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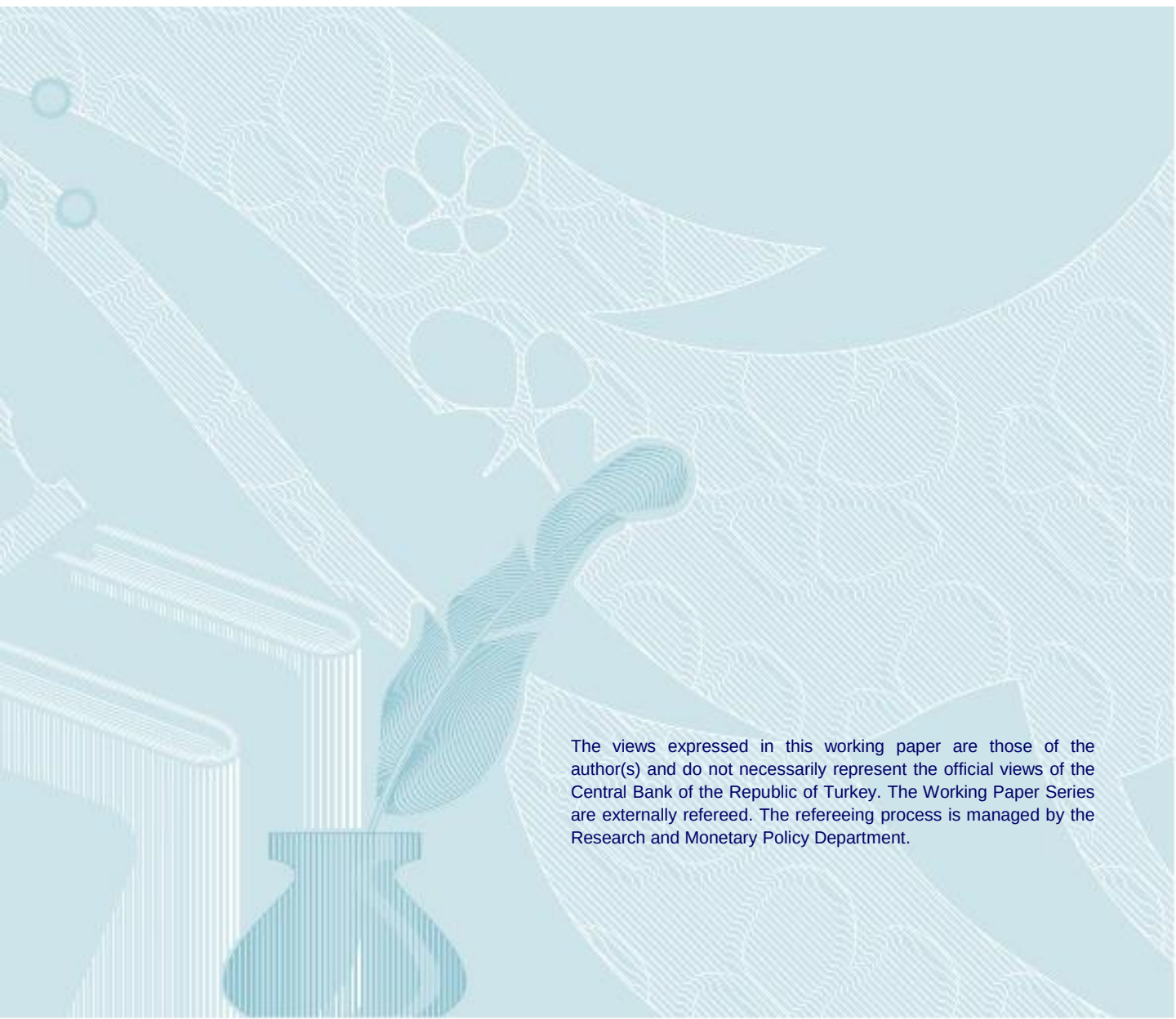

Minimum Wage Effects on Labor Market Outcomes in Turkey*

H. Burcu Gürcihan Yüncüler † **Çağlar Yüncüler** ‡

Abstract

This paper estimates the impact of minimum wages on the labor market outcomes in Turkey using the sizable minimum wage increase in 2004. Utilizing a quasi-experimental approach we provide new evidence from a developing country where the minimum wage is binding to a great extent. Our results suggest that minimum wage increase of 2004 compressed the wage distribution from below. Using degree of impact measures we estimate that a 1 percent surge in the minimum wage increased wages by an extra $0.22 - 0.35$ percent. Wage response was lower for informally working, low educated and young employees. Higher minimum wage was accompanied by an increase in the likelihood of informal employment. The minimum wage increase did raise working hours, suggesting that firms may have tried to offset part of the increase in the labor cost by increasing employment at the intensive margin. Estimations do not point out to an adverse impact for the overall employment. But due to data limitations results on employment are less robust. Furthermore, looking at the impact of minimum wages on the formal and informal divide, our results do not support the predictions of the dual market hypothesis on wages. We observe wage increase not only for the formal but also for the informal employees pointing out to the presence of a "lighthouse" effect previously documented for some other developing countries.

JEL codes: J31, J42, R23.
Keywords: Minimum wage; Turkey; difference in differences; informality.

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1 Introduction

Labor market in Turkey is characterized with a significant mass of employees earning around and below the national minimum wage. Thus potentially the minimum wage policy has a significant sphere of influence on the labor market in Turkey. Yet the number of studies on the labor market impact of minimum wages is limited. The aim of this paper is to analyze the minimum wage impact on wages, informality, working hours and employment in Turkey using the sizable minimum wage increase in 2004. In doing so, we further investigate differential effects on the vulnerable groups, i.e. females, ones with low education levels, youth and those working informally. Moreover, given the high informality rate among wage earners we also test the arguments of the dual market hypothesis.

A vast empirical literature has developed throughout the years on the impact of minimum wage on labor market outcomes. There is agreement to a great extent on the compression impact of minimum wages on the wage distribution (Brown, 1999; Lemos, 2009). However no consensus has been reached regarding its impact on employment. The classical theory argues that workers, whose productivity levels are surpassed by the minimum wage lose their jobs (Stigler, 1946). As an outcome, wages at the low end of the wage distribution would increase, earnings would become less dispersed and wage distribution would be compressed. Many of the early empirical studies, mostly focusing on the US data and based on time-series estimation methods, confirmed the predictions of the classical theory, in particular for youth employment by finding statistically significant but modest impact of the minimum wage on employment and the distribution of income (Brown et al., 1982). However as more studies utilizing micro data sets and other econometric techniques become prominent, the results regarding its impact on employment in the developed countries began to conflict (Brown, 1999). While some continue to find negative but mitigated relationship between minimum wage and employment (Neumark and Wascher, 1992, 2000), others like Card and Krueger (1995); Machin and Manning (1994); Machin et al. (2003), Dickens et al. (1999) find non-negative employment results.[1]

Although, the impact of the minimum wage on employment is studied mostly on the extensive margin, there are also studies investigating the issue at the intensive margin by examining the hours worked. Hamermesh (1993) states that employers are quicker to adjust working hours compared to employment levels. In the empirical literature there are conflicting findings on this issue. Some advocate that working hours decrease with the minimum wage (e.g. Neumark et al. (2004) for US; Stewart and Swaffield (2008) and Machin et al. (2003) for UK; Gindling and Terrell (2007) for Costa Rica) and on the contrary some papers find evidence of an increase in the working hours (e.g. Pratomo (2012) for Indonesia; Hyslop and Stillman (2007) for New Zealand). There are also papers that find no effect at all (e.g. Rattenhuber (2014) for Germany). This diversity is not surprising given the distinct economic and institutional

[1] For thorough literature reviews on this issue, see Card and Krueger (1995), Brown (1999) and Neumark and Wascher (2007).

characteristics of each country. These characteristics generate variation in the bite of the minimum wage, degree of informality and compliance with the labor law etc., which in turn influence the results.

Lately, the focus on this issue shifted towards the developing countries, whose labor market characteristics differ from that of the developed countries. In the developing countries, bite of the minimum wage is higher. Moreover, informal employment constitutes an important share of the total workforce. Thus, the existence of a dualistic labor market in the formal and informal divide necessitates reasoning within the two-sector model framework (Welch, 1976; Mincer, 1976; Gramlich, 1976). According to this model, under the assumption of labor mobility, workers who are crowded out of the formal (covered) sector due to the minimum wage increase, seek job in the informal (uncovered) sector, which drives wages down and increases employment in the informal sector. Under this framework, one would expect wage dispersion between formal and informal sectors to increase. On the other hand, the magnitude of employment changes in the two sectors depends on the elasticities of supply and demand as well as how much the labor supply shifts (Gindling and Terrell, 2009). Existence of a such duality complicates the total employment effects of the minimum wage as the two sectors are possibly affected in an opposite way.

The standard theory for dual labor markets indicates a negative relationship between the formal and informal wages. However, formal and informal wages may rise at the same time following a hike in the minimum wage. This phenomenon called as the lighthouse effect in the literature may emerge under different assumptions. One explanation is that under different set of assumptions regarding the elasticities of the labor market, both wages may rise (Carruth and Oswald (1981), Hamermesh (1993), Leamer et al. (1995), Lustig et al. (1996)). Some argue that the relationship between formal and informal sectors is not only through the supply side but also through the demand side (Tokman (1978), Fiszbein (1992)). It is argued that the products of informal sector are mostly demanded by the poorer people, who are thought to be the main benefactors from a minimum wage increase. Accordingly, when benefactors welfare rises due to an increase in the minimum wage, the demand for the goods produced by informal sector rises, which increases demand for informal labor and pushes up the informal wages. The third one, and probably the most pronounced one, is the benchmark role of the minimum wage for the informal sector wages. In other words, minimum wage is thought to be a reference for informal sector wages (Maloney and Mendez, 2004). The last and the most recent argument is that minimum wage changes the skill composition of formal and informal sectors, which increases average wages in the informal sector following a minimum wage hike, as more skilled people are transferred to the informal sector (Boeri et al., 2011).

