

Minimum Wage Effects under Informality: Evidence from Turkey*

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Abstract

This paper studies the wage and employment effects of the minimum wage under the presence of high informality in the labour market. The paper assesses several minimum wage incidence parameters, and analysis suggests that the choice of the minimum wage incidence parameter significantly affects the results. For assessing the credibility of different measures, the study proposes a novel approach for the minimum wage incidence, which differentiates the effects on formal and informal workers. Results suggest that minimum wage leads to an increase in formal wages, but there exists weaker evidence for a significant effect on informal market wages. There is no adverse effect of the minimum wage on total employment, but there is a transition from formal employment to informal employment. However, the increase in informal employment is partly due to increased labour force participation. Both the wage and employment effects are stronger for women, as they get paid less than men. Although the minimum wage is set for a calendar month, there exist no significant changes in the working hours of formal and informal workers.

JEL Classification: J31, J46

Keywords: Labour Market, Minimum Wage, Informality

Kayıt Dışılık Altında Asgari Ücretin Etkileri: Türkiye Örneği

Özet

Bu makale, kayıt dışılığın yüksek olduğu işgücü piyasalarında, asgari ücretin, ücretler ve istihdam üzerindeki etkilerini incelemektedir. Makale, birden çok asgari ücret ölçüm parametresini test etmekte ve asgari ücretin etkisini ölçmek için kullanılan parametre seçiminin, sonuçları önemli ölçüde etkilediğini göstermektedir. Çalışma, farklı ölçütlerin güvenilirliğini değerlendirmek amacıyla asgari ücret ölçüm parametresini kayıtlı ve kayıt dışı çalışanlar için farklılaştıran yeni bir yaklaşım önermektedir. Sonuçlar, asgari ücretin, kayıtlı çalışan ücretlerinde artışa yol açtığını göstermektedir. Ancak, kayıt dışı çalışanların ücretlerinin arttığına dair daha zayıf kanıtlar sunmaktadır. Asgari ücret artışları toplam istihdam üzerinde olumsuz bir etki yapmamakta, kayıtlı istihdamdan kayıt dışı istihdama geçişe neden olmaktadır. Ancak, kayıt dışı istihdamdaki artış kısmen artan işgücüne katılımdan kaynaklanmaktadır. Erkeklere göre daha az ücret aldıkları için hem ücret hem de istihdam etkileri kadınlar için daha güçlüdür. Asgari ücret aylık olarak belirlenmesine rağmen, kayıtlı ve kayıt dışı çalışanların çalışma saatlerinde asgari ücret artışı kaynaklı bir değişiklik gözlenmemektedir.

JEL Sınıflandırması: J31, J46

Anahtar Kelimeler: İşgücü Piyasası, Asgari Ücret, Kayıt Dışılık

* This paper is the updated and extended version of the third chapter of my PhD dissertation at the University College London. I am very grateful to Guy Laroque and Ian Preston for their guidance. I would like to thank Attila Lindner, Konrad Mierendorff, Martin Weidner and Peter Spittal as well as many seminar participants at UCL for valuable comments. I also thank the editor Ozan Hatipoğlu, and two anonymous referees for their helpful comments and suggestions. All errors are my own.

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Minimum wage is one of the most discussed policy instruments as it has both efficiency and equity implications. While its opponents put forward the possible inefficient outcomes in labour markets, advocates point to the fair living standards for workers, especially for the less fortunate. The classical theory suggests that increasing wages in the lower part of the income distribution leads to an adverse effect on the employment of low-income earners.

A new discussion on the effects of the minimum wage started in the early 1990s (Card, 1992; Neumark and Wascher, 1992; Card and Krueger, 1995), and is still going on. In the context of the US and UK, many of the studies focus on employment in specific sectors or teen employment¹. While some studies report sizeable negative effects on employment (Neumark and Wascher, 1992, 2000), many others find no adverse effect of the minimum wage (Card and Krueger, 1995; Machin and Manning, 1994; Machin et al., 2003).

