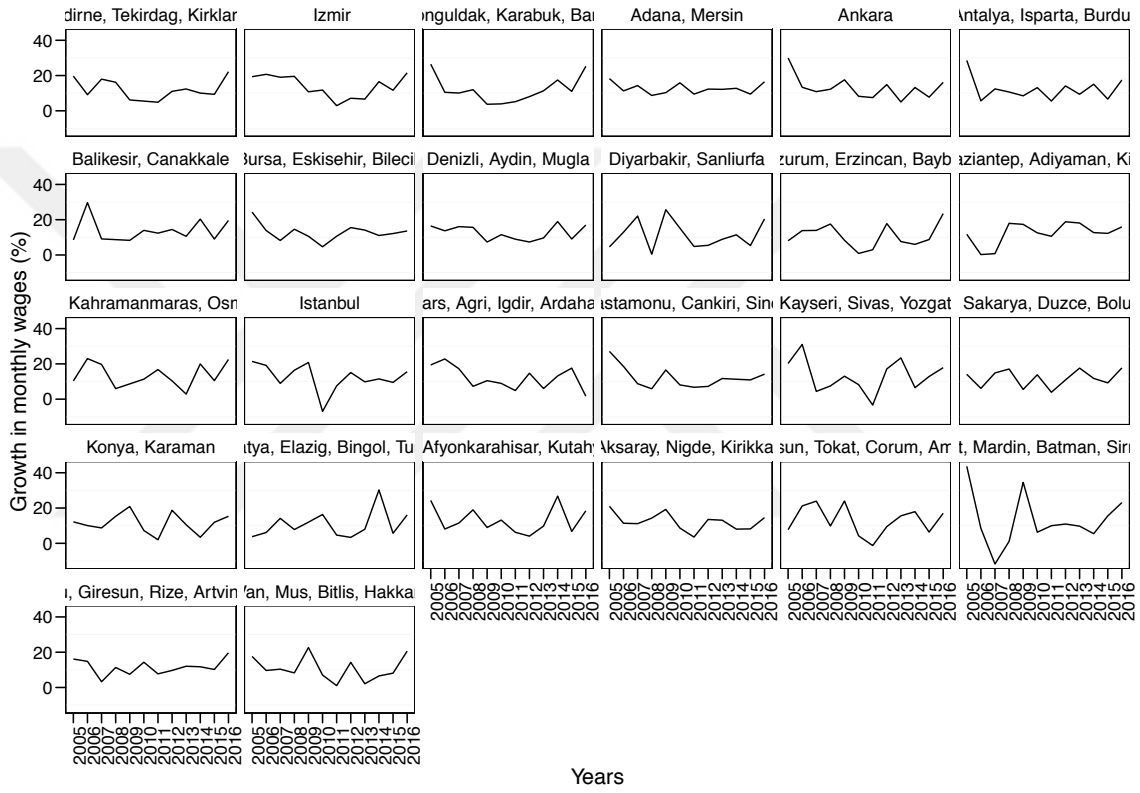

Figure A.2: Average wage growth by regions (NUTS-2)

Notes: The author's calculations based on annual HLFS. Those who are employed, wage or salaried employees, casual workers, full time workers, and declare an earning are included.

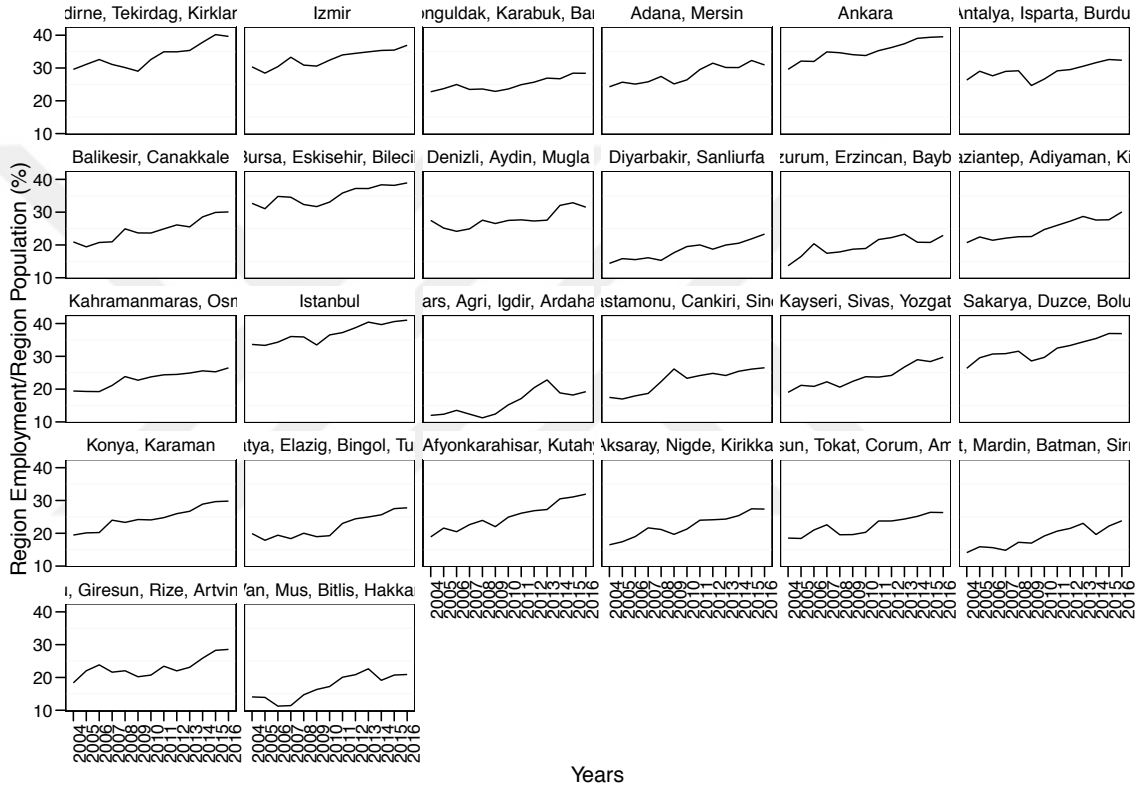

Figure A.3: Full time wage employment/population ratio by region (NUTS-2)

Notes: The author's calculations based on annual HLFS. Observations are grouped by gender, year, and age-cohort. Number of workers who are full time wage, salaried, or casual workers is divided by population.

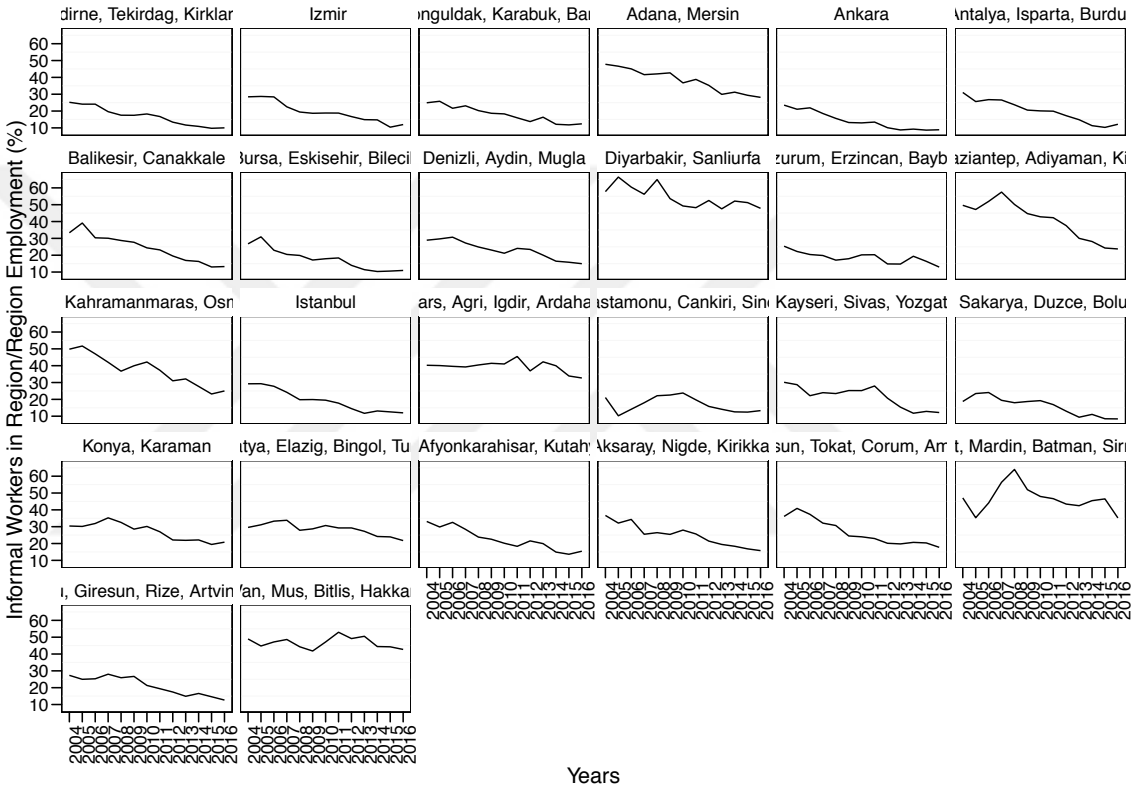

Figure A.4: Informal workers/Employment ratio by region (NUTS-2)

Notes: The author's calculations based on annual HLFS. Observations are grouped by age-cohorts. Number of full-time informal workers who are full time wage, salaried, or casual workers is divided by the number of employed full time wage, salaried, or casual workers.