Despite its importance, empirical work conducted for the developing countries on this issue is relatively limited, but growing in number. Studies for the Latin American countries, in partic-

ular Brazil, comprise a significant portion of the literature. In general, results indicate a wage compression effect on both formal and informal sectors following a minimum wage increase (Fajnzylber, 2001; Maloney and Mendez, 2004; Lemos, 2009). On the other hand, impact on employment is ambiguous. Carneiro (2004) finds evidence supporting the predictions of the Two-Sector Model for Brazil. Bell (1997) finds a disemployment effect in Colombia but no significant effect for Mexico. Maloney and Mendez (2004) for Colombia; Fajnzylber (2001) for Brazil find negative aggregate employment effects. On the other hand, Lemos (2009) again for Brazil finds no evidence of any employment effect for both sectors.

Evidence from other developing countries is also mixed. Among them, the studies on Poland and Greece find negative employment effects, especially for the vulnerable groups such as the youth and the women ((Melnyk, 1996; Majchrowska and Zólkiewski, 2012; Broniatowska et al., 2015) for Poland; Karageorgiou (2004) for Greece). Bhorat et al. (2013) and Dinkelman and Ranchhod (2012); on the contrary, find no clear employment effects, but positive wage effects for South Africa. Comola and De Mello (2011) find that informal employment gains dominate formal employment losses for Indonesia.

In this study we analyze wage and employment effects of the minimum wage changes in Turkey, which is one of the largest developing economies and has labor market characteristics similar to widely studied Latin American countries. However, despite the long history of national minimum wage legislation and the significant share of workers potentially subject to the minimum wage policies, the literature on its impact on labor market outcomes is rather limited. Among them, Pelek (2011) examines the existence of disemployment effects of the minimum wage for youth employment by using regional panel data. She finds that the minimum wage does not affect the overall employment level in the youth labor market. Pelek (2013) investigates the impact of the minimum wage increase in 2004 on the entire wage distribution, by addressing its implications on the wage inequality across genders. She finds that wage inequality decreased for both genders after the minimum wage increase. Papps (2012) is another study examining aggregate employment effects of the minimum wage in Turkey following the minimum wage boost in 2004. The main focus is on the comparison of minimum wage and social security taxes in terms of their impact on employment. Using a longitudinal data extracted from the Household Labor Force Survey (HLFS), he finds that a social security tax has a larger negative effect than the minimum wage on the probability of being employed in the next quarter when both increase in equal amounts. Öztürk (2007), by using data prior to 2000 shows that minimum wage increases working hours demanded by employees above that is desired by women, thereby reducing their labor force participation and employment. Against this background, the contribution of our study is threefold: First, it is one of the very few studies regarding the minimum wage effects on the labor market outcomes in Turkey. Second, it adds to the rather limited literature of minimum wage effect on wage

dispersion, informality, hours worked and employment in the developing countries. Third, we provide evidence on informal and formal markets separately, thereby contributing to the discussion on the validity of the predictions of the dual market hypothesis in the developing countries.

We employ a quasi-experimental approach using the difference-in-differences methodology, where 2004 is the treatment year and *industry* × *occupation* groups with a significant share of workers earning around the minimum wage are the treatment (high impact) groups. To preview our results, minimum wage increase in 2004 did compress the wage distribution from below compared to 2003. Estimation results using various impact variables indicate that a 1 percent surge in the minimum wage increased wages by an extra $0.22 - 0.35$ percent. Looking at the subgroups, wage response was lower for the informal workers, low educated workers and young workers. Moreover, rise in the minimum wage increased the likelihood of informal employment. However, there was no indication of an adverse total employment effect. Higher minimum wage increased weekly working hours for the formal, male and high educated employees and reduced it for the informal, low educated and young employee groups. Once we exclude casual employees, i.e those with no advance commitment as to the duration of working hours, positive impacts become stronger and negative impacts lose significance. This hints that minimum wage increase did tend to increase working hours for the regular employees more compared to that of casual employees whose work arrangements are made on an hourly basis. This evidence suggests that firms may have tried to offset part of the increase in the labor cost by increasing employment at the intensive margin. Finally, our results do not support the predictions of the dual market hypothesis. There were no significant negative (positive) employment effects in the formal (informal) sector. Moreover, we observe a wage increase not only for the formal but also for the informal employees, which indicates the existence of the lighthouse effect.

The design of the study is as follows. In the next section, we present the data and background on minimum wages in Turkey. Section 3 explains our econometric identification strategy. Section 4 discusses the empirical results and section 5 concludes.

2 Background and Data

Minimum wage in Turkey is set by a committee made up of representatives from three parties: government, employee and employer unions. Next year's minimum wage to be legally effective as of January 1 is determined in the last months of the current year. In 2003, the committee started negotiations in November and the decision on the minimum wage rate for 2004 was announced in December. Hence the decision was taken short before the time of execution and the determined increase was significantly above the expected CPI inflation. Therefore the

decision can be interpreted as a complete surprise.

Figure 1 displays the evolution of the real gross national minimum wage in Turkey since its introduction in 1974.[2] The level of minimum wage has changed significantly through time. The devaluation of the Turkish Lira in 1979 and the inflationary period that followed eroded the real value of the minimum wage. In the following decade minimum wage remained relatively flat. Even though there were increases in real terms starting with the 1990s, these improvements were later interrupted with the depreciation of the domestic currency amid the crises in 1994 and 2001. A major jump took place in 2004, when net minimum wage rose by 37.5 percent in nominal terms. Given the expected inflation of the time this increase amounted to a 20.7 percent real increase. Government subsidized part of the employers social security contribution. Consequently, the cost to the employer increased at a lower rate by around 29 percent in nominal terms. Appendix A provides detailed calculations on the increase in total labor cost of a minimum wage worker.

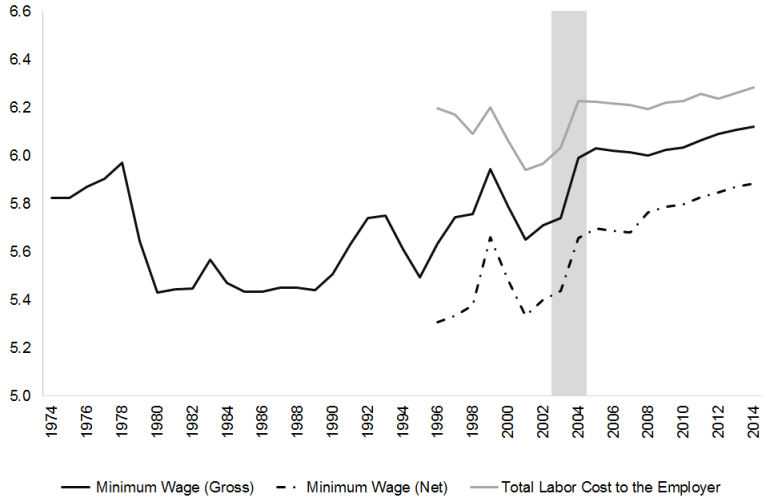

Figure 1: **Minimum Wage in Turkey (1974-2014, natural log).** *Source:* Ministry of Labor and Social Security. Minimum wage is deflated by 2003 based CPI.

Minimum wage practices, which aim at securing a certain state of welfare and life standard for workers, concern a considerable part of the labor market in Turkey, which is characterised with low educational attainment levels and high rate of informality.[3] Informality here is defined as the share of workers that are not registered with a social security institution. Table 1 provides a summary of the minimum wage and its relative weight on the wage distribution from 2003 to 2013. When measured based on monthly wages, in 2003 almost 26 percent of all full time wage employees earned at or below the minimum wage. Through time the share of

[2]Despite its presence in the labor law since 1936 minimum wage policy was effectively implemented only after 1951. Initially it was sectoral and regional, in 1974 it became national and general in coverage (Süreyya, 1973).

[3]Educational attainment levels in Turkey are significantly below the OECD average. As of 2012, the share of the tertiary educated adults was 33.6 percent in the OECD countries, whereas the corresponding figure was only 15.3 percent in Turkey (OECD, 2014).

those working at the minimum wage has increased and the share of those working below the minimum wage has decreased. Overall, the share working at and below the minimum wage did not change significantly in the following ten years. Taking into account also the proportion of workers that earn between the old and the new minimum wage, potential impact zone of the minimum wage was as high as 50 percent of the pool of full time employees in 2003. As these rates imply, Turkey has one of the highest minimum wage to median wage ratios among the OECD countries. As of 2013 this ratio was around 0.8 in Turkey whereas the OECD average in 2012 was 0.49. It is more striking if we measure minimum wage relative to the lower end of the wage distribution. The ratio of minimum wage to the 10^{th} percentile of the distribution is above 1. It is higher than the Latin American countries for which minimum wage impact has been studied extensively in the literature. As provided in Maloney and Mendez (2004), for most Latin American countries in the late 1990s, the minimum wage standardized by the 10^{th} percentile of the distribution ranged between 0.6 to 1.

	Expected	Minimum Wage			Minimum Wage w.r.t			Fraction	Fraction
	inflation(%)[a]	Net, TL[b]	(% Change)	(Real % Change)	Mean	50th	10th	below (%)	at(%)
2003	24.7	226	30.0	4.3	0.49	0.65	1.26	16.5	9.3
2004	13.9	311	37.5	20.7	0.61	0.78	1.55	16.5	18.9
2005	8.7	350	12.7	3.7	0.56	0.70	1.17	11.3	17.0
2006	5.84	380	8.7	2.7	0.54	0.69	1.09	10.7	10.5
2007	7.11	411	8.0	0.9	0.52	0.69	1.03	8.0	14.1
2008	6.14	492	19.8	12.9	0.55	0.70	1.15	14.8	11.9
2009	8.45	537	9.0	0.5	0.56	0.77	1.34	16.3	10.3
2010	6.56	588	9.5	2.8	0.57	0.73	1.18	14.5	14.6
2011	6.95	644	9.6	2.5	0.56	0.76	1.29	15.5	12.1
2012	7.1	720	11.8	4.4	0.56	0.72	1.20	12.7	18.2
2013	6.34	789	9.6	3.0	0.55	0.79	1.13	11.1	16.3

Table 1: **Summary Statistics on the Minimum Wage and the Wage Distribution (2003-2013)**. Minimum wage data is retrieved from the Ministry of Labor and Social Security. Inflation expectations are taken from CBRT Expectations Survey. Rest of the table is authors' own calculations using Turk Stat HLFS micro data sets. **(a)** Expected annual CPI inflation as of the last month of the previous year. **(b)** Minimum wage is the net amount received after income taxes and social security premium paid by the worker. Fraction at is the share of employees that earn at the 5 percent neighborhood of the average minimum wage set for the corresponding year. Fraction below is the share of employees below the minimum wage. These fractions are computed using monthly wages of employees that work in between 30 and 85 hours. More detailed explanation on these measures is available in the methodology section.