The studies on developed countries generally report very few significant effects, which are in turn small in magnitude. This could be due to the relatively low minimum wage levels in these countries or to the small increments in the minimum wage. Lemos (2009) points out the difference in the role of the minimum wage for developing countries. In many developing countries (including Turkey), the minimum wage is not set for an individual. Both the politicians and decision-makers regard it as a living wage for the family. Therefore, the relative level of the minimum wage (bite of MW) is higher² compared to developed countries, and a hike in minimum wage could possibly create sizeable effects on labour market outcomes as the wage distribution is concentrated around the minimum wage. Moreover, developing countries have a significant informal share in their labour markets, which leads to low compliance with labour market regulations. Hence, it seems plausible to expect different consequences of the minimum wage in developing countries. On one side, the concentration of the wage distribution around the minimum wage could amplify the impacts of a minimum wage increase. However, on the other side, high informality rates could lower compliance rates and reduce the effects of the minimum wage.

The canonical Two-Sector Model (Welch-Gramlich-Mincer) anticipates an increase in formal wages with the minimum wage hike. Due to this increase, there will be job losses in the formal market and these individuals will seek a job in the informal market. As a result, the wages in the informal market will decrease and there will be an increase in informal employment. Studies concerning the effects of the minimum wage in developing countries often test this theoretical prediction.

The existing research confirms the compression effect of the minimum wage. A rise in the minimum wage leads to an increase in wages for low-income earners, which leads to a shift in the left tail of the wage distribution. The change in formal market wages is to be expected, but theory tells the opposite for informal wages. On the contrary, Khamis (2013) for Argentina and Baanante (2004) for Peru find even stronger effects in informal market wages than the wages in the formal market. Maloney and Mendez (2004) suggests a lighthouse effect in Colombia labour market: the formal minimum wage serves as a reference for the informal labour market, namely, wages in the informal market increase with the minimum wage.

However, results for employment effects of the minimum wage are quite controversial. For Brazil, Fajnzylber (2001) finds negative employment effects for both formal and informal workers. Interestingly, the negative elasticity is higher for the informal market, which is explained by

¹ See Neumark and Wascher (2007), Dube et al. (2010), Allegretto et al. (2011 and 2017), Neumark et al. (2014).

² Among the OECD countries Turkey and Latin American countries have the highest minimum wage to average wage ratios.

reference to an increase in formal job-seeking. On the other hand, Lemos (2009) finds no evidence of employment effects for either the formal or informal sectors in Brazil. For Colombia, Maloney and Mendez (2004) and Bell (1997) find significant adverse effects of the minimum wage on overall employment. Montenegro and Pages (2004) comes up with similar results for Chile. They find negative effects of an increase in the minimum wage on employment by using time series data for the years 1960-1998. Away from the South American countries, results are differentiated for employment effects. For South Africa, Bhorat et al. (2013) finds no significant effect of minimum wage on employment. However, Broniatowska et al. (2015) shows adverse effects on employment in Poland, and for Greece, Karageorgiou (2004) finds disemployment effects of an increase in the minimum wage.

The introduction of the minimum wage in Turkey dates back to the 1800s, where a regional minimum wage had been implemented for some specific sectors (Gerek, 1999). These limited applications lasted until the late 1920s. The first modern minimum wage legislation was passed in 1936. During the following years, regional commissions set the minimum wages which led to inconsistent wage rates even in close neighbourhoods. Thus, beginning in 1967, a central committee was established to set the minimum wage rates for some regions and sectors. Since 1989, a minimum wage that applies to all sectors and regions has been set by a central committee made of workers, employees and government representatives. This committee used to meet at the end of the year and set the minimum wages for the first and second³ half of the following year (except for the years 2005 and 2006). Since 2016, the committee sets a minimum wage that applies to the entire country for the whole year.

Despite the long history of the minimum wage in Turkey, there are only a handful of studies dealing with the labour market effects of the minimum wage.

Ozturk (2009) estimates a structural model by considering the inflexible labour market structure of Turkey. By using Labour Force Surveys for 1988-1999, the study suggests that minimum wage leads to a shortage of part-time jobs that causes a significant reduction in employment. Workers who prefer flexible working hours (mainly female workers) suffer from this shortage, and they eventually quit the labour force.

Pelek (2015) examines the effect of minimum wage on employment in Turkey for the years 2004-2014. The study points out the adverse effect of minimum wage on the informality in the labour market. Pelek (2015) focuses on teen employment. However, the minimum wage earners in Turkey are not necessarily the younger population. In our study, we extend the analysis for all age groups. To measure the impact of minimum wage, Pelek (2015) uses the Kaitz index, which is defined as the ratio of the minimum wage to the mean or median wages. The Kaitz index does not take non-compliance (due to informality) into account. Finally, Pelek (2015) utilizes yearly LFS, but for the studied period, the minimum wage had been updated every six months. The mentioned study uses the average minimum wage for each year which will create a bias in the estimates.