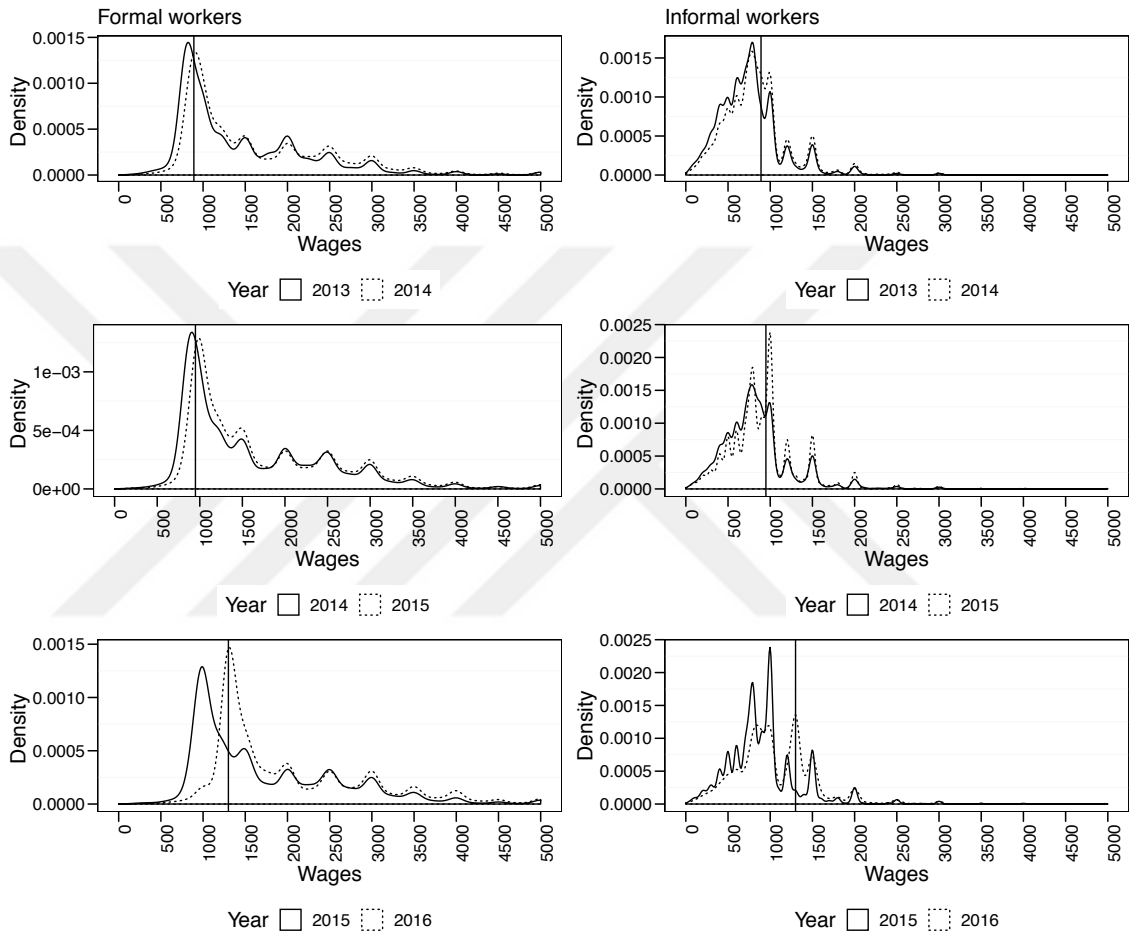

Figure A.5: Wage distribution by years, full-time wage employment, 2013-2016

Notes: The author's calculations based on HLFS.Vertical lines show the new minimum wage for each year-pair.The left column shows the formal workers' wage distribution, the right column shows informal workers' wage distribution.

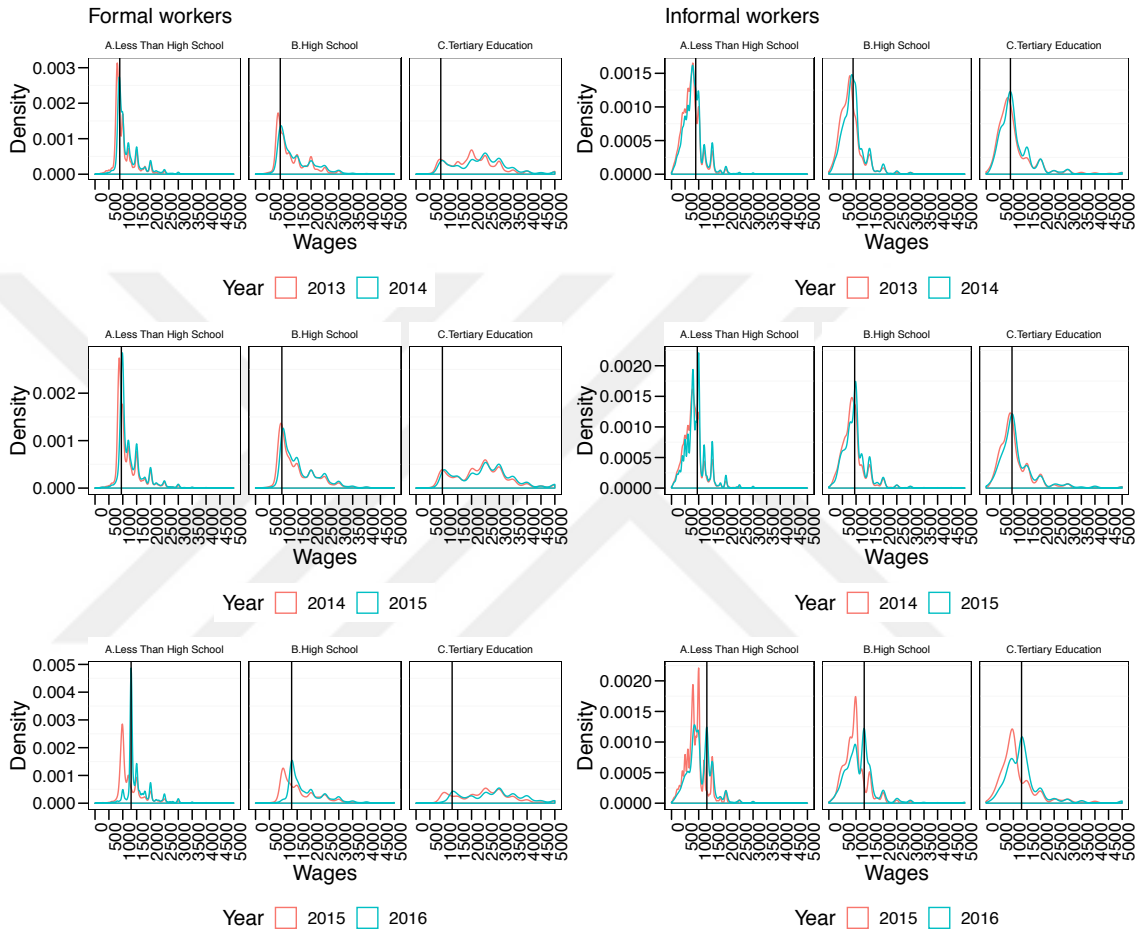

Figure A.6: Wage distribution by years and education groups, full-time wage employment, 2013-2016

Notes: The author's calculations based on HLFS.Vertical lines show the new minimum wage for each year-pair.The left column shows the formal workers' wage distribution, the right column shows informal workers' wage distribution.