Data. We use individual level data from Household Labor Force Survey (HLFS) micro data sets disclosed by Turkish Statistical Institute (Turk Stat). HLFS follows the norms and the standards of the European Union Statistical Office and International Labour Organization (ILO). Survey is representative of the all labor force in the country. Survey questionnaire contains questions relating to demographics, education, nature of work and income. Our sample is restricted to wage earners that work between 30 to 85 hours per week and covers all

paid employees, both regular and casual. We set the lower bound for filtering out part-time workers and upper bound to eliminate potential misreporting. Minimum wage data is retrieved from the Ministry of Labor and Social Security. Appendix B provides detailed description and the summary statistics of the variables used in the empirical analysis.

In 2004, sample size of the survey was increased in order to compile data at the regional level. In order to get rid of potential bias on estimated coefficients due to enlarged sample we use trimmed data. Trimming is carried out at the *industry* × *occupation* dimension. Based on box plot analysis we removed *industry* × *occupation* groups whose employment growth is a major outlier. Moreover, Turk Stat declares that grouped data with a size representing a population less than 2000 is not reliable. Thus, we exclude such *industry* × *occupation* cells from the sample. Finally we remove outliers by applying adjusted box plot method introduced by Hubert and Vandervieren (2008) to the hourly wage data.

Change in the Wage Distribution in 2004

The increase in 2004 was one of the sharpest hikes in the minimum wage history in Turkey. With this spurt gross minimum wage increased back to its level in the 1970s. It also marks the period when wage distribution shifted at a large scale. Figure 2 illustrates Kernel wage densities for the period 2003-2013. The most dramatic change in the wage distribution took place in 2004. Wage distribution was compressed from the low-end, as wages at the lower half of the distribution saw a relatively stronger real increase. Another important point to note from Figure 2 is the spikes of the wage distributions around the minimum wage depicted by vertical lines. There is a significant degree of concentration around the minimum wage, indicating that the minimum wage is binding (Khamis, 2013; Kristensen and Cunningham, 2006).[4]

Before advancing to the main analysis we dig deeper into the change in the wage distribution from 2003 to 2004. The first block in Table 2 shows the fraction of young workers (age below 25), females, informal workers and low educated workers along the wage distribution. In 2003, average years of schooling in Turkey was 8.7 years, slightly above secondary school degree. Accordingly we define low educated group as high school dropouts and below. Overall, 29 percent of the sample used to work informally. Only 20 percent was female, 17 percent was young and 55 percent was low educated. As we move up in the wage distribution the share of informal, female, youth and low educated declines.

The second block in Table 2 shows the average change in real wages, informality and working hours for different deciles of the wage distribution. Using pooled data for 2003 and 2004, we estimate the following equation for each decile of the wage distribution:

[4]Estimated distributions are bimodal. First peak is due to the minimum wage and second is due to the public sector employees. Once we exclude the latter, wage distribution becomes a unimodal distribution with wages concentrated around the minimum wage.

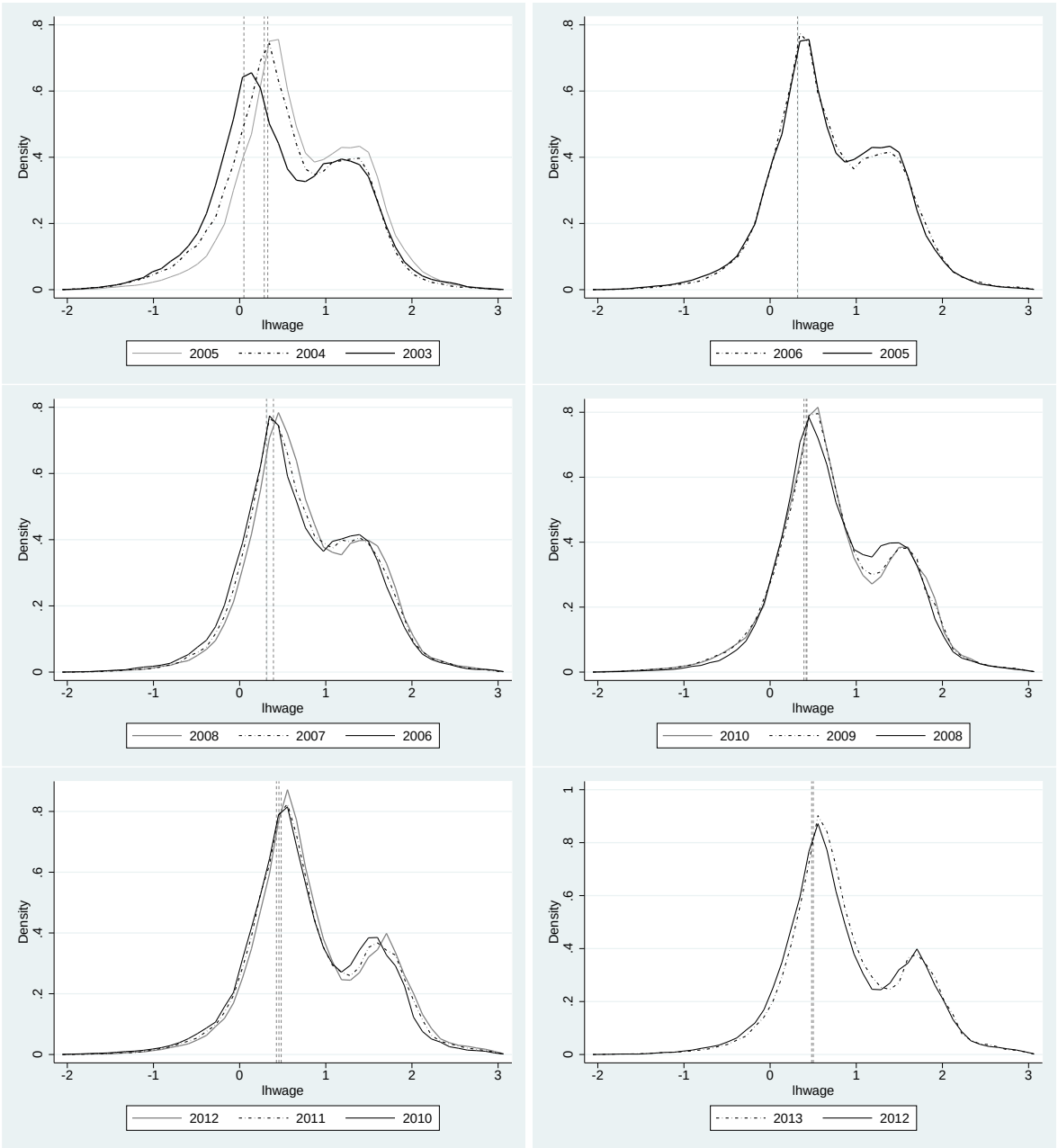

Figure 2: **Kernel Density Estimates of Real Hourly Wages (natural log, 2003-2013).** Sample is restricted to wage earners that work from 30 to 85 hours. Vertical lines display the minimum wage levels.

Wage decile	Percentile/ min. wage (2003)	Wage distribution in 2003				Regression results: change in hourly wages, informality and hours worked[(a)]		
		Fraction informal	Fraction female	Fraction youth	Fraction low educ.	Dependent variable: log hourly wage	Dependent variable: informal, binary (1/0)	Dependent variable:hours/week
all		0.29	0.20	0.17	0.55	0.068***	0.013***	1.299***
1	0.80	0.85	0.25	0.43	0.87	0.064***	0.003	1.829***
2	1.00	0.60	0.25	0.32	0.77	0.093***	0.036	3.604***
3	1.11	0.42	0.22	0.28	0.74	0.108***	0.062***	2.533***
4	1.33	0.41	0.20	0.23	0.71	0.117***	-0.000	1.220*
5	1.59	0.33	0.21	0.18	0.67	0.089***	0.012	1.622***
6	1.99	0.26	0.17	0.14	0.59	0.032***	0.029	0.040
7	2.39	0.10	0.18	0.08	0.47	-0.029***	0.016	3.550***
8	3.01	0.04	0.19	0.05	0.34	-0.023***	0.009	0.810
9	3.58	0.01	0.19	0.03	0.27	-0.008**	0.006	0.497*
10		0.02	0.17	0.02	0.22	-0.019**	-0.001	0.358

Table 2: **Change in Real Wages, Informality Rate and Working Hours Along the Wage Distribution (2003-2004).** ***, **, and * refer to 1%, 5% and 10% significance levels, respectively. Wages are deflated with 2003 based CPI. **(a)** This block of the table shows individual level regression estimates for deciles of the wage distribution. Sample is restricted to wage earners that work between 30 and 85 hours per week. All equations include a year dummy for 2004, industry and occupation fixed effects and controls including gender, marital status, age group dummies, years of schooling, firm size dummies, urban versus rural area dummy ana tenure. Each cell is the coefficient of the time dummy from the regression concerning the respective decile referred to in each row.

$$Y_{i,t} = \alpha + \beta \cdot T_t + IO_{i,t} + \gamma \cdot X_{i,t} + \phi \cdot Z_{j,t} + \epsilon_{i,t}, \tag{2.1}$$

Where i, t index individuals and years, respectively; Y is the labor market outcome of interest, X contains data on individual level characteristics, IO is a vector of dummy variables for the *industry* $\times$ *occupation* groups, Z is an industry and time specific proxy for the economic activity, T is a time dummy for 2004 and ϵ is the error term. The values in the regression results block in Table 2 are the estimated coefficients on the year dummy. They represent the change in hourly wages/informality rate/hours worked for the corresponding deciles. Accordingly, controlling for demographics and other compositional shifts in the labor market, in 2004 hourly wages increased on average by 7 percent in real terms, the share of those working informally increased by 1.3 percentage point and working hours per week increased by 1.3 hours on average. There is a lot of variation along the wage distribution with respect to the magnitude of the change in wages, informality rate and working hours. The 10 percent neighborhood (5 percent at both sides) of the minimum wage corresponds to a portion of decile 2, and almost all of decile 3. Wages increased by 9 percent and 11 percent in deciles 2 and 3, respectively. Given that minimum wage increased by 37.5 percent, decile 4 covers the region between the old and the new minimum. In this decile wage increase was the highest by 12 percent on average. There are increases up to decile 7, albeit at a smaller magnitude. There is no increase above the threshold of decile 7, which corresponds to 2.4 times the minimum wage (Table 2, Column 2). Informality has increased significantly at decile 3. Hours worked per week increased at various points along the wage distribution. Magnitude of the increase

in hours worked around the minimum wage are among the highest observed.