Yüncüler and Yüncüler (2016) investigates the 2004 minimum wage hike in Turkey by using a difference-in-differences (DiD) method. They find a wage compression effect of the minimum wage at the lower part of the wage distribution but find no adverse effect on overall employment. Their results do not agree with the predictions of the dual market hypothesis as there exist no negative effects for the formal workers, and they do not observe a positive change in the informal

³ From January 1st to June 30th and from July 1st to December 31st.

market. Their study finds positive wage effects of the minimum wage on informal wages, which suggests the presence of the so-called lighthouse effect in Turkey.

In a recent study, by utilizing firm-level data, Akgündüz et al. (2019) investigates the impact of the 2016 minimum wage increase on export value and prices of firms. They focus on the labour cost effect of the minimum wage hike and report a significant increase in wages (labour cost) with a reduction in employment for exporting firms. Since the administrative data covers officially reported information of companies, it is not possible to observe informal workers. Although they mention that the informality issue is not crucial for their study, the lack of direct tests about the possible effects of informality turns out as an important problem.

Finally, Papps (2012) compares the effects of similar changes in the minimum wage and social security contribution for 2004. By using the Labour Force Survey, the study suggests that higher social security contribution leads to larger employment loss.

In this study, we attempt to analyse the effects of the minimum wage under the presence of informality in the labour market. Ulyseia (2018) points out two margins of informality that firms can exploit. On the extensive margin, agents give a decision about registering their business and becoming a taxpayer. However, even if the firm is officially registered, they could hire workers without a formal contract, which refers to the intensive margin. In Turkey, it is quite common to hire formal and informal labour at the same time. Therefore, the present study focuses on the intensive margin responses to the minimum wage that includes working hours and the transitions between formal and informal labour markets. On the extensive margin, we analyse the labour force participation decisions of the agents. Since there exist few studies on the minimum wage in Turkey, our study sheds light on the effect of minimum wage under the presence of high informality.

The minimum wage in Turkey is set at the national level. Therefore, there is a limited variation in the minimum wage that arises only from the change in minimum wage through time. Therefore, we aggregate the individual-level data over time and regions and exploit the regional variation in wages within and across the regions in time to assess the effects of the minimum wage on employment outcomes.

The high informality rate in the labour market complicates the analysis. We propose a novel approach to differentiate the effects on formal and informal workers. Studies do not differentiate the bite of the minimum wage for formal and informal workers, and instead utilize a single overall measure for all workers. However, the magnitude of the minimum wage bite for formal and informal markets have differentiated consequences on wages and employment outcomes. We test several minimum wage measures available in the literature, and our results suggest that when there is sizeable informal labour, defining the bite of the minimum wage plays a crucial role in the estimation. To the best of our knowledge, this is the first study that points out this important issue.

The minimum wage in Turkey has a dynamic setting structure and generally leads the overall wages in the economy. However, several studies focus on one single increase in the minimum wage, which provides a limited analysis of the possible effects of the minimum wage. The present study extends the analysis to a longer period and utilizes quarterly LFS, which enables to assess all minimum wage changes in the 2005-2017 period. Defining an accurate incidence parameter for the minimum wage is the main difficulty of using yearly LFS. Our study does not suffer from these problems, and we believe that our results are the most precise available so far.

The present study confirms that there is no adverse change in total employment associated with an increase in the minimum wage. Our results suggest that minimum wage shifts the formal

wage distribution to the right, whereas it has no or weaker effect on informal market wages. Our results partially confirm the predictions of the Two-Sector Model. The minimum wage leads to a significant transition from formal employment to informal employment. However, the transition into the informal labour market is partly due to the increased labour force participation. The wage and employment effects are stronger for women, as their wages are highly concentrated around the minimum wage. Working hours in formal and informal labour markets are not affected by the minimum wage, even though the minimum wage is set for a calendar month.

The paper proceeds as follows. Section 1 describes the data and presents descriptive statistics for Turkey. Section 2 presents the econometric analysis. We have additional analysis and robustness checks in Sections 3. Finally, Section 4 concludes.