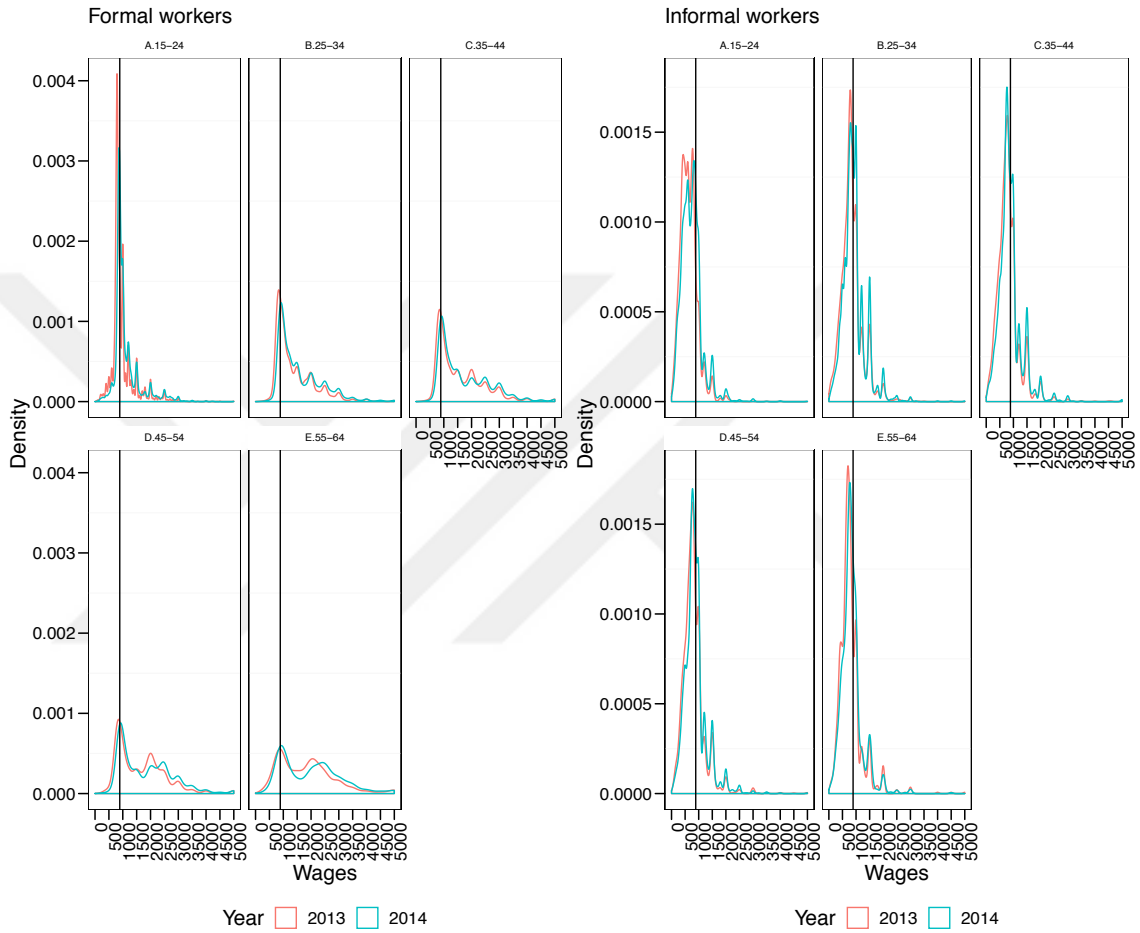

Figure A.7: Wage distribution by years and age groups, full-time wage employment, 2013-2014

Notes: The author's calculations based on HLFS.Vertical lines show the new minimum wage for each year-pair.The left column shows the formal workers' wage distribution, the right column shows informal workers' wage distribution.

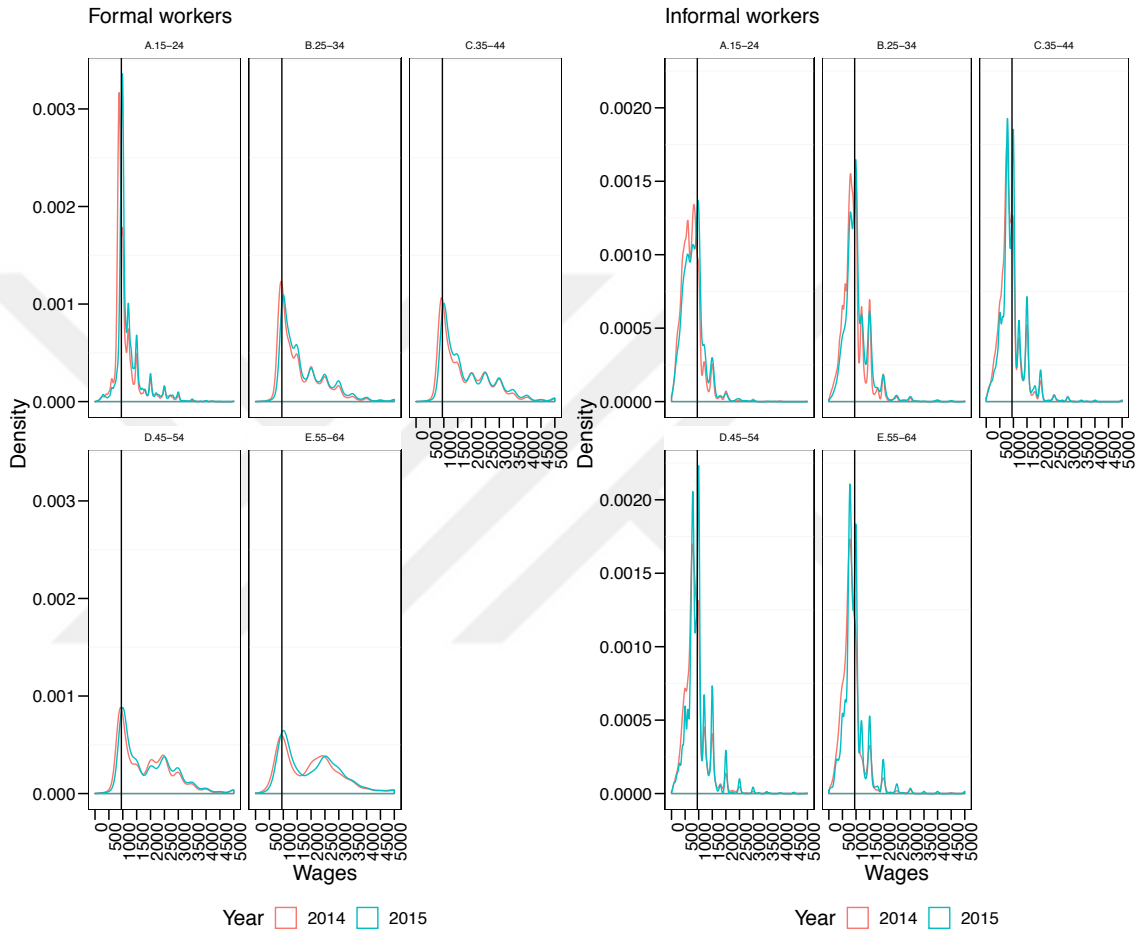

Figure A.8: Wage distribution by years and age groups, full-time wage employment, 2014-2015

Notes: The author's calculations based on HLFS.Vertical lines show the new minimum wage for each year-pair.Left column shows the formal workers' wage distribution, right column shows informal workers' wage distribution.

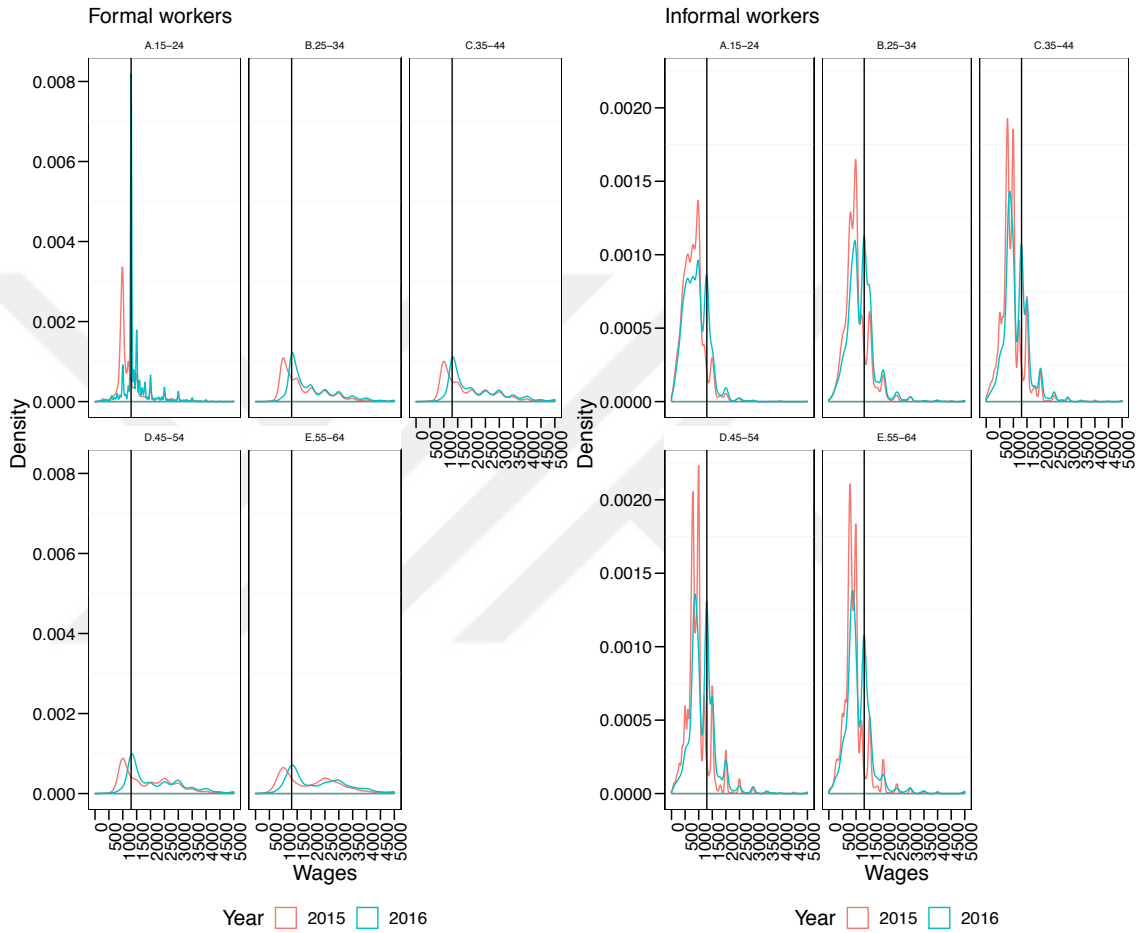

Figure A.9: Wage distribution by years and age groups, full-time wage employment, 2015-2016

Notes: The author's calculations based on HLFS.Vertical lines show the new minimum wage for each year-pair.Left column shows the formal workers' wage distribution, right column shows informal workers' wage distribution.