Most of the change took place at the low end of the wage distribution and the magnitude of the change decreases as one moves up the distribution. Interestingly, wages of the employees that earn above the minimum wage also increased (deciles 5-7). Finally, we note that the most pronounced changes are observed on those deciles where the share of informal, young and less educated workers is high.

Although the minimum wage policy applies to the formal labor market, looking at the wage densities, we observe that it is also binding for the informal employees. Figure 3 displays the wage densities in the formal and informal divide for 2003 and 2004. Wage density of the formal employees has a double peak with first peak formed around the minimum wage. On the other hand, a quasi-normal wage distribution is observed for the informal employees, where the average wage is close to the minimum wage. From 2003 to 2004, the wage distribution is compressed from the lower end for the formal employees. Real wages of the formal high wage earners have seen almost no real increase. For the informal employees wage distribution has shifted to the right. This common movement in the formal and the informal labor markets hints the incidence of a lighthouse effect.

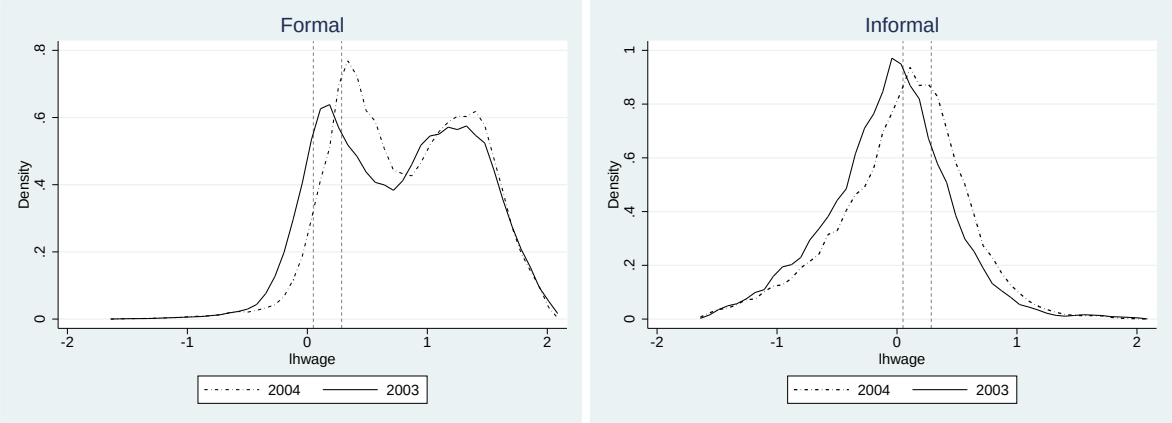

Figure 3: **Kernel Estimates: Formal vs. Informal Sector (2003-2004).**

3 Methodology

In order to estimate the causal impact of the minimum wage increase we use the difference-in-differences (DID) methodology with a variation in the minimum wage's bite at the *industry* × *occupation* level. Differential change in the high impact groups with respect to the low impact groups point out the impact of the minimum wage increase. The treatment here is the minimum wage increase in 2004.

Our methodology is closely related to that of Card (1992), Stewart (2002) and Khamis (2013).

In order to measure the impact, this setup requires a group wise variation in the minimum wage's bite. If the minimum wage varies at the sectoral or the regional level the type of diversification is straightforward. But if the minimum wage is set at the national level with full coverage, then one needs to set up a group wise variation at some dimension such as region, industry or position on the wage distribution. Depending on the wage distribution at the group level, bite of the minimum wage varies. In this case high impact (low impact) groups are the groups that are expected to be affected more (less) by the minimum wage increase. Several different low impact groups that have been used in the literature include: individuals at the higher levels of the wage distribution (Currie and Fallick, 1993), regions where the bite of minimum wage is low (Card, 1992; Stewart, 2002), industries where the bite of minimum wage is low (Dickens et al., 1999). Among these alternatives we prefer not to use higher deciles of the wage distribution for the reason that the use of higher deciles is based on the assumption that the minimum wage has no impact on wages higher than the minimum wage. But as pointed out by Khamis (2013) and as implied by our results presented in Table 2, the minimum wage increase might have spillover effects. Finally, we are unable to use regional level variation in the minimum wage's bite, because the 2003 HLFS questionnaire does not include information on the region of inhabitance. Thus, we form a group wise variation on the basis of industry and occupation dimensions. Industry coding is based on the European Standard Classification $NaceRev$ 1.1 and includes 9 industries. Occupation coding is based on the International Standard Classification of Occupations ($ISCO$ 88), which is also based on 9 groups. Accordingly, we have 81 industry $\times$ occupation groups in total.

Impact variables. There are two sets of minimum wage indicators in the empirical literature: Relative minimum wage measures and the degree of impact measures. Among the former we can count; minimum wage deflated by a price index, the ratio of minimum wage to the average wage (Kaitz Index) and the ratio of minimum wage to the median wage (Kaitz Index 50). The latter group of measures include fraction at, fraction below and fraction affected, which identify the bite of the minimum wage. There are pros and cons of using both indicator groups. For the first group, the definitions are clear and the parameter estimates by using these indicators are easier to interpret. However, if minimum wage is constant, the variation of the indicator comes from the variation of the denominator. Furthermore, the change in the average or median wages may be lagged and may stem from not only minimum wage changes but also other factors, which contaminate the indicator in question (Lemos, 2004). For the second group, the interpretation of the parameter estimates is not straightforward and needs adjustment for a comparable inference. Nevertheless, they have the advantage that the size of the indicator is directly related to the minimum wage itself. Given this advantage we prefer to use degree of impact measures.

We use two different impact variables: fraction at and fraction affected. Fraction at is the

initial proportion of employees around the minimum wage ($0.95 * mw_t < w_t < 1.05 * mw_t$). Fraction affected covers fraction at and the proportion of employees earning between the old and the new minimum wage ($0.95 * mw_t < w_t < 1.05 * mw_{t+1}$). Both indicators are measures of the effectiveness of the increase. Moreover, it should be noted that higher minimum wage increase means that more workers fall between the new and old levels of the minimum wage. Thus, fraction affected is also related to the size of the minimum wage increase. We calculate these measures for each *industry* × *occupation* group.

In the regressions, we use both the binary version as in Khamis (2013) and Stewart (2002) and the continuous versions as in Waldinger (2010) of these variables. In the binary version, the challenge is how to define the treatment and the control groups. In the literature, high and low impact groups are determined in a rather *ad hoc* way. In Stewart (2002), where regional variation in minimum wages bite is used, high impact group is defined as the local areas with the highest low-pay rates and which constitute 10 percent of the total number of employees. Analogously, low impact groups are the 10 percent of the employees in the areas with the lowest low-pay rates. Khamis (2013) also uses regional variation and defines 5 regions with the highest percentage of low-paid workers as the high impact group and rest of the regions as the low impact group. In our case, we use mean of the impact variable as a cutoff point to construct its binary version. *Industry* × *occupation* groups with a share above the mean of the respective impact measure are classified as the high impact groups and those below as the low impact groups. Appendix C provides a descriptive table showing the high and low impact groups for the overall sample.

The left panel in Figure 4 displays the fraction affected by each *industry* × *occupation* group for 2003. Values for this measure ranges from almost zero in some high skilled occupations to around 70 percent in the very low skilled occupations. Although fraction affected takes low values in high skilled occupations without exception (occupation groups 1 & 2), groups with high fraction affected are not necessarily all low skilled occupations. Looking at the industry dimension; fraction affected is high in manufacturing, construction, trade-hotels-restaurants and finance-insurance-real estate-business services. The right panel in Figure 4 displays the change in the wage distribution for the high and low impact groups. Clearly the shift in the wage distribution is more pronounced for the high impact groups.