1. Data and Descriptive Statistics

We mainly utilize Turkish Household Labour Force Surveys (LFS) conducted by the Turkish Statistical Institute (TurkStat) and focus on the working population aged 15 to 65. We study quarterly data from 2005 to 2017, hence we have, in total, 13 years and 52 quarters. The minimum wage was updated every six months before 2016 (except for the years 2005 and 2006), and it was set for the whole year for 2016 and 2017. We aggregate the data to cover all different minimum wage periods. The LFS contains information on employment, wages, occupation, sector, registration status to the Social Security Institution (SSI), and demographic characteristics of respondents for a representative sample of individuals in the economy.

The LFS has a rotating sampling procedure. However, TurkStat does not distribute the panel identifier, and hence we cannot utilize the panel dimension of the data. Thus, we have repeated cross-sections covering half-million observations per year and for each quarter we have on average 80,000 observations for the working-age population. By aggregating the data over regions, we create a pseudo-panel that contains 22 different minimum wage periods. The LFS is representative for 26 NUTS-2 level regions in Turkey. Figure 1 shows the Nomenclature of Territorial Units for Statistics (NUTS-1, NUTS-2 and NUTS-3) classifications of Turkey.

Figure 1 NUTS Classifications



Notes: Thick Black Line: NUTS-1 Regions. Colours: NUTS-2 Regions, Thin Line: NUTS-3 Regions

In January 2008, the government introduces a Minimum Living Allowance (MLA) calculated based on the minimum wage, depending on the marital status and the number of children. MLA is deducted from the income tax. While the cost of the minimum wage to the employer is unchanged, the after-tax net minimum wage of the agents differs. MLA is paid to the employee by the employer on behalf of the state and deducted from the employer's total tax. Hence, MLA is perceived by employers as an additional cost, and it is highly criticized. It mostly applies to workers in large firms and strictly monitored sectors. Additionally, MLA is paid to the household head (i.e., member of the family whose social security is used by other members of the family) which makes it very hard to identify who is eligible for MLA. One possibility could be using the minimum wage with MLA instead of the minimum wage by restricting the MLA receivers to household heads. In LFS there is a question about the household head; however, due to cultural reasons, 99% of this group is male. This might create misleading results as we still do not have any information about how wide MLA is used in the labour market. Moreover, when we checked the wage distributions, we do not see any significant difference for potential receivers of MLA. Due to its limited implementation, difficulties in controlling, and relation to the family structure, we disregard MLA in our estimations.

Following the global financial crisis, the Turkish government initiated an employment subsidy program in 2008 that targeted young agents and women. Balkan et al. (2014) analyse the effects of this subsidy program. Their results reveal that the subsidy program did not create any significant change in aggregate employment outcomes of the youth and women. However, when heterogeneity among the treatment group is accounted for, they find noticeable effects on some sub-groups. They point out that the increase in employment probability is more pronounced for older women, while a weaker positive effect is observed for younger women and almost no effect is detected for younger men. Since this program is ineffective even on targeted groups, it is hard to expect to have an impact on general wages and employment levels. Therefore, in our analysis, we do not take this subsidy program into account.

For the wage statistics, we drop employers, self-employed and unpaid family workers as there is no wage information for these groups, and they are not subject to the minimum wage. Agents who were hired just before the survey and have not yet received their first wage are dropped in the analysis. For the outliers, we applied a winsorization which sets 15,000 Turkish Liras (TL) as the highest income level, thus replacing the higher wage incomes with this maximum (in total 263 individuals for the whole period).

Table 1 presents summary statistics on the Turkish labour market, while the lower panel separates the formal and informal labour markets. The monthly wage is calculated for 30 days for all months in Turkey, and the minimum wage is set for 30 days. Hence, the hourly wage is calculated by using the agent's monthly wage and weekly hours. The effect of the 2016 minimum wage hike is remarkable for all statistics. The increase in the ratio of the minimum wage to the median wage in 2016 shows the compression effect of the minimum wage increase.

Without controlling for agents' characteristics (age, gender, education etc.), the informal worker's monthly mean wage is half that of the formal worker's. Since working hours are higher for informal workers, the average hourly wage is less than half of the formal workers' hourly wage. Officially, the minimum wage legislation applies to the formal market. However, the lower panel of Table 1 shows the positive changes in informal worker wages as well. This feature of the market could be an argument for the lighthouse effect, where employers and workers take formal market minimum wage as a reference point. However, this change in informal wages might not be due to

the minimum wage. In the following sections, we will empirically analyse the relationship between informal wages and the minimum wage.