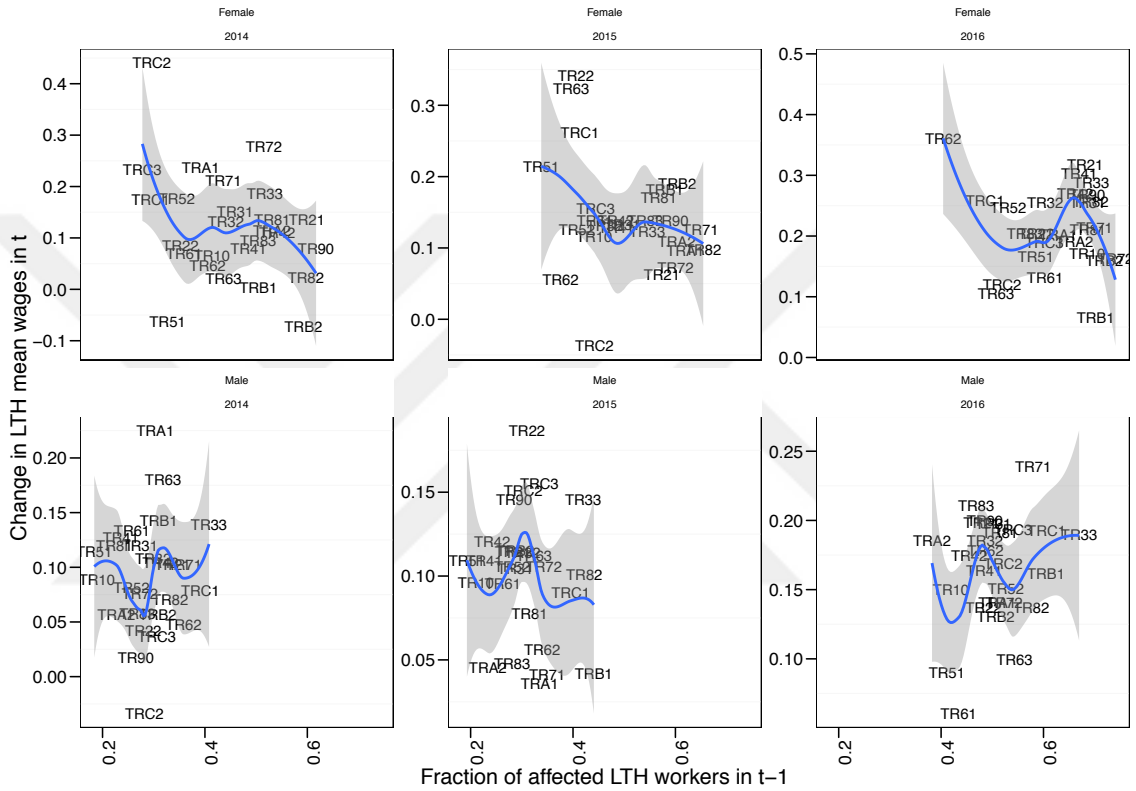

Figure A.10: The relationship between the fraction variable and change in average wages of workers with no high school degree

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

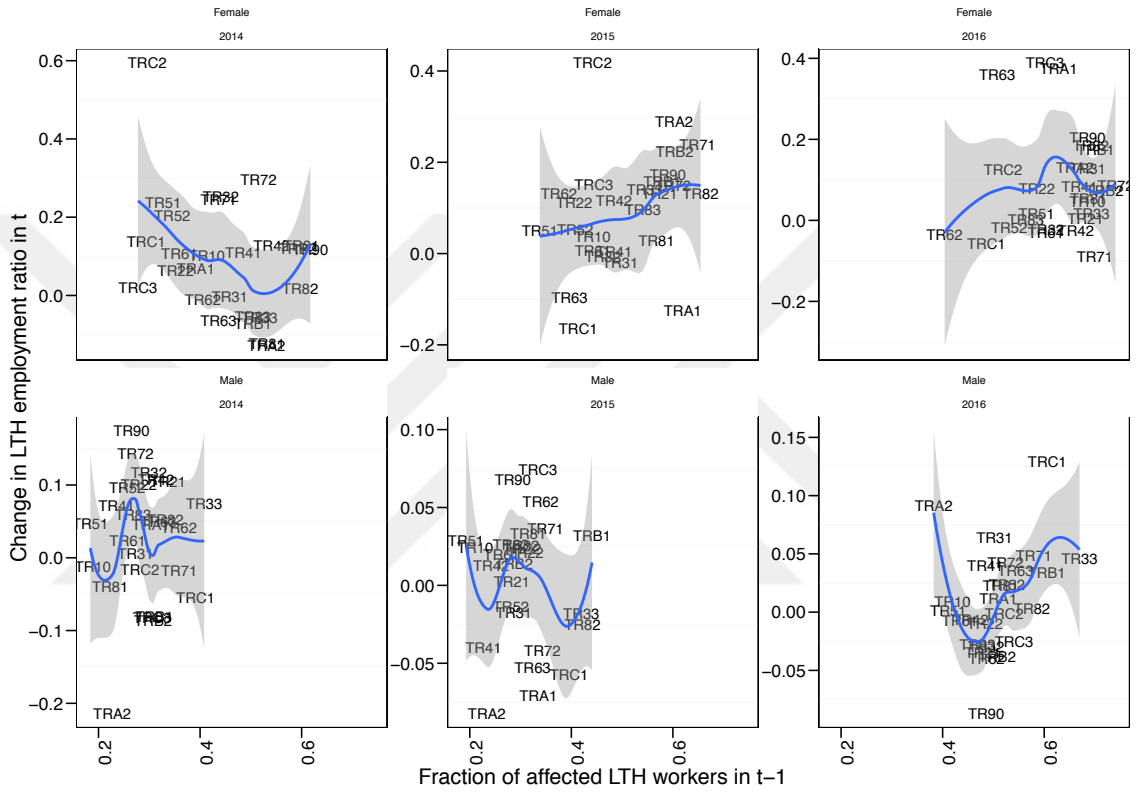

Figure A.11: The relationship between the fraction variable and change in employment rate of workers with no high school degree

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

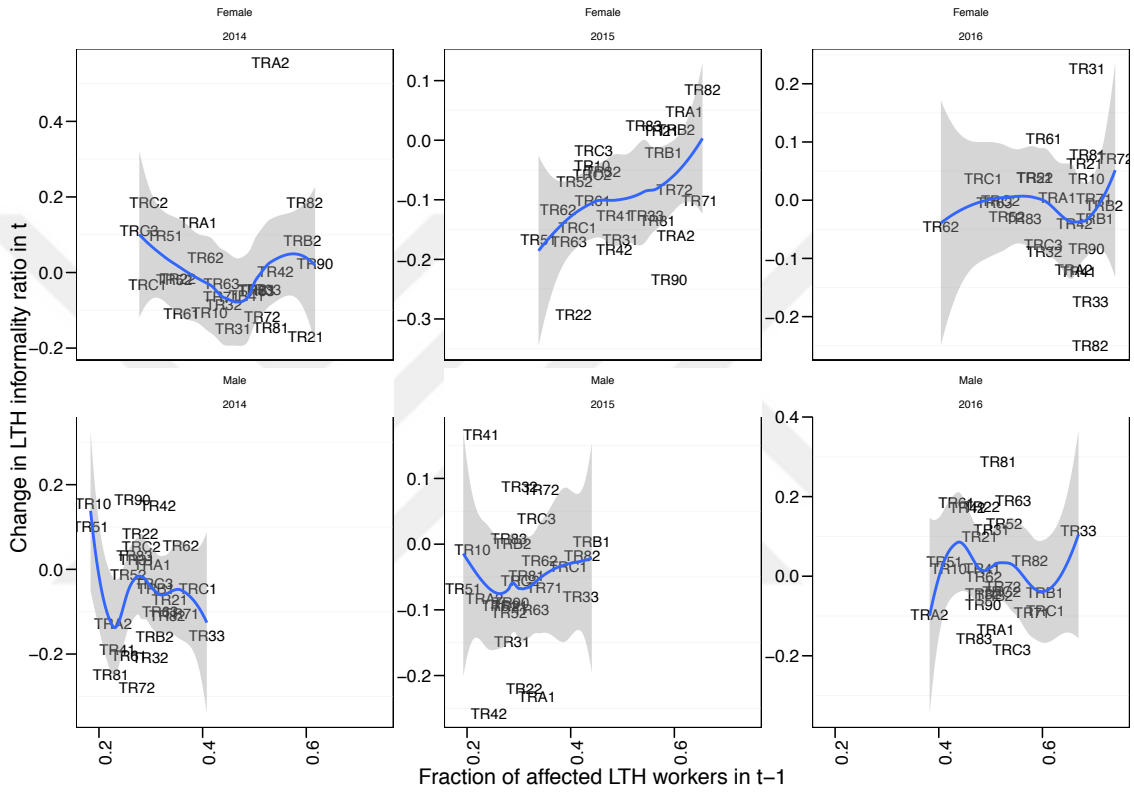

Figure A.12: The relationship between the fraction variable and change in informality rate of workers with no high school degree