DID framework. We are working with pooled cross sections from 2003 and 2004. Our DID equation is formulated as follows:

$$Y_{i,j,t} = \alpha + \beta \cdot T_t + \delta \cdot Impact_j + \theta \cdot (T_t \times Impact_j) + \gamma \cdot X_{i,j,t} + \phi \cdot Z_{j,t} + \epsilon_{i,j,t}, \qquad (3.1)$$

where i, j, t index individuals, *industry* × *occupation* groups and time respectively, Y is the

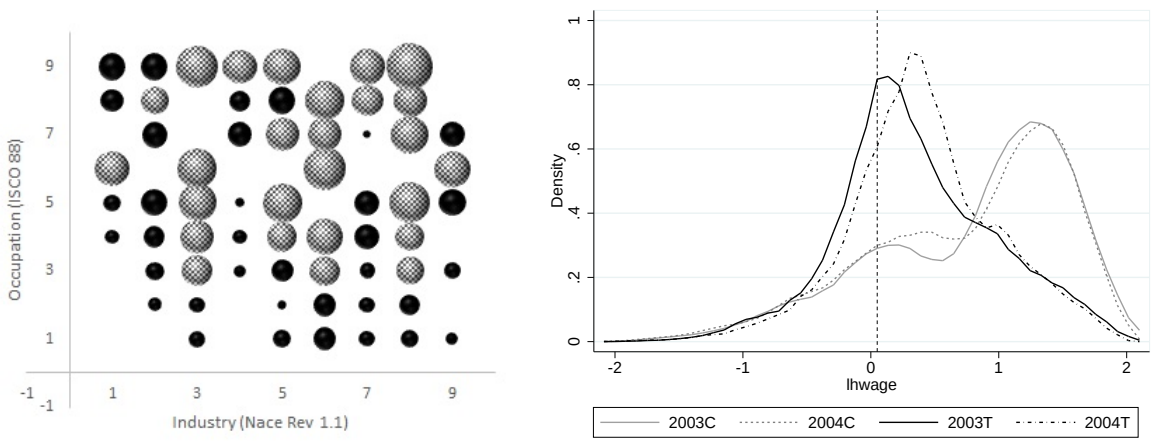

Figure 4: **Left Panel. Fraction Affected by** $Industry \times Occupation$ **Groups (2003)**. Checkered bubbles are the treatment groups and solid black bubbles are the control groups in the analysis using binary variables. High impact (low impact) groups constitute the highest (lowest) 50% of the sample. Nace Rev 1.1 coding: (1) Agriculture, forestry, hunting and fishing; (2) Mining and quarrying; (3) Manufacturing; (4) Electricity gas and water; (5) Construction; (6) Wholesale and retail trade, hotels and restaurants; (7) Transportation communication and storage; (8) Finance, insurance, real estate and business services; (9) Community social and personal services. ISCO 88 coding: (1) Legislators, senior, officials and managers; (2) Professionals; (3) Technicians and associate professionals; (4) Clerks; (5) Service workers and shop and market sales workers; (6) Skilled agricultural, and fishery workers; (7) Craft and related trades workers; (8) Plant and machine operators and assemblers; (9) Elementary occupations. **Right Panel. Wage Distributions for High and Low Impact Groups (2003-2004)** Kernel Estimates. Vertical dashed line displays the minimum wage in 2003. Source: HLFS, authors' own calculations.

labor market outcome of interest, X is the vector of individual level characteristics, Z is the value added at industry level with variation over time, and ϵ is the error term. In this setup we use both the continuous and the binary versions of the treatment variable $Impact$. In the binary case $Impact$ takes a value of 1 for the high impact groups and value 0 for the low impact groups. In the continuous case, the impact variable takes the value of the calculated fraction of employees for each $industry \times occupation$ group.

The main parameter of interest is θ, which measures the marginal change in the labor market outcome of high impact $industry \times occupation$ groups as a result of the change in the minimum wage. Industry level value added is included to control for shocks other than the change in the minimum wage. The individual specific variables are included to capture the differences in labor market outcomes due to differences in observed characteristics and working conditions. These include gender, marital status, age group dummies, years of schooling, tenure, firm size dummies, urban versus rural area dummy. Appendix B provides detailed description and the summary statistics of the variables used in the empirical analysis.

Since we are not directly interested in δ, another possible formulation to use in the DID setting is to include a full set of $industry \times occupation$ fixed effect denoted by f_{IO}. This reformulation is feasible since the impact variables can be generated as a linear combination

of *industry* × *occupation* fixed effects. In this case DID equation takes the following form:

$$Y_{i,j,t} = \alpha + \beta \cdot T_t + f_{IO} + \theta \cdot (T_t \times Impact_j) + \gamma \cdot X_{i,j,t} + \phi \cdot Z_{j,t} + \epsilon_{i,j,t}. \tag{3.2}$$

In all of the individual level estimations, observations are weighted by factors representing the population shares. We allow for residuals to be correlated within the industry and occupation groups. Hence, standard errors are corrected for two-way clustering at the industry and occupation level by applying the method proposed by Cameron et al. (2011).

Our framework measures the impact of the minimum wage increase using pooled cross section and group wise variation of the minimum wages' bite at the *industry* × *occupation* dimension. Our sample includes only part of the labor force that is employed and excludes those who are unemployed. Since we use neither variation at the regional level nor individual level panel data, in order to measure the impact of minimum wage increase on employment we use data collapsed at the *industry* × *occupation* level. We use the following specification:

$$Y_{j,t} = \alpha + \beta \cdot T_t + f_{IO} + \theta \cdot (T_t \times Impact_j) + \gamma \cdot X_{j,t} + \phi \cdot Z_{j,t} + \epsilon_{j,t}, \tag{3.3}$$

where $Y_{j,t}$ is the log of employment at the *industry* × *occupation* group j at time t. As in Equation 3.2, Z is an industry and time specific proxy for economic activity, and ϵ is the error term. The main parameter of interest is θ which measures the change in labor market outcome of high impact *industry* × *occupation* groups as a results of the change in the minimum wage. Individual specific characteristics are averaged out at the group level.

4 Results

In this section we present the estimated effects of the minimum wage increase on the labor market outcomes in Turkey. For hourly wages, informality rate and hours worked per week, the estimated equations are of the form in equation 3.2. For employment we use group level data and estimate equation 3.3. In order to save space we do not report all the regression results. Instead we collect the coefficients on the $Time \times Impact$ variable and report these in the tables.[5] The number of observations, total number of groups and the number of high impact groups used for each regression is reported together with the estimation results. We estimate equations for the whole salaried workers and for the following sub groups separately: employees working formally, working informally, males, females, low educated, high educated and youth.

[5] Detailed results are available upon request.

We use binary and continuous versions of fraction at and fraction affected as described in the methodology part. The interpretation of the coefficient estimates for each version is different. Coefficient of the binary indicators presents the average differential impact of the minimum wage change on the high impact over the low impact groups. The continuous version, on the other hand, enables us to measure the marginal impact of a one unit change in the impact variable. The latter indicator enables us to calculate the minimum wage impact on each *industry* × *occupation* group separately. We report the values for the *industry* × *occupation* group at the mean and for the *industry* × *occupation* group with the highest value of the corresponding impact variable, in other words the most vulnerable group.

Hourly wage results. Table 3 reports the effect of the minimum wage increase on the real hourly wages of salaried employees. The dependent variable is the log of the real hourly wages. All of the estimation results show that the estimate of θ in Equation 3.2 is positive and statistically significant in almost all sections of the labor market. For the overall sample, the average differential impact on real hourly wages of high impact groups ranges between 5.9 percent and 9.3 percent, following the 26.6 percent increase in the real minimum wage. Thus the minimum wage elasticity of hourly wages is in the interval of 0.22 and 0.35 percent. The results utilizing the continuous versions of the impact variables show that the average impact for the group at the mean ranges between 3.5 and 7.0 percent. And for the most vulnerable *industry* × *occupation* group the impact reaches as high as 22 percent, which indicates an elasticity of almost 0.9.

There are several observations worth mentioning at this point. The first one is that following the boost in the minimum wage informal wages also increased along with formal wages. This is in contradiction with the classical dual market hypothesis, which predicts a fall in the informal wages. Thus, the estimation results point to the existence of the so-called lighthouse effect in Turkish labor market for the informal wages. The second point is that lighthouse effect disappears when we consider wider range of workers in the informal sector with the fraction affected measure. That is to say, lighthouse effect seems to be valid for the informal workers working in the vicinity of the minimum wage.

Using the fraction at measure the impact of the minimum wage does not vary significantly among the subgroups. However coefficient estimates for the fraction affected measure are either not significantly different from zero or smaller in magnitude for informal, low educated and young workers relative to the overall sample. Table 11 in the Appendix D reports p-values for testing the null hypothesis of equal marginal wage impact for different sub groups. Accordingly, wage response in the high impact groups are significantly lower for the low educated workers compared to the overall sample or formal group of employees. For youth and informal workers the impact is statistically not significant. Difference in the results using two measures hints that those earning between the old and the new minimum wage benefited

relatively less compared to those earning in the vicinity of the old minimum wage. Another point to note from Table 11 in the Appendix is that marginal wage increases do not differ between males and females. This is inline with Pelek (2013), where she concludes that wage inequality decrease for both genders after the minimum wage increase.

The wage rise in all sections of the labor market may hint the benchmark role of the minimum wage - one of the explanations for the light house effect- for the overall wages in the labor market as documented for Colombia (Maloney and Mendez, 2004), Brazil (Lemos, 2004) and Argentina (Khamis, 2013). An alternative explanation for the light house effect is a compositional shift. If more skilled people become informally employed following the minimum wage increase, this might increase the wages at the informal market. We can rule out this possibility as average years of schooling declines from 2003 to 2004 for workers around the minimum wage. The validity of other possible explanations mentioned early in the paper for the lighthouse effect is not straightforward and needs to be further studied.

Informality rate. Table 4 reports the effect of the minimum wage on the likelihood of informal employment. For measuring the impact on informality, we generate a binary indicator of informally employed, which takes the value 1 if an individual is not registered with a social security institution and 0 otherwise. Results with the continuous version of the fraction at and fraction affected show that 26.6 percent upsurge in the minimum wage increased the likelihood of having an informal job for the overall sample around 0.7 to 1.0 percent for the mean group and 3.0 to 4.0 percent for the most vulnerable group. Looking at the subgroups, the rise in the informality rate is observed for male, high educated and low educated workers. There is no significant impact as far as the binary impact variables are concerned except for the high educated workers.

Hours per week. The results for the working hours is presented in Table 5. The estimation results utilizing binary versions of the impact variables point to no differential impact across the high impact groups. For the continuous version we observe conflicting results among the subgroups, pointing that some subsections of the labor market may behave differently. Using fraction at we see no impact of the minimum wage increase for the overall sample, however working hours of the informal workers and the low educated workers diminish. Using fraction affected, change in the working hours for the overall sample becomes significantly positive and working hours for the mean $industry \times occupation$ group rises by around a quarter of an hour. This implies that the working hours of fraction of workers between the old and new minimum wage were affected to a greater extent. The rise is observed mostly for the formal and the male worker groups, while the impact is insignificant for the others.