Table 1 Summary Statistics

Variable / Year	2013/1	2013/2	2014/1	2014/2	2015/1	2015/2	2016	2017
Minimum Wage	773.01	803.68	846.00	891.03	949.07	1000.54	1300.99	1404.06
Net % Increase	4.49	3.97	5.27	5.32	6.51	5.42	30.03	7.92
Median Wage	1000	1000	1100	1200	1250	1300	1500	1700
MW/Median	0.773	0.804	0.769	0.743	0.759	0.77	0.867	0.826
50-10%	400	300	370	400	450	550	500	600
Mean Wage	1390.89	1432.14	1517.56	1569.23	1654.33	1712.73	1974.45	2169.90
Δ in Mean	6.18	2.97	5.96	3.40	5.42	3.53	15.28	9.90
MW/Mean	0.556	0.561	0.557	0.568	0.574	0.584	0.659	0.647
Weekly Hours	49.40	50.11	49.22	49.50	48.64	49.12	48.12	47.94
Hourly Wage	7.27	7.36	7.92	8.15	8.67	8.96	10.41	11.45
Δ in Hourly Wage	8.18	1.24	7.61	2.90	6.38	3.34	16.18	9.99
Average Age	34.57	34.78	34.74	34.92	34.98	35.02	35.35	35.68
Informal Share*	17.21	17.07	15.86	16.35	14.50	15.68	14.40	14.47
Informal Share**	35.92	35.43	33.80	33.95	32.25	32.64	32.26	32.68
Formal Market								
Median Wage	1120	1200	1200	1300	1400	1500	1650	1800
50-10%	366	400	350	430	460	500	350	400
Mean Wage	1531.39	1567.81	1655.20	1712.46	1787.49	1860.49	2132.54	2341.09
Weekly Hours	48.93	49.36	48.76	48.78	48.13	48.29	47.52	47.44
Hourly Wage	8.04	8.13	8.66	8.95	9.40	9.77	11.30	12.41
Average Age	34.76	34.96	34.91	35.03	35.06	35.18	35.40	35.73
Informal Market								
Median Wage	700	750	750	800	800	900	1000	1000
50-10%	450	450	450	460	500	500	600	570
Mean Wage	714.82	772.80	787.20	836.23	868.99	918.15	1034.47	1157.65
Weekly Hours	51.68	53.80	51.67	53.20	51.61	53.54	51.70	50.86
Hourly Wage	3.53	3.63	3.98	4.05	4.37	4.60	5.16	5.80
Average Age	33.64	33.90	33.85	34.40	34.51	34.14	35.07	35.37

Notes: Author's calculations based on LFS. Turkish Liras. *Includes wage earners only. **Includes all employed agents.

Table 2 presents the bite of the minimum wage in Turkey. During the last 15 years, around 20-25% of the workers get a wage lower than the official minimum wage rate, and this ratio is around 10-15% when only the formal labour market is considered. This quite high ratio reflects the difficulty of applying the minimum wage legislation. The first row of Table 2 gives the percentage of workers who earned less than the minimum wage. So, for example, 23.55% of the workers in the second half of 2013 had a lower wage than the minimum wage. The second row gives the percentages of workers who earned less than the minimum wage in the following year. 26.18% of the workers in 2013/2 received less than the minimum wage in 2014/1. While the percentage of people below the minimum wage of the following period is around 30% before 2016, the percentage of workers in 2015/2 with a lower wage than the 2016 minimum wage rate jumps over 50%. Moreover, it seems that the economy could not respond sufficiently to this wage increase as the percentage of workers in 2016 who earned less than the 2016 minimum wage is 39.02%. It is worth noting that there is a stable 10% difference between the percentages of workers who earn less than the next minimum wage and the percentage of workers in the following period who earn

less than that period's minimum wage. The third row shows the share of workers earning less than the previous year's minimum wage. The labour market reacts slowly to changes in the minimum wage as 14.27% of the workers in 2017 received a wage lower than the 2016 minimum wage. To see how dense wage distribution is around the minimum wage, Table 2 presents the share of the workers with a wage level in the interval ($i \pm 10\%$) of the minimum wage rate. The concentration around the minimum wage level is quite high (as 25-30% of the wage earners are in this 10-percentage interval).