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

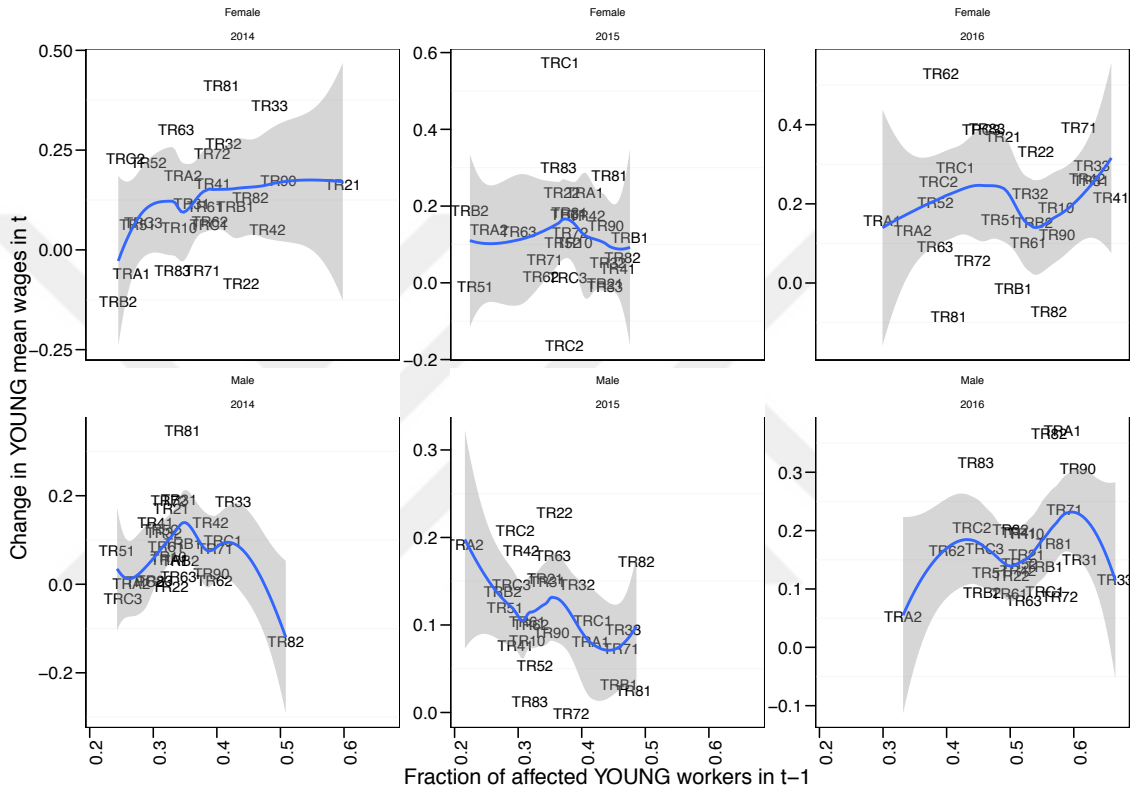

Figure A.13: The relationship between the fraction variable and change in young workers' average wages

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

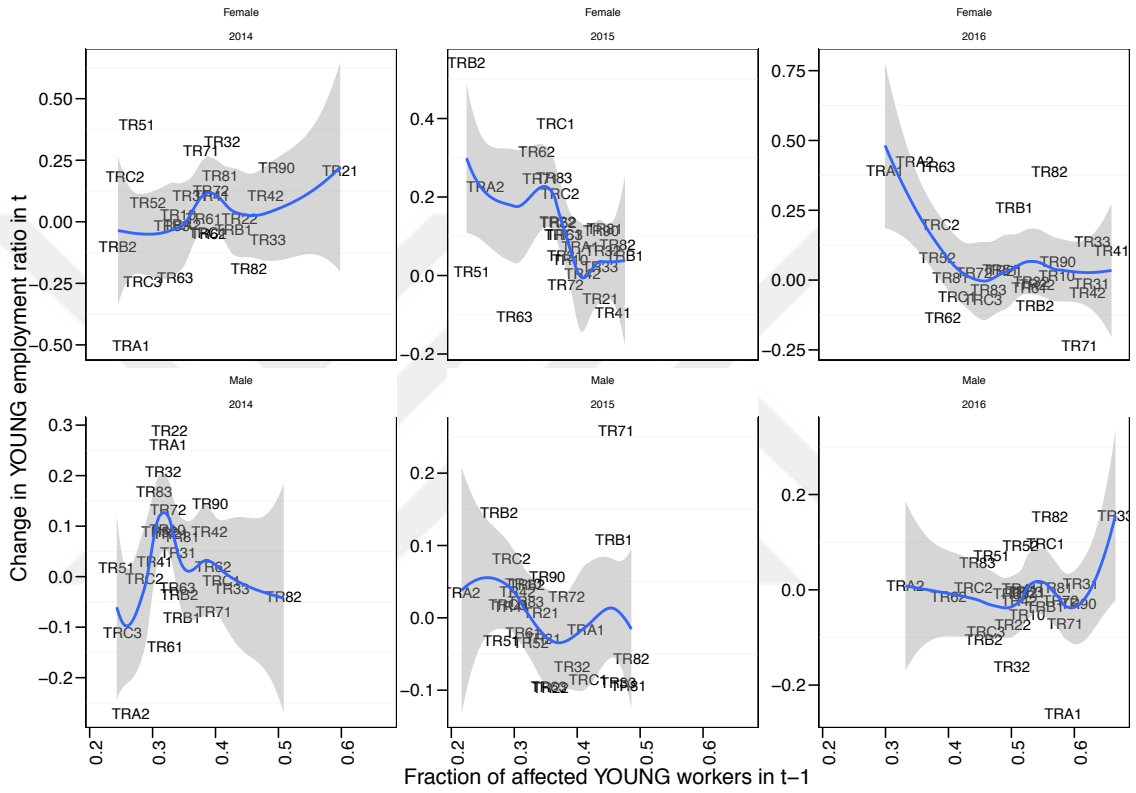

Figure A.14: The relationship between the fraction variable and change in young workers' employment rates

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

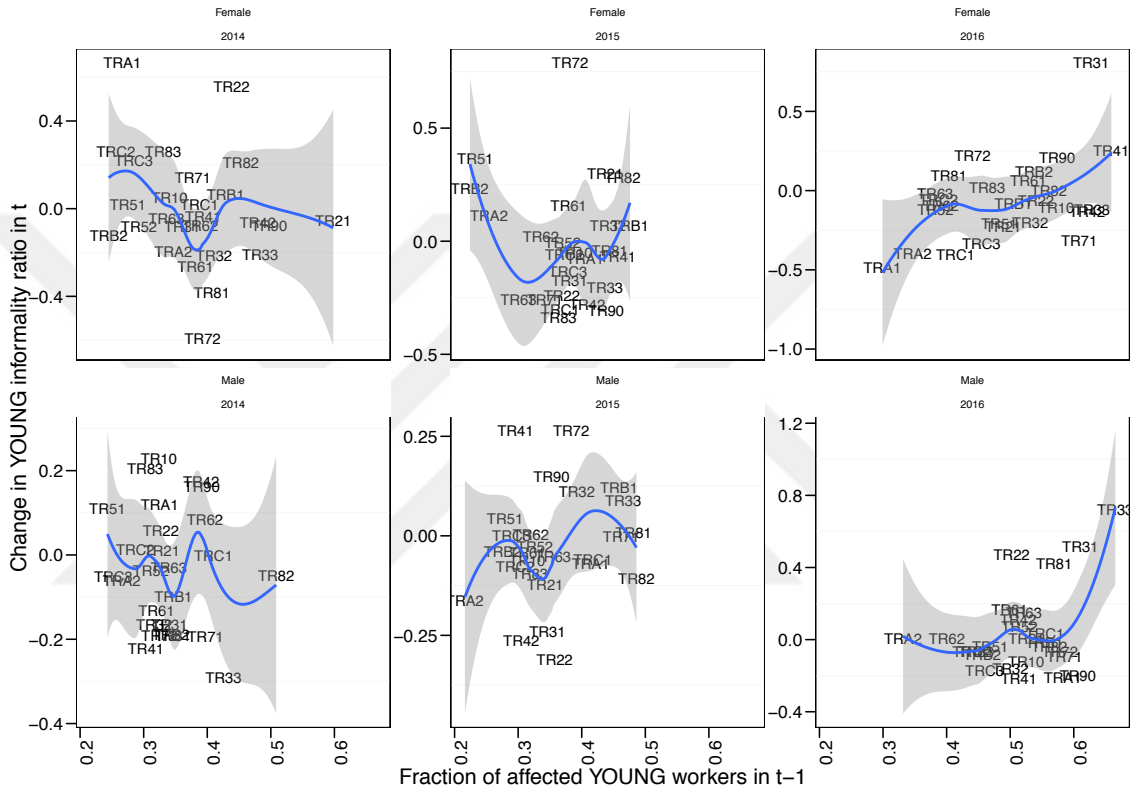

Figure A.15: The relationship between the fraction variable and change in young workers' employment rates