One possible explanation for this dissimilarity in outcomes in formal male and informal and young workers is the potential differential impact of the minimum wage on regular and casual

employees. Our sample covers all salaried employees, both regular and casual. Regular employees mostly earn a monthly wage, whereas casual employees are paid on an hourly/daily basis. If firms can discard overtime payments to some extent, they may try to offset increase in the labor cost by increasing working hours of the regular employees and by reducing those of the casual employees.

When we repeat the analysis after excluding casual employees, we see a stronger increase in the working hours for the overall sample, reaching up to almost half an hour on average (Appendix E Table 12). This rise originates from the response of the working hours of high educated workers. With this new contracted sample, along with formal and male workers, the working hours of the high educated workers also rose. As for the vicinity of the minimum wage, the negative impact on informal and young workers are no longer significant. These results imply that employers demand more hours from employees, whose wages are determined at a monthly basis, and to some extent employ less hours of casual employees to cut back on total labor expenses. Results using the binary version of the impact variables cast a shadow upon the second part of this argument as average differential impact for the informal workers at the vicinity of the minimum wage and low educated workers earning between the old and new wage levels take significant negative values.

Employment. We measure the impact of minimum wage on employment using group level estimation model as given in equation 3.3. Looking at the results in Table 6, there is no indication of a negative employment effect of the minimum wage increase. For the most vulnerable groups such as females, young workers and low educated, the estimated impact is negative but statistically insignificant. Given the bite of the minimum wage and the size of the minimum wage increase this is a rather surprising result. In the developing countries, where bite of the minimum wage is high as in Turkey, most of the time employment elasticity is estimated to be negative (Neumark and Wascher, 2007). Papps (2012) finds a negative employment effect of the minimum wage increase in 2004, albeit small.

These results imply that higher minimum wage does help reduce wage inequality. Informality increases for both the low and high educated group of workers. Although the impact is limited in size, working hours of the regular employees paid on a monthly basis increase. Finally, there is no significant adverse impact on employment.

5 Conclusion

Despite the long history of the national minimum wage legislation and the significant share of workers potentially subject to the minimum wage policy, there is limited literature on its impact on the labor market outcomes in Turkey. In this paper we study the minimum wage impact on wages, informality, working hours and employment in Turkey by using the sizable

minimum wage increase in 2004. In doing so, we contribute to the literature on the minimum wage effects on labor market outcomes in Turkey and in developing countries. Moreover by investigating informal and formal markets separately we provide evidence against the validity of the dual market hypothesis.

In our empirical analysis, we use HLFS micro data set for the years 2003 and 2004. We employ a quasi-experimental approach using the difference-in-differences methodology, where 2004 is the treatment year. The treatment groups are $industry \times occupation$ groups with a significant fraction of workers earning at the old minimum wage or significant fraction earning at the old minimum wage and between the old and the new minimum wage. We find that following the minimum wage increase in 2004 wage distribution was compressed from below. Various minimum wage impact variables indicate that in response to a 1 percent rise in the minimum wage, wages increased in the range of 0.22 percent to 0.35 percent. Wage response is found to be lower for the informally employed, low educated and young workers. Additionally, rise in the minimum wage increased the likelihood of informal employment for both the low and the high educated group of employees. Unlike Papps (2012) we find no indication of a negative overall employment effect. Furthermore, our results do not support the inference of the dual market hypothesis. We observe wage increase not only for the formal but also for the informal employees, which probably is a sign of integrated labor market rather than a separated labor market similar to Brazil as shown by Lemos (2004).

In the final analysis, impact on wages has been sizable. We observe significant effect on informality and working hours but no significant adverse effect on employment. At this point, we should note that the minimum wage increase in 2004 occurred in the context of a bustling economy. In this year the GDP growth was 8.8 percent, surpassing its long-term average growth rate of 5 percent (Öğünç and Sarıkaya, 2012). One episode quasi-experimental approach has the advantage that it allows us to treat the considerable wage increase of 2004 as an exogenous shock. But on the other hand, caveat of using one episode to measure the impact of the minimum wage increase is that we are unable to control for the state of the economy. Response of the employers in good states might be different than that in bad states especially when markups are tight. Moreover at the time government subsidy for employers was in place. This could be another factor limiting the adverse impact on employment. We observe that despite having taken place in a favorable state of the economy, the minimum wage increase in 2004 had an adverse impact on informality and working hours. Under bad states one would expect wage response to be weaker and the adverse impact on informality, working hours and employment to be more pronounced. Thus we need to be cautious when generalizing these findings across all states of the economy. Nonetheless, we can say that the results on wages represent an upper bound and those on informality, hours and employment may be interpreted as a lower bound of the potential impact.

Dependent variable: real hourly earnings (natural log)								
Impact variable: Fraction at (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$	0.059**	0.082***	0.055***	0.065***	0.119***	0.094***	0.055**	0.046*
	(0.024)	(0.016)	(0.018)	(0.021)	(0.034)	(0.024)	(0.027)	(0.024)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	26	24	16	25	14	20	20	17
Impact variable: Fraction at (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$ (1)	0.460***	0.476***	0.518**	0.438***	0.497***	0.692***	0.351***	0.278***
	(0.074)	(0.124)	(0.249)	(0.092)	(0.100)	(0.164)	(0.049)	(0.099)
Average impact (1) $\times$ (2)	0.035	0.041	0.045	0.033	0.057	0.048	0.042	0.046
Maximum impact (1) $\times$ (3)	0.216	0.238	0.160	0.201	0.250	0.260	0.176	0.115
Sample information								
Fraction at (mean) (2)	0.077	0.087	0.086	0.075	0.115	0.069	0.120	0.164
Fraction at (max) (3)	0.470	0.501	0.310	0.459	0.502	0.376	0.501	0.413
Impact variable: Fraction affected (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$	0.093***	0.078***	-0.009	0.072***	0.082**	0.098*	0.036**	0.038
	(0.021)	(0.018)	(0.025)	(0.021)	(0.036)	(0.054)	(0.015)	(0.024)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	27	28	18	29	15	25	28	21
Impact variable: Fraction affected (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$ (1)	0.305***	0.264***	0.137	0.291***	0.292***	0.350***	0.241***	0.152
	(0.034)	(0.048)	(0.161)	(0.044)	(0.101)	(0.043)	(0.070)	(0.098)
Average impact (1) $\times$ (2)	0.07	0.07		0.07	0.09	0.08	0.09	
Maximum impact (1) $\times$ (3)	0.22	0.20		0.21	0.21	0.23	0.18	
Sample information								
Fraction affected (mean) (2)	0.24	0.25	0.40	0.25	0.30	0.22	0.38	0.50
Fraction affected (max) (3)	0.72	0.76	0.69	0.72	0.71	0.67	0.74	0.87

Table 3: **Minimum wage effect on hourly wages.** ***, **, and * refer to 1%, 5% and 10% significance levels, respectively. Standard errors in the parentheses are robust to clustering at industry and occupation level. Real wages are deflated with CPI taking 2003 as the base year. Sample is restricted to wage earners that work between 30 and 85 hours per week. Each cell is the estimate of θ from the equation of the group referred to in the column. All of the equations include a year dummy, industry-occupation fixed effects, log GDP by industry and other controls including gender, marital status, age group dummies, years of schooling, tenure, firm size dummies, urban versus rural area dummy. Low education refers to high school dropouts and below.

Dependent variable: Binary Variable, 0 if registered 1 if not registered						
Impact variable: Fraction at (Binary)						
	Total	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$	0.009	0.008	0.006	0.007	0.008	0.001
	(0.011)	(0.015)	(0.020)	(0.008)	(0.018)	(0.023)
# of Observations	61,479	51,381	13,250	31,062	35,439	10,721
# of Groups	65	64	34	58	51	37
# of Treatment groups	26	25	14	20	20	17
Impact variable: Fraction at (Continuous)						
	Total	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$ (1)	0.087**	0.084**	0.052	0.115*	0.084**	0.052
	(0.042)	(0.035)	(0.094)	(0.062)	(0.035)	(0.094)
Average impact (1) $\times$ (2)	0.007	0.006		0.008	0.010	
Maximum impact (1) $\times$ (3)	0.041	0.039		0.043	0.042	
Sample information						
Fraction at (mean) (2)	0.077	0.075	0.115	0.069	0.120	0.164
Fraction at (max) (3)	0.470	0.459	0.502	0.376	0.501	0.413
Impact variable: Fraction affected (Binary)						
	Total	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$	0.010	0.024	0.004	0.013*	0.024	0.004
	(0.008)	(0.019)	(0.024)	(0.007)	(0.019)	(0.024)
# of Observations	61,479	51,381	13,250	31,062	35,439	10,721
# of Groups	65	64	34	58	51	37
# of Treatment groups	27	29	15	25	28	21
Impact variable: Fraction affected (Continuous)						
	Total	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$ (1)	0.044**	0.085**	0.006	0.057**	0.085**	0.006
	(0.022)	(0.037)	(0.070)	(0.027)	(0.037)	(0.070)
Average impact(1) $\times$ (2)	0.01	0.02		0.01	0.03	
Maximum impact(1) $\times$ (3)	0.03	0.06		0.04	0.06	
Sample information						
Fraction affected (mean) (2)	0.24	0.25	0.30	0.22	0.38	0.50
Fraction affected (max) (3)	0.72	0.72	0.71	0.67	0.74	0.87

Table 4: **Minimum wage effect on the ratio of informal employment to total employment.** ***, **, and * refer to 1%, 5% and 10% significance levels respectively. Standard errors in the parenthesis are robust to clustering at industry and occupation level. Sample is restricted to wage earners that work between 30 to 70 hours per week. Each cell is the estimate of θ from the equation of the group referred to in the column. All of the equations include a year dummy, industry-occupation fixed effects, log GDP by industry and other controls including gender, marital status, age group dummies, years of schooling, tenure, firm size dummies, urban versus rural area dummy. Low education refers to high school dropouts and below.