Table 2 Bite of the Minimum Wage

Variable / Year	2013/1	2013/2	2014/1	2014/2	2015/1	2015/2	2016	2017
% Paid less than MW_t	20.84	23.55	17.36	20.06	19.00	32.78	39.02	34.08
% Paid less than MW_{t+1}	32.44	26.18	27.98	29.24	37.50	50.52	42.86	48.69
% Paid less than MW_{t-1}	13.78	13.42	14.87	12.96	12.33	13.25	12.53	14.27
% of $\pm 10\%$ around MW_t	25.68	21.00	23.90	19.82	26.33	25.86	29.30	33.45
Formal Market								
% Paid less than MW_t	12.53	15.32	9.07	12.43	11.86	24.89	32.11	27.31
% Paid less than MW_{t+1}	24.38	18.34	20.61	21.78	30.51	43.97	36.19	42.05
% Paid less than MW_{t-1}	5.27	5.39	6.36	4.74	5.18	5.39	4.85	6.25
% of $\pm 10\%$ around MW_t	25.72	21.27	24.13	20.86	26.54	26.45	30.44	34.42
Informal Market								
% Paid less than MW_t	60.82	63.50	61.35	59.13	61.09	75.16	80.13	74.14
% Paid less than MW_{t+1}	71.20	64.30	67.07	67.42	78.74	85.74	82.52	87.96
% Paid less than MW_{t-1}	54.73	52.46	60.05	55.07	54.47	55.48	58.22	61.69
% of $\pm 10\%$ around MW_t	25.48	19.70	22.68	14.50	25.06	22.71	22.49	27.72

Notes: Author's calculations based on LFS.

The lower panel of Table 2 shows the difference between the formal and informal markets. A sizeable portion of informal workers get a wage lower than the minimum wage, and this is still the case when we compare their wage with the previous year's minimum wage. For example, in 2016, 80.13% of the informal workers earned less than the minimum wage. Moreover, in 2017, 61.69% of the workers still got a lower wage than the 2016 minimum wage. On the other hand, 32.11% of the formal workers in 2016 got a wage lower than the 2016 minimum wage. However, this share drops to 6.25% when we compare 2017 wages with the 2016 minimum wage.

Figures 2 and 3 offer a clear picture of the effect of the minimum wage in Turkey. Figure 2 presents the wage distributions for the formal labour market, and there is a dramatic hike around the minimum wage shown by the red line. On the left panel of Figure 2, we have nominal wages for the years 2015 and 2016. For both years, the left side of the distributions are concentrated around minimum wage, and once the minimum wage changes, we have a shift for the mode of the distribution. The change in real wage distribution is on the right panel and a similar shift is visible. Kernel density estimations show the shift in wage distributions with the minimum wage. These features of the wage distribution may induce significant changes in labour market outcomes after a change in the minimum wage. On the other hand, the low compliance rate attracts attention to another feature of Turkey's labour market. A relatively high share of the total labour market in Turkey consists of informal workers; i.e., it represents workers unregistered in the social security system. On average, the informal market is around 30-35% of the labour market, although this reaches 80% in agriculture and 50% for some service sectors like tourism. The high informality rate in the labour market complicates the analysis of the effects of a minimum wage increase.