Notes: The author's calculations based on HLFS. X-axis shows the share of workers earning higher than 75% of the minimum wage in year $t-1$ and lower than minimum wage level in year t. Y-axis illustrates how the outcome variable change from $t-1$ to t. Years (t) are showed at the top of the graphs. Each observation is a NUTS-2 region.

APPENDIX B: ADDITIONAL TABLES

Table B.1: Fraction of minimum and sub-minimum wage workers

NUTS-2	Subminimum LTHs	Fraction of Affected LTHs	Subminimum Youngs	Fraction of Affected Youngs
TR33	0.17	0.67	0.14	0.65
TR31	0.25	0.55	0.15	0.62
TR90	0.30	0.53	0.20	0.60
TR71	0.21	0.60	0.14	0.59
TR41	0.30	0.53	0.19	0.56
TR82	0.21	0.61	0.15	0.56
TR42	0.31	0.51	0.21	0.55
TR72	0.27	0.57	0.20	0.54
TR10	0.40	0.48	0.27	0.54
TRB1	0.18	0.62	0.12	0.54
TRA1	0.31	0.53	0.21	0.54
TR22	0.25	0.51	0.16	0.52
TRC1	0.16	0.59	0.14	0.51
TR21	0.25	0.54	0.20	0.51
TR81	0.27	0.55	0.19	0.51
TR61	0.30	0.48	0.22	0.51
TR32	0.21	0.52	0.14	0.51
TR63	0.18	0.54	0.13	0.49
TR52	0.22	0.53	0.15	0.49
TR51	0.41	0.45	0.29	0.47
TRB2	0.29	0.53	0.29	0.47
TRC3	0.15	0.55	0.10	0.46
TR83	0.23	0.49	0.15	0.45
TRC2	0.12	0.52	0.11	0.43
TR62	0.13	0.47	0.07	0.40
TRA2	0.26	0.41	0.31	0.33

Note: Own calculations based on HLFS.

Table B.2: A brief survey of the minimum wage literature

Authors	Country	Identification Strategy	Findings
The consensus in the 1980s			
See Brown et al. (1982)'s extensive review	U.S.	variation in employment and minimum wage level (or Kaitz index) over time	10% increase in minimum wage causes 0 to 0.75 percent increase in teenage unemployment, considerable increases in low-skilled wages
First-wave case studies			
Card (1992*a*)	U.S.	variation in the fraction of affected and non-affected workers within California where considerable minimum wage increase took place in 1987-1989.	5% to 10% increase in earnings of low-wage workers, no loss in teenage employment and retail trade employment
Card (1992*b*)	U.S.	regional variation in fraction of affected workers with lower than new federal minimum wage.	No decrease in teenage employment

Katz & Krueger (1992)	U.S.	variation in the fraction of affected workers within Texas in which one-third of new coming restaurants workers worked at old minimum wage	Relative increase in affected restaurants' employment
Card & Krueger (1994)	U.S.	variation in the intensity of minimum wage increase between neighboring states New Jersey and Pennsylvania	No reduction in employment, considerable wage gains
Recent case studies			
Sabia et al. (2012)	U.S.	variation in minimum wage increase across geographically proximate states over a short time period	Large negative employment elasticity (-0.7) for those aged 16 to 24. Large negative employment elasticity (-0.1 to -0.3) for low-skilled workers

Jardim et al. (2018)	U.S.	individual level wage variation in Seattle where a considerable minimum wage increase took place in 2015 and 2016	A slight decrease in affected workers' working hours, substantial wage increases in wages of above-median workers, not important change in less-skilled workers' wage, 8% reduction in job-turnover rates and the rate of new entries
State level panel studies without state-specific trends			
Neumark & Wascher (1992)	U.S.	variation in minimum wage level and employment level across states over times	10% increase in minimum wage is associated with 1-2% fall in teenage employment and 1.5-2% fall in young adults' employment

Zavodny (2000)	U.S.	variation in minimum wage level and employment level across states over times	Decrease in probability of remaining employed among low wage teenagers
Neumark (2001)	U.S.	variation in minimum wage level and employment level across states over times	Large employment elasticities (-0.1 to -0.2) for those aged 16-24
Couch & Wittenburg (2001)	U.S.	variation in minimum wage level and employment level across states over times	Large employment elasticities (-0.1 to -0.3) for those aged 16-19
Sabia (2009)	U.S.	variation in minimum wage level and employment level across states over times	10% increase in minimum wage causes 3.4-3.8% decrease in teenage employment in retail trade, 3.8-4.2% decrease in hours worked in the same sector

Lordan & Neumark (2018)	U.S.	variation in low-skill employment across industries	10% increase in minimum wage creates 0.31% decrease in share of automatable jobs done by low-skilled workers
Border discontinuity design			
Allegretto et al. (2011)	U.S.	variation in minimum wage level and employment level between contiguous county pairs	High wage elasticities (0.22-0.27), statistically and economically insignificant employment elasticities for teenagers
Dube et al. (2010)	U.S.	variation in minimum wage level and employment level between contiguous county pairs	Positive, substantial and statistically significant wage elasticities (0.14-0.23), insignificant and small employment elasticities for teenagers

Dube et al. (2013)	U.S.	variation in minimum wage level and employment level between contiguous county pairs	No decrease in employment stock, but substantial decrease in employment flows
For a more detailed review of studies using border discontinuity design see Neumark (2017)			
Recent exchanges on the identification issues			
Neumark et al. (2014)	U.S.	variation in the minimum wage level across states over time	An identification strategy based on contiguous county pairs are not spurior to the identification strategy based on cross-state variation
Allegretto et al. (2017)	U.S.	variation in minimum wage level between contiguous county pairs	Time-varying heterogeneties across states result in biased estimates.Neumark et al. (2014) violates parallel trend assumption.

Neumark (2017)	U.S.		Border discontinuity design does not necessarily produce insignificant employment effects. Allegretto et al. (2017) ignore growing number of new evidences
Studies on the other developed countries			
Machin et al. (2003)	U.K.	sectoral variation of minimum wage workers	important compression in wage distribution and negative employment elasticities varying from -0.05 to -0.16 in residential care industry
Dolton et al. (2015)	U.K.	variation in minimum wage/regional averages of wages	no employment effects

Campolieti et al. (2006)	Canada	variation in minimum wage and employment level across states over times	large and negative employment coefficient (-0.30)
Anton & de Bustillo (2010)	Spain	variation in minimum wage law intensity for different age groups	negative employment effects for young workers,decrease in formal education.
Bossler & Gerner (2016)	Germany	variation in within firm-fraction of workers affected by the minimum wage introduction	4.8% increase in average wages, 1.9% decrease in employment of affected firms.
Caliendo et al. (2018)	Germany	regional variation in fraction of workers affected by the minimum wage introduction	moderate (140,000 jobs) negative employment effects.
Studies on the developing countries			
See extensive review of Pelek (2014)			
Lemos (2009)	Brazil	variation in minimum wage level and employment level across states over times	Compression in wage distribution, no change in formal and informal employment.