Dependent variable: hours per week								
Impact variable: Fraction at (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$	-0.326	0.136	-0.534	0.146	-0.777	-0.020	-0.326	-0.741
	(0.234)	(0.413)	(0.377)	(0.270)	(0.912)	(0.475)	(0.258)	(0.569)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	25	28	17	23	15	20	23	18
Impact variable: Fraction at (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$ (1)	-0.335	1.935	-3.336**	1.345	-1.275	2.873	-1.512***	-2.781
	(1.037)	(1.653)	(1.619)	(1.143)	(2.415)	(1.852)	(0.580)	(2.944)
Average impact (1) $\times$ (2)			-0.288				-0.182	
Maximum impact (1) $\times$ (3)			-1.031				-0.756	
Sample information								
Fraction at (mean) (2)	0.077	0.087	0.086	0.075	0.115	0.069	0.120	0.164
Fraction at (max) (3)	0.470	0.501	0.310	0.459	0.502	0.376	0.501	0.413
Impact variable: Fraction affected (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$	-0.350	0.320	-0.404	0.231	-0.102	-0.075	-0.143	-0.286
	(0.291)	(0.393)	(0.400)	(0.307)	(0.888)	(0.495)	(0.170)	(0.465)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	27	27	21	26	15	25	24	19
Impact variable: Fraction affected (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$ (1)	1.437**	1.693**	-0.840	2.301***	0.005	2.029	-0.769	-1.729
	(0.709)	(0.754)	(3.353)	(0.579)	(2.202)	(1.357)	(0.710)	(2.360)
Average impact (1) $\times$ (2)	0.35	0.42		0.56				
Maximum impact (1) $\times$ (3)	1.04	1.29		1.66				
Sample information								
Fraction affected (mean) (2)	0.24	0.25	0.40	0.25	0.30	0.22	0.38	0.50
Fraction affected (max) (3)	0.72	0.76	0.69	0.72	0.71	0.67	0.74	0.87

Table 5: **Minimum wage effect on working hours per week.** ***, **, and * refer to 1%, 5% and 10% significance levels, respectively. Standard errors in the parentheses are robust to clustering at industry and occupation level. Sample is restricted to wage earners that work between 30 to 85 hours per week. Each cell is the estimate of θ from the equation of the group referred to in the column. All of the equations include a year dummy, industry-occupation fixed effects, log GDP by industry and other controls including gender, marital status, age group dummies, years of schooling, tenure firm size dummies, urban versus rural area dummy. Low education refers to high school dropouts and below.

Dependent variable: employment level (natural log)								
Impact variable: Fraction at (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$	0.064	0.091	-0.022	0.064	-0.078	0.094	-0.097	-0.011
	(0.092)	(0.065)	(0.121)	(0.116)	(0.187)	(0.067)	(0.150)	(0.152)
# of Observations	132	136	79	131	70	119	105	76
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	26	24	16	25	14	20	20	17
Impact variable: Fraction at (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$ (1)	0.495	0.672*	0.258	0.515	-0.238	0.370	-0.452	-0.411
	(0.570)	(0.351)	(0.996)	(0.542)	(0.372)	(0.397)	(0.765)	(0.766)
Average impact (1) $\times$ (2)		0.058						
Maximum impact (1) $\times$ (3)		0.337						
Sample information								
Fraction at (mean) (2)	0.077	0.087	0.086	0.075	0.115	0.069	0.120	0.164
Fraction at (max) (3)	0.470	0.501	0.310	0.459	0.502	0.376	0.501	0.413
Impact variable: Fraction affected (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$	0.139	0.110	-0.062	0.155	-0.083	0.048	-0.133	-0.016
	(0.127)	(0.082)	(0.095)	(0.108)	(0.151)	(0.053)	(0.157)	(0.140)
# of Observations	132	136	79	131	70	119	105	76
# of Groups	65	67	39	64	34	58	51	37
# of Treatment groups	27	28	18	29	15	25	28	21
Impact variable: Fraction affected (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$ (1)	0.398	0.380*	-0.367	0.447	-0.222	0.304*	-0.304	0.068
	(0.336)	(0.171)	(0.554)	(0.348)	(0.357)	(0.139)	(0.693)	(0.432)
Average impact (1) $\times$ (2)		0.09				0.07		
Maximum impact (1) $\times$ (3)		0.29				0.20		
Sample information								
Fraction affected (mean) (2)	0.24	0.25	0.40	0.25	0.30	0.22	0.38	0.50
Fraction affected (max) (3)	0.72	0.76	0.69	0.72	0.71	0.67	0.74	0.87

Table 6: **Minimum wage effect on employment.** ***, **, and * refer to 1%, 5% and 10% significance levels, respectively. Standard errors in the parentheses are robust to clustering at industry and occupation level. Sample is restricted to wage earners that work between 30 and 85 hours per week. All of the above equations include a year dummy, industry-occupation fixed effects and log GDP by industry. Other controls include: share of women, share of informal workers, share of people working in firms with size greater than 50 person, share of workers at an age less than 25, share of married, living in urban areas, share of low educated, average tenure, share of those enrolled in school.

A Minimum Wage and Total Cost to the Employer

	Net Min. Wage	Gross Min. Wage (1)	Contribution base	Employer's contribution (2)	Employee's contribution paid by the employer (3)	Total Labor Cost (1+2+3)
07.2002 - 03.2003	226.0	306.0	327.0	70.3	3.2	379.5
04.2003 - 06.2003	226.0	306.0	393.0	84.5	13.1	403.6
07.2003 - 12.2003	226.0	306.0	458.0	98.5	22.8	427.3
01.2004 - 06.2004	303.1	423.0	423.0	90.9	0	514.0
07.2004 - 12.2004	318.2	444.2	444.2	95.5	0	540.0
2003 avg.	226.0	306.0				409.4
2004 avg.	310.7	433.6				526.8
2003 - 2004 % *change*	37.5	41.7				28.7
2003 - 2004 % *real change*(a)	20.7	24.4				13.0

Table 7: **Minimum wage and total cost to the employer (TL)**. Both employees and employers contribute a fraction of gross wage to the social security fund and the unemployment insurance fund. In the private sector, employer contribution rate in total was 21.5 percent and employee contribution rate was 15 percent of the gross rate. If gross wage fell below the contribution base announced by the government, employers paid the employee contribution arising from the gap. For the first half of 2004 government increased contribution base to 549.6 TL, but at the same time subsidized the additional contribution to be paid by the employers. Thus effective base was 423 TL. Due to government subsidies, increase in the total labor cost was around 10 percentage points lower. (a) Deflated by expected CPI inflation.

B Descriptive Statistics

In this appendix, we provide detailed descriptions of the variables we have used in the regressions.

Informal employment: The informal employment is defined by a dummy variable taking 1 if the worker is NOT registered with the social security institution in his current job and 0 if he is registered.

Marital status: The variable used to describe the marital status of the individuals is a dummy variable taking 1 if the worker is married and 0 otherwise.

Low education: The last degree obtained is described in 7 categories in the Turkish HLFS: 0 illiterate, 1 no degree, 2 primary school, 3 middle school, 4 high school, 5 vocational high school, and 6 college or above. In the paper, we define the workers with low education by a dummy variable taking 1 if the worker has a degree from middle school or below, (excluding) category 4.

Education: The education variable is calculated using information on the last degree obtained. It shows the years spent at school: 0 (illiterate), 3 years (no degree), 5 years (primary school), 8 years (middle school), 11 years (high school), 15 years (college or above).

Urban/rural status: Whether the worker resides in an urban versus rural area is described by a dummy variable taking 1 if the worker lives in an urban area and 0 otherwise. In the survey, an urban area defined as a residential area with population size above 20,000.

Firm size: In the survey, firm size is measured with the number of workers employed in the firm in which the worker is currently employed. This is a categorical variable describing firm size in 4 categories: $1-9$, $10-24$, $25-49$, 50 or above. Each category is included as a separate dummy variable into the regressions.

Age: This is a categorical variable describing age in 13 categories from $0-4$ years to 65+. Each category is included as a separate dummy variable into the regressions.

Enrolled:This is a dummy variable taking 1 if the worker is enrolled in education and 0 otherwise.

Tenure: The survey provides information on the year that the worker started working in the current job. Tenure is calculated as the current date minus the starting date.

Industry: The survey provides information on one-digit industry codes based on the standard Nace-Rev 1.1 classification.

Occupation: The survey provides information on one-digit occupation codes based on the standard ISCO 88 classification.

Industry and occupation categories and their interaction categories are included into the regressions as separate dummy variables. Other general variables that do not need any description include gender and year dummies.

	Employment Shares %		**Value Added (Annual % change)**
Agriculture, forestry, hunting and fishing	6.0	6.1	2.8
Mining and quarrying	1.4	1.5	3.4
Manufacturing	15.7	15.0	11.7
Electricity, gas and water	1.7	1.3	7.3
Construction	12.9	12.7	14.1
Wholesale and retail trade, hotels and restaurants	14.0	15.4	12.7
Transportation communication and storage	10.7	10.8	10.5
Finance, insurance, real estate and business	8.9	9.5	10.9
Community social and personal services	28.8	27.7	2.1

Table 8: **Employment shares and value added by industry**.

Control variables	**2003 Mean**	**2004 Mean**
Informal	29.8	33.0
Female	18.7	19.1
Age (average)	33.9	34.3
Firm size (< 10)	36.7	38.0
Firm size (11-24)	11.2	10.6
Firm size (25-49)	13.6	15.4
Firm size (> 50)	38.5	35.9
Married	73.0	72.9
Urban	74.4	81.9
Average years of schooling	8.5	8.3
Enrolled	3.9	3.5
Tenure (years)	8.2	7.8
Occupation shares		
Legislators, senior officials and managers	5.6	5.8
Professionals	3.1	3.1
Technicians and associate professionals	15.5	14.6
Clerks	12.5	12.1
Service workers and shop and market sales workers	12.8	12.5
Skilled agricultural and fishery workers	0.9	1.2
Craft and related trades workers	15.7	15.9
Plant and machine operators and assemblers	10.7	11.5
Elementary occupations	23.2	23.2
# of Observations (trimmed sample)	23927	37653
# of Observations	45883	70764

Table 9: **Sample of employees (% of the sample)**.