Figure 2 Formal Market Wage Distributions for 2015 and 2016

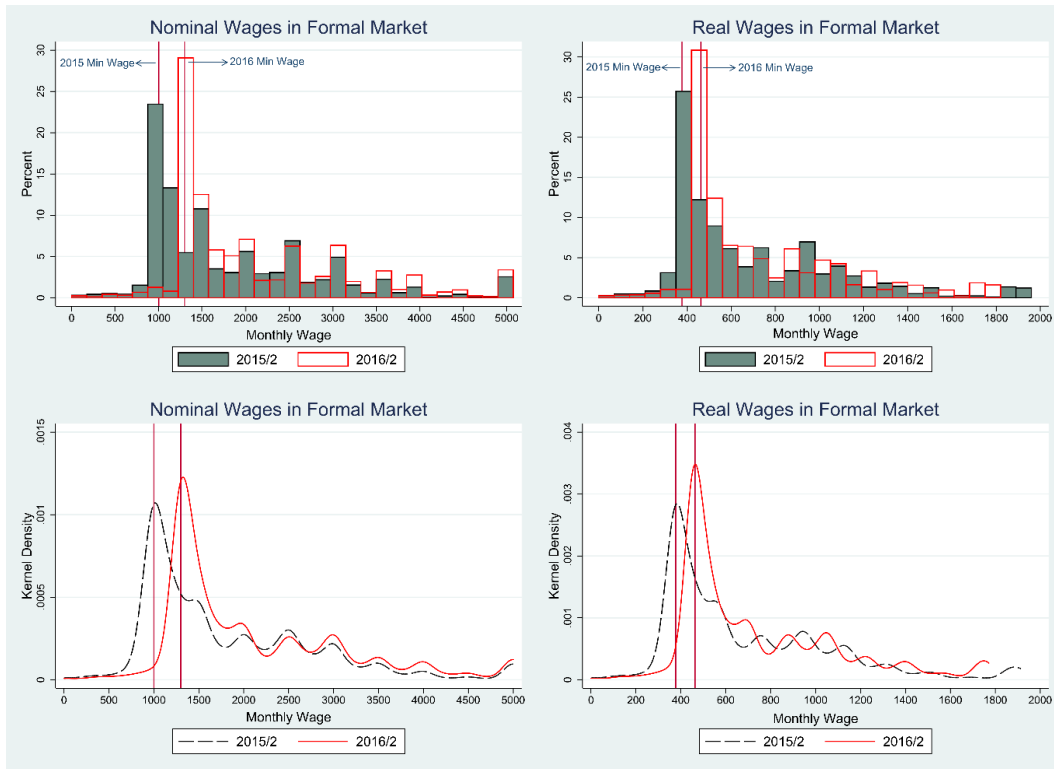
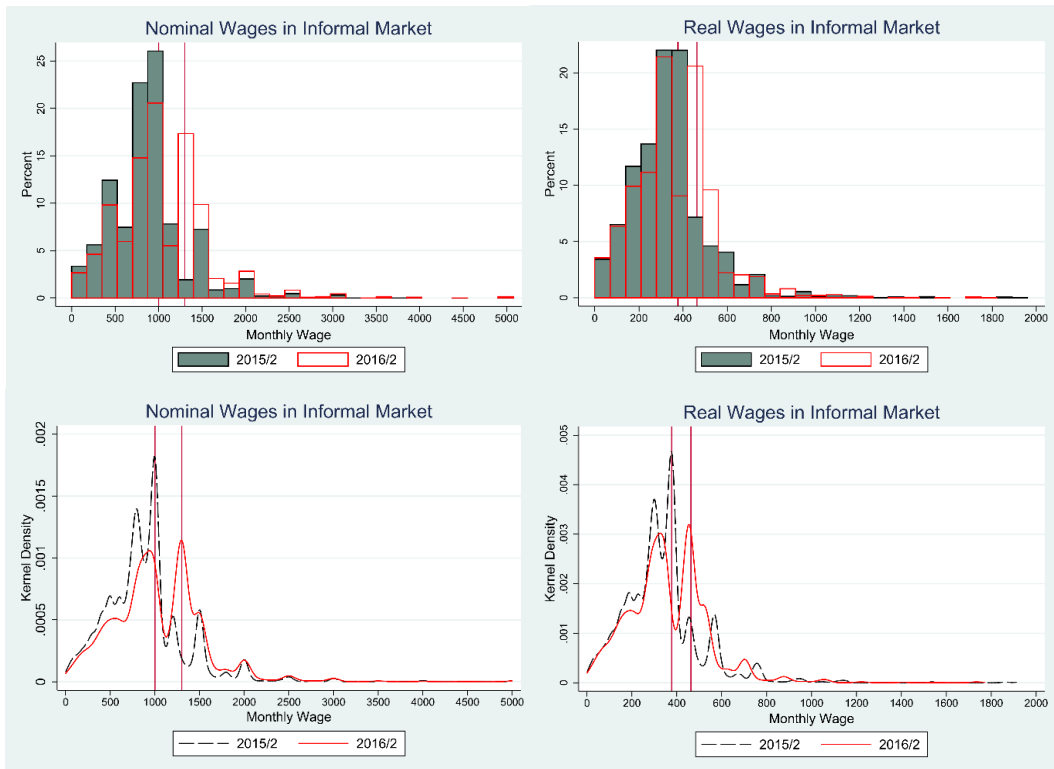