Rama (2001)	Indonesia	variation in minimum compliance	5-15% increase in average wages, 0-5% decrease in employment.
Comola & Mollo (2011)	Indonesia	variation in minimum compliance	formal job losses which were not compensated by job gains in informal sector.
Dinkelman & Ranchhod (2012)	South Africa	variation in minimum compliance	formal job losses which were not compensated by job gains in informal sector.
Khamis (2013)	Argentina	variation in intensity of minimum wage law by sectors	wage increase in both formal and informal sector, but no statistically significant change in employment .
Ham (2018)	Honduras	variation arising from the changes in the number of minimum wage categories	reduction in formal employment, increase in informal employment
Studies on Turkey			
Güven et al. (2011)	Turkey	variation in minimum wage level and employment over time	no relationship between minimum wage and employment

Papps (2012)	Turkey	variation in intensity of labor costs as a mix of social security system and minimum wage law	1 unit increase in minimum wage labor cost causes 0.13% decrease in probability of being employed.
Pelek (2015)	Turkey	variation in minimum wage level/regional average wages ratio	Positive relationship between minimum wage and informality.
Yüncüler & Yüncüler (2016)	Turkey	variation in fraction of minimum wage workers across industry x occupation interactions	a large wage elasticity (0.22-0.35), increase in working hours, no statistically significant employment effects, but increase in informality.
Gürsel et al. (2018)	Turkey	variation in share of affected workers across industries	increase in informality of male workers
Acar et al. (2019)	Turkey	within firm-variation in fraction of affected workers	an increase in firms' exit rates from the formal sector

Table B.3: Descriptive statistics for the period of 2014-2016

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
I.Less Than High School Educated Workers							
Men							
Fraction of Affected LTH Workers in $t-1$	78	0.369	0.116	0.184	0.283	0.477	0.669
LTH Employment/LTH Population	78	0.331	0.070	0.211	0.284	0.393	0.497
LTH Mean Wages	78	1,126.947	170.572	725.715	997.552	1,250.063	1,556.388
LTH Informals/LTH Employment	78	0.307	0.132	0.157	0.216	0.365	0.649
Women							
Fraction of Affected LTH Workers in $t-1$	78	0.530	0.117	0.278	0.445	0.612	0.751
LTH Employment/LTH Population	78	0.080	0.036	0.021	0.054	0.111	0.162
LTH Mean Wages	78	780.788	144.464	489.101	688.012	878.169	1,146.720
LTH Informals/LTH Employment	78	0.520	0.188	0.239	0.363	0.650	0.946
II.15-24							
Men							
Fraction of Affected Young Workers in $t-1$	78	0.405	0.105	0.216	0.321	0.496	0.665
Young Employment/Young Population	78	0.327	0.066	0.188	0.281	0.390	0.465
Young Mean Wages	78	952.138	155.038	621.506	859.882	1,043.469	1,347.439
Young Informals/Young Employment	78	0.385	0.146	0.182	0.272	0.493	0.754
Women							
Fraction of Affected LTH Workers in $t-1$	78	0.417	0.099	0.224	0.364	0.473	0.659
Young Employment/Young Population	78	0.147	0.069	0.028	0.101	0.196	0.311
Young Mean Wages	78	963.025	197.130	557.442	835.686	1,065.011	1,557.395
Young Informals/Young Employment	78	0.299	0.158	0.106	0.201	0.362	0.825

Note: Own calculations based on HLFS.

Table B.4: Effects of the minimum wage increase in 2015 and 2016 on labor market outcomes of the least affected groups

	Dependent variable:											
	Tertiary Education											
	Men						**Women**					
	Mean Wages		Employment/Population		Informal Workers/Employment		Mean Wages		Employment/Population		Informal Workers/Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Fraction of Affected TE Workers in $t-1$	1.013	0.216	0.157	0.614	0.027	0.026	0.322	0.137	−0.101	−0.061	0.043	0.085
	(0.604)	(0.756)	(0.409)	(0.509)	(0.113)	(0.047)	(0.238)	(0.272)	(0.183)	(0.275)	(0.161)	(0.168)
log(Per capita GDP in $t-1$)	−0.980**	−1.330***	−0.291**	−0.349***	0.144**	0.161*	−0.144	−0.242	0.073	0.091	−0.345**	−0.362*
	(0.457)	(0.412)	(0.136)	(0.120)	(0.067)	(0.091)	(0.350)	(0.524)	(0.358)	(0.448)	(0.153)	(0.196)
D_{2015} x Fraction of Affected TE Workers in 2014	−0.917**	−0.212	−0.250	−0.543	−0.175	−0.112	−0.045	0.075	0.350*	0.312	0.151	0.173
	(0.451)	(0.614)	(0.285)	(0.368)	(0.155)	(0.142)	(0.208)	(0.260)	(0.207)	(0.315)	(0.160)	(0.188)
D_{2016} **x Fraction of Affected TE Workers in 2015**	0.198	0.806	0.001	−0.429	−0.074	−0.064	0.220	0.333	0.234	0.164	−0.153	−0.153
	(0.626)	(0.751)	(0.335)	(0.464)	(0.128)	(0.092)	(0.234)	(0.302)	(0.191)	(0.255)	(0.154)	(0.191)
	35-44 Ages											
	Men						**Women**					
	Mean Wages		Employment/Population		Informal Workers/Employment		Mean Wages		Employment/Population		Informal Workers/Employment	
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Fraction of Affected Adult Workers in $t-1$	0.180	0.353	−0.220	−0.300	−0.090	−0.120	−0.370	−0.404	−0.125**	−0.092	0.195	0.278
	(0.230)	(0.428)	(0.230)	(0.227)	(0.181)	(0.144)	(0.248)	(0.324)	(0.057)	(0.080)	(0.224)	(0.249)
log(Per capita GDP in $t-1$)	−0.144	−0.130	0.026	−0.054	−0.264*	−0.185*	0.726*	0.631	−0.035	−0.059	−0.065	−0.042
	(0.417)	(0.377)	(0.156)	(0.210)	(0.147)	(0.106)	(0.368)	(0.546)	(0.165)	(0.176)	(0.355)	(0.454)
D_{2015} x Fraction of Affected Adult Workers in 2014	−0.099	−0.160	0.359***	0.440**	0.042	0.083	0.068	0.050	0.204***	0.130	0.033	−0.027
	(0.204)	(0.284)	(0.126)	(0.186)	(0.112)	(0.075)	(0.324)	(0.346)	(0.062)	(0.131)	(0.217)	(0.274)
D_{2016} **x Fraction of Affected Adult Workers in 2015**	−0.012	−0.104	0.373**	0.372*	−0.121	0.080	0.572***	0.691**	0.116**	0.084	−0.072	0.037
	(0.255)	(0.266)	(0.175)	(0.219)	(0.152)	(0.113)	(0.174)	(0.307)	(0.049)	(0.087)	(0.184)	(0.203)
Region Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year x 5 Regions Interaction	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Observations	78	78	78	78	78	78	78	78	78	78	78	78
R^2	0.981	0.986	0.989	0.990	0.981	0.989	0.961	0.966	0.987	0.988	0.982	0.984
Adjusted R^2	0.968	0.972	0.982	0.980	0.969	0.979	0.935	0.930	0.978	0.975	0.970	0.967
Residual Std. Error	0.028 (df = 46)	0.026 (df = 38)	0.010 (df = 46)	0.010 (df = 38)	0.023 (df = 46)	0.019 (df = 38)	0.048 (df = 46)	0.050 (df = 38)	0.006 (df = 46)	0.007 (df = 38)	0.032 (df = 46)	0.034 (df = 38)

Note: Standard errors are shown in paranthesis. *p<0.1; **p<0.05; ***p<0.01. All models include year and region fixed effects. All standard errors are clustered at region and year level.

Table B.5: Baseline results and follow-up models with alternative time periods

	Dependent variable:																	
	Less Than High School																	
	Men									**Women**								
	log(Mean Wages)			Employment/Population			Informal Workers/Employment			log(Mean Wages)			Employment/Population			Informal Workers/Employment		
	(Baseline)	(2)	(3)	(Baseline)	(5)	(6)	(Baseline)	(8)	(9)	(Baseline)	(11)	(12)	(Baseline)	(14)	(15)	(Baseline)	(17)	(18)
Fraction of Affected LTH Workers in $t-1$	−0.087	−0.021	0.018	0.078	−0.030	−0.171***	0.193	0.058	−0.324***	−0.172	0.345**	1.035***	−0.006	−0.007	−0.036***	0.133	−0.041	−0.299***
	(0.190)	(0.237)	(0.132)	(0.083)	(0.052)	(0.056)	(0.203)	(0.175)	(0.113)	(0.183)	(0.154)	(0.152)	(0.027)	(0.019)	(0.013)	(0.159)	(0.080)	(0.083)
log(Per capita GDP in $t-1$)	0.320	0.240	0.027	0.118	0.014	0.134**	−0.302**	−0.045	−0.054	0.156	0.281	0.330	−0.039	−0.068	−0.032	−0.868***	−0.452	−0.276
	(0.258)	(0.163)	(0.113)	(0.075)	(0.052)	(0.065)	(0.141)	(0.134)	(0.124)	(0.412)	(0.356)	(0.430)	(0.068)	(0.042)	(0.026)	(0.308)	(0.275)	(0.185)
D_{2006}:Fraction of Affected LTH Workers in 2005			−0.292***			−0.109**			0.299**			−0.322*			−0.010			0.019
			(0.083)			(0.049)			(0.151)			(0.173)			(0.012)			(0.062)
D_{2007}:Fraction of Affected LTH Workers in 2006			−0.163			0.074			0.471***			−0.124			0.015*			0.178*
			(0.176)			(0.046)			(0.096)			(0.130)			(0.009)			(0.100)
D_{2008}:Fraction of Affected LTH Workers in 2007			−0.015			0.212***			0.402***			−0.767***			0.019*			0.069
			(0.154)			(0.045)			(0.091)			(0.256)			(0.011)			(0.136)
D_{2009}:Fraction of Affected LTH Workers in 2008			−0.105			0.286***			0.385***			0.238			0.010			0.291
			(0.104)			(0.064)			(0.103)			(0.246)			(0.022)			(0.222)
D_{2010}:Fraction of Affected LTH Workers in 2009			−0.014			0.221**			0.330***			−0.397**			0.001			0.291
			(0.064)			(0.094)			(0.095)			(0.166)			(0.030)			(0.290)
D_{2011}:Fraction of Affected LTH Workers in 2010			−0.015			0.183**			0.293**			−0.663**			0.018			0.235*
			(0.088)			(0.073)			(0.119)			(0.275)			(0.013)			(0.138)
D_{2012}:Fraction of Affected LTH Workers in 2011		−0.091*	−0.022		0.074	0.236**		0.077**	0.337***		−0.015	−0.660***		−0.023*	0.012		0.275**	0.459***
		(0.053)	(0.131)		(0.048)	(0.095)		(0.033)	(0.118)		(0.304)	(0.161)		(0.014)	(0.022)		(0.131)	(0.111)
D_{2013}:Fraction of Affected LTH Workers in 2012		0.224	0.216		−0.093	0.072		−0.144***	0.182		−0.076	−0.742***		0.010	0.038*		0.198**	0.438***
		(0.162)	(0.164)		(0.081)	(0.072)		(0.050)	(0.166)		(0.214)	(0.155)		(0.028)	(0.021)		(0.092)	(0.101)
D_{2014}:Fraction of Affected LTH Workers in 2013		0.202	0.267		−0.006	0.150**		−0.153	0.150		−0.186	−0.691**		−0.013	0.015		0.189	0.530***
		(0.165)	(0.169)		(0.036)	(0.068)		(0.105)	(0.125)		(0.182)	(0.279)		(0.023)	(0.026)		(0.134)	(0.138)