C Control and treatment groups for the overall sample

Industry (Nace Rev 1.1)	Occupation (ISCO 88)	Fraction at	Classification*	Fraction aff.	Classification*
Agriculture, forestry, hunting and fishing	Professionals	0.00	C	0.00	C
Agriculture, forestry, hunting and fishing	Clerks	0.01	C	0.06	C
Agriculture, forestry, hunting and fishing	Service workers and shop and market sales workers	0.00	C	0.09	C
Agriculture, forestry, hunting and fishing	Skilled agricultural, and fishery workers	0.12	T	0.39	T
Agriculture, forestry, hunting and fishing	Plant and machine operators and assemblers	0.00	C	0.17	C
Agriculture, forestry, hunting and fishing	Elementary occupations	0.02	C	0.24	C
Mining and quarrying	Professionals	0.00	C	0.06	C
Mining and quarrying	Technicians and associate professionals	0.10	T	0.10	C
Mining and quarrying	Clerks	0.00	C	0.14	C
Mining and quarrying	Service workers and shop and market sales workers	0.11	T	0.22	C
Mining and quarrying	Craft and related trades workers	0.04	C	0.21	C
Mining and quarrying	Plant and machine operators and assemblers	0.10	T	0.26	T
Mining and quarrying	Elementary occupations	0.07	C	0.23	C
Manufacturing	Legislators, senior, officials and managers	0.03	C	0.08	C
Manufacturing	Professionals	0.02	C	0.08	C
Manufacturing	Technicians and associate professionals	0.11	T	0.30	T
Manufacturing	Clerks	0.12	T	0.36	T
Manufacturing	Service workers and shop and market sales workers	0.14	T	0.46	T
Manufacturing	Skilled agricultural, and fishery workers	0.24	T	0.52	T
Manufacturing	Elementary occupations	0.26	T	0.57	T
Electricity gas and water	Professionals	0.00	C	0.00	C
Electricity gas and water	Technicians and associate professionals	0.01	C	0.04	C
Electricity gas and water	Clerks	0.04	C	0.06	C
Electricity gas and water	Service workers and shop and market sales workers	0.03	C	0.03	C
Electricity gas and water	Craft and related trades workers	0.15	T	0.19	C
Electricity gas and water	Plant and machine operators and assemblers	0.09	T	0.14	C
Electricity gas and water	Elementary occupations	0.20	T	0.39	T
Construction	Legislators, senior, officials and managers	0.00	C	0.10	C
Construction	Professionals	0.00	C	0.02	C
Construction	Technicians and associate professionals	0.03	C	0.15	C
Construction	Clerks	0.07	C	0.29	T
Construction	Service workers and shop and market sales workers	0.15	T	0.52	T
Construction	Craft and related trades workers	0.04	C	0.36	T
Construction	Plant and machine operators and assemblers	0.05	C	0.23	C
Construction	Elementary occupations	0.05	C	0.45	T
Wholesale and retail trade, hotels and restaurants	Legislators, senior, officials and managers	0.02	C	0.16	C
Wholesale and retail trade, hotels and restaurants	Professionals	0.02	C	0.17	C
Wholesale and retail trade, hotels and restaurants	Technicians and associate professionals	0.07	C	0.28	T
Wholesale and retail trade, hotels and restaurants	Clerks	0.12	T	0.44	T
Wholesale and retail trade, hotels and restaurants	Skilled agricultural, and fishery workers	0.20	T	0.59	T
Wholesale and retail trade, hotels and restaurants	Craft and related trades workers	0.07	C	0.36	T
Wholesale and retail trade, hotels and restaurants	Plant and machine operators and assemblers	0.15	T	0.52	T
Transportation communication and storage	Legislators, senior, officials and managers	0.03	C	0.08	C
Transportation communication and storage	Professionals	0.00	C	0.08	C
Transportation communication and storage	Technicians and associate professionals	0.02	C	0.08	C
Transportation communication and storage	Clerks	0.06	C	0.20	C
Transportation communication and storage	Service workers and shop and market sales workers	0.05	C	0.19	C
Transportation communication and storage	Craft and related trades workers	0.01	C	0.02	C
Transportation communication and storage	Plant and machine operators and assemblers	0.03	C	0.32	T
Transportation communication and storage	Elementary occupations	0.11	T	0.41	T
Finance, insurance, real estate and business services	Legislators, senior, officials and managers	0.00	C	0.09	C
Finance, insurance, real estate and business services	Professionals	0.01	C	0.12	C
Finance, insurance, real estate and business services	Technicians and associate professionals	0.07	C	0.25	T
Finance, insurance, real estate and business services	Clerks	0.09	T	0.26	T
Finance, insurance, real estate and business services	Service workers and shop and market sales workers	0.15	T	0.56	T
Finance, insurance, real estate and business services	Craft and related trades workers	0.12	T	0.48	T
Finance, insurance, real estate and business services	Plant and machine operators and assemblers	0.20	T	0.37	T
Finance, insurance, real estate and business services	Elementary occupations	0.47	T	0.72	T
Community social and personal services	Legislators, senior, officials and managers	0.01	C	0.04	C
Community social and personal services	Technicians and associate professionals	0.03	C	0.09	C
Community social and personal services	Service workers and shop and market sales workers	0.07	C	0.23	C
Community social and personal services	Skilled agricultural, and fishery workers	0.17	T	0.43	T
Community social and personal services	Craft and related trades workers	0.10	T	0.21	C
Community social and personal services	Plant and machine operators and assemblers	0.04	C	0.20	C
Community social and personal services	Elementary occupations	0.12	T	0.34	T

Table 10: **Control and treatment groups for the overall sample**. Based on 2003 HLFS micro data. * Groups above (below) the average are classified as treatment (control).

D Testing for the equality of marginal wage response among the sub groups

Sample i / Sample j	Formal	Informal	Male	Female	High Ed.	Low Ed.	Youth
Total	-0.54	-2.85***	-0.71	-0.26	0.09	-2.21**	-1.72*
Formal		-2.53**	-0.22	0.10	0.35	-1.79*	-1.33
Informal			2.21**	1.87*	1.65	1.23	1.10
Male				0.24	0.45	-1.39	-1.07
Female					0.25	-1.18	-1.02
High Ed.						-1.11	-1.02
Low Ed.							0.07

Table 11: **P-value for testing the null hypothesis of equal marginal wage impact for different groups.** **, and * refer to 5% and 10% significance levels, respectively. Hypothesis tested is $(\theta_i = \theta_j)$ where θ is the estimated coefficient of the interaction term $fraction\ affected\ binary \times T$ from equation 3.2. i and j refers to the groups in the rows and columns, respectively. Test statistics is computed as $Z = (\theta_i - \theta_j)/\sqrt{se\theta_i^2 + se\theta_j^2}$ as recommended in Paternoster et al. (1998) when testing for the equality of regression coefficients.

E Minimum wage effect on working hours: only regular employees (excludes casual employees)

Dependent variable: hours per week								
Impact variable: Fraction at (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$	0.092	0.200	-0.994*	0.302	0.059	0.109	0.185	0.397
	(0.268)	(0.389)	(0.574)	(0.308)	(0.357)	(0.470)	(0.375)	(0.333)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	32	65	33	57	49	35
# of Treatment groups	27	28	15	25	14	21	21	19
Impact variable: Fraction at (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction at $\times T$ (1)	1.314	2.165	-2.658	2.147	0.638	3.582**	-0.436	2.723
	(1.114)	(1.627)	(2.329)	(1.403)	(1.213)	(1.600)	(0.871)	(2.615)
Average impact (1) $\times$ (2)						0.256		
Maximum impact (1) $\times$ (3)						1.292		
Sample information								
Fraction at (mean) (2)	0.081	0.089	0.110	0.078	0.129	0.071	0.127	0.175
Fraction at (max) (3)	0.473	0.492	0.342	0.454	0.532	0.361	0.509	0.373
Impact variable: Fraction affected (Binary)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$	0.111	0.265	0.814	0.296	0.325	0.082	-0.441*	0.525
	(0.334)	(0.412)	(1.108)	(0.379)	(0.546)	(0.420)	(0.257)	(0.389)
# of Observations	61,479	51,409	19,007	51,381	13,250	31,062	35,439	10,721
# of Groups	65	67	32	65	33	57	49	35
# of Treatment groups	27	29	13	26	16	24	27	17
Impact variable: Fraction affected (Continuous)								
	Total	**Formal**	**Informal**	**Male**	**Female**	**High Ed.**	**Low Ed.**	**Youth**
Fraction affected $\times T$ (1)	2.007***	1.706**	1.365	2.328***	0.921	1.863*	0.256	2.361
	(0.585)	(0.734)	(3.752)	(0.790)	(1.182)	(1.000)	(0.618)	(2.497)
Average impact (1) $\times$ (2)	0.49	0.43		0.56		0.41		
Maximum impact (1) $\times$ (3)	1.47	1.29		1.69		1.23		
Sample information								
Fraction affected (mean) (2)	0.24	0.25	0.45	0.24	0.32	0.22	0.38	0.52
Fraction affected (max) (3)	0.73	0.76	0.73	0.73	0.75	0.66	0.76	0.91

Table 12: **Minimum wage effect on working hours per week.** ***, **, and * refer to 1%, 5% and 10% significance levels, respectively. Standard errors in the parentheses are robust to clustering at industry and occupation level. Sample is restricted to regular employees that work between 30 to 85 hours per week. Each cell is the coefficient of the impact variable in the row from the equation of the group referred to in the column. All of the equations include a year dummy, industry-occupation fixed effects, log GDP by industry and other controls including gender, marital status, age group dummies, years of schooling, tenure, firm size dummies, urban versus rural area dummy. Low education refers to high school dropouts and below.

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