D_{2015}:Fraction of Affected LTH Workers in 2014	0.009	0.271*	0.235*	−0.063	−0.039	0.101*	0.019	−0.138	0.238**	−0.207	−0.198	−0.647**	0.024	−0.005	0.029	0.092	0.257	0.597***
	(0.115)	(0.158)	(0.127)	(0.054)	(0.047)	(0.057)	(0.082)	(0.139)	(0.114)	(0.184)	(0.145)	(0.265)	(0.020)	(0.035)	(0.029)	(0.113)	(0.197)	(0.188)
D_{2015}:**Fraction of Affected LTH Workers in 2015**	0.173*	0.372*	0.400**	0.019	0.037	0.160***	0.074	−0.038	0.292**	−0.338	−0.428**	−0.950***	0.032	−0.004	0.032	0.056	0.198	0.474***
	(0.096)	(0.207)	(0.178)	(0.035)	(0.043)	(0.043)	(0.076)	(0.123)	(0.119)	(0.271)	(0.205)	(0.304)	(0.035)	(0.044)	(0.033)	(0.135)	(0.139)	(0.140)
	15-24 Ages																	
Fraction of Affected YOUNG Workers in $t-1$	−0.324	−0.324*	0.090	−0.166**	−0.006	−0.235***	0.015	−0.046	−0.532***	0.251	−0.066	0.864***	0.023	−0.036	−0.053***	−0.249*	0.137	−0.547***
	(0.274)	(0.183)	(0.217)	(0.078)	(0.089)	(0.090)	(0.244)	(0.162)	(0.128)	(0.399)	(0.291)	(0.217)	(0.032)	(0.049)	(0.017)	(0.146)	(0.131)	(0.156)
log(Per capita GDP in $t-1$)	−0.181	0.339*	0.318*	0.105	0.088	0.277***	−0.144	−0.094	−0.131	1.924	1.441**	0.734*	0.133	0.036	−0.022	−1.877**	−0.908**	−0.368
	(0.510)	(0.200)	(0.180)	(0.145)	(0.113)	(0.066)	(0.352)	(0.193)	(0.123)	(1.215)	(0.657)	(0.421)	(0.126)	(0.068)	(0.048)	(0.860)	(0.379)	(0.245)
D_{2005}:Fraction of Affected YOUNG Workers in 2005			0.152			0.045			0.296***			−0.317**			0.062***			0.316***
			(0.217)			(0.072)			(0.088)			(0.144)			(0.021)			(0.095)
D_{2007}:Fraction of Affected YOUNG Workers in 2006			−0.077			−0.092			0.406***			−0.643***			0.020			0.595***
			(0.197)			(0.118)			(0.075)			(0.204)			(0.027)			(0.110)
D_{2008}:Fraction of Affected YOUNG Workers in 2007			0.082			0.198**			0.557***			−0.684**			0.064**			0.316
			(0.149)			(0.083)			(0.102)			(0.322)			(0.030)			(0.271)
D_{2009}:Fraction of Affected YOUNG Workers in 2008			−0.257			0.173			0.526***			−1.126***			0.043			0.756***
			(0.156)			(0.116)			(0.081)			(0.243)			(0.050)			(0.138)
D_{2010}:Fraction of Affected YOUNG Workers in 2009			−0.095			0.212*			0.654***			−1.394***			0.014			0.618***
			(0.256)			(0.109)			(0.175)			(0.300)			(0.043)			(0.180)
D_{2011}:Fraction of Affected YOUNG Workers in 2010			−0.328*			0.226***			0.366*			−1.133***			0.038			0.819***
			(0.196)			(0.080)			(0.194)			(0.379)			(0.038)			(0.159)
D_{2012}:Fraction of Affected YOUNG Workers in 2011		0.025	−0.305		0.106	0.263***		0.262	0.623***		−0.236	−1.259***		−0.020	0.015		0.314*	1.040***
		(0.167)	(0.197)		(0.103)	(0.082)		(0.200)	(0.225)		(0.213)	(0.299)		(0.020)	(0.036)		(0.183)	(0.133)
D_{2013}:Fraction of Affected YOUNG Workers in 2012		0.110	−0.402		−0.206	−0.062		−0.111	0.290		0.445	−0.652*		0.033	0.054*		−0.389	0.317*
		(0.214)	(0.330)		(0.167)	(0.147)		(0.170)	(0.218)		(0.399)	(0.394)		(0.060)	(0.030)		(0.253)	(0.165)
D_{2014}:Fraction of Affected YOUNG Workers in 2013		0.382	−0.010		−0.174***	−0.005		−0.355*	0.109		0.626	−0.376		0.090	0.151***		−0.425***	0.389**
		(0.323)	(0.226)		(0.063)	(0.099)		(0.201)	(0.229)		(0.580)	(0.449)		(0.066)	(0.034)		(0.122)	(0.181)
D_{2015}:Fraction of Affected YOUNG Workers in 2014	0.015	0.407*	−0.053	0.044	−0.147***	−0.025	0.118	−0.061	0.385***	−0.145	0.564	−0.017	−0.075***	−0.008	0.066	0.335***	−0.255	0.270*
	(0.199)	(0.224)	(0.282)	(0.092)	(0.021)	(0.071)	(0.089)	(0.183)	(0.092)	(0.374)	(0.483)	(0.296)	(0.027)	(0.061)	(0.040)	(0.087)	(0.222)	(0.162)
D_{2015}:**Fraction of Affected YOUNG Workers in 2015**	0.148	0.484***	0.062	0.060	−0.136	−0.013	0.454**	0.311	0.698***	−0.369	−0.325	−1.016***	−0.046	−0.002	0.030	0.511***	0.097	0.699***
	(0.289)	(0.166)	(0.154)	(0.064)	(0.086)	(0.108)	(0.215)	(0.203)	(0.126)	(0.552)	(0.268)	(0.208)	(0.047)	(0.041)	(0.036)	(0.178)	(0.092)	(0.199)
Year and Region Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year and 5 Regions Interaction	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	78	156	312	78	156	312	78	156	312	78	156	312	78	156	312	78	156	312
R^2	0.960	0.960	0.980	0.960	0.920	0.890	0.960	0.950	0.950	0.890	0.910	0.940	0.990	0.970	0.960	0.950	0.920	0.850
Adjusted R^2	0.920	0.940	0.970	0.910	0.870	0.850	0.920	0.920	0.920	0.780	0.860	0.910	0.980	0.950	0.940	0.890	0.860	0.790
Residual Std. Error	0.046 (df = 38)	0.055 (df = 98)	0.072 (df = 218)	0.019 (df = 38)	0.023 (df = 98)	0.031 (df = 218)	0.041 (df = 38)	0.046 (df = 98)	0.050 (df = 218)	0.098 (df = 38)	0.098 (df = 98)	0.120 (df = 218)	0.010 (df = 38)	0.015 (df = 98)	0.017 (df = 218)	0.052 (df = 38)	0.058 (df = 98)	0.079 (df = 218)

Note:Standard errors are shown in paranthesis. *p<0.1; **p<0.05; ***p<0.01.

All models include year and region fixed effects. All standard errors are clustered at region and year level.