Figure 3 Informal Market Wage Distributions for 2015 and 2016



The shift in formal wages is something to be expected. However, a similar but weaker pattern can be observed for the informal market in Figure 3. As mentioned above, the standard textbook model with two types of labour inputs (formal and informal) anticipates a decrease in the informal market wage when the formal market wage is increased exogenously. The model says that once you increase the minimum wage level in the formal market, some formal workers may lose their jobs and possibly look for a job in the informal market, which leads to a reduction in informal worker wages. The Two-Sector model assumes a segmented labour market; however, if the labour market works as an integrated competitive market, the prediction of the Two-Sector model may not hold. There are several explanations about the increase in informal wages due to the minimum wage. If the hike in the minimum wage leads to a capital reallocation into the labour-intensive informal market, this could increase the wages for informal workers. Moreover, the increase in minimum wage could increase the demand for the goods that are produced by informal labour and the increased prices could lead to an increase in informal wages. Or simply, firms may take minimum wage as a reference while setting their wages and increase wages for their informal workers. It is important to note that the change in informal wages might be due to the large-scale increase in 2016 or some other reasons. In the following sections, we will assess the effect of the minimum wage for the 2005-2017 period.

The left panel of Figure 4 shows the nominal and real minimum wages for the past 15 years. The nominal minimum wage follows a steady increasing path up to 2016 and then shows a dramatic hike in the past 3 years. However, in real terms after the jump in 2016, the real wage decreases due to increasing inflation. Figure 4 draws quarterly real minimum wages; since the minimum wage is updated every six months, we observe a reduction in real terms for the second and the fourth quarters of each year. Although the scales are different, nominal and real minimum rates show similar trends. It seems that the committee takes inflation into consideration while updating the minimum wage.

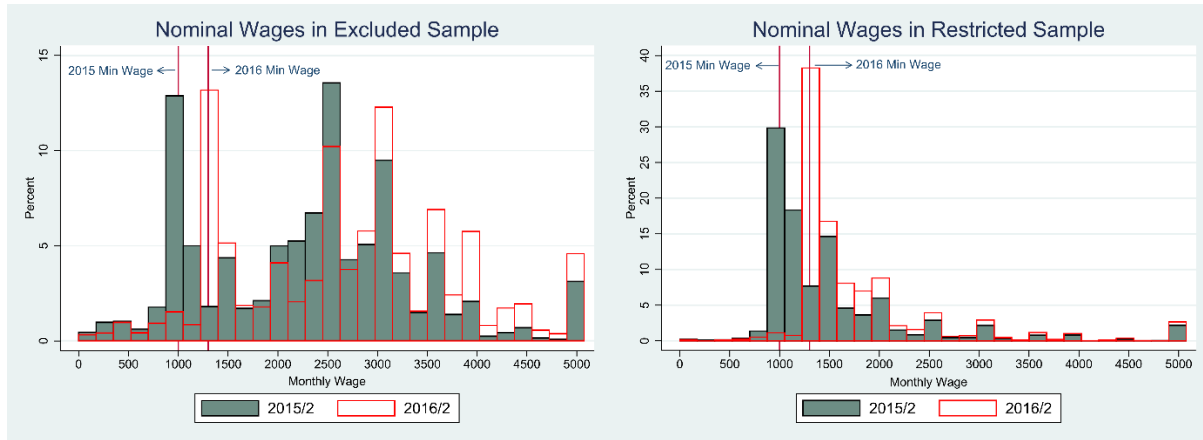
Figure 4 Nominal and Real MW and Cumulative Wage Distributions for 2016 and 2017



The right panel of Figure 4 shows the cumulative distribution of wages for 2016 and 2017. Wages are set for a month, and increments are multiples of 10 Turkish Liras. However, we observe a concentration around the 50s and 100s. While the red dashed lines show the minimum wages for 2016 and 2017 respectively, black dashed lines show the multiples of 100. It is quite common in Turkey that the wage bargaining is negotiated by multiples of 50 Turkish Liras. Individuals may report rounded wages which will affect the calculations of the summary statistics and estimations.

We should note that rounding creates very limited differences. Moreover, for our estimations using exact minimum wages or rounded minimum wages do not create any significant change in coefficients. Therefore, we use the exact value of the minimum wage in this study.

Figure 5 Wage Distributions for Excluded and Restricted Samples



In Turkey, public workers' salaries are set by a special procedure. Moreover, part-time workers, seasonal workers and workers in agriculture get a daily wage or piece-rate payments that are independent of the minimum wage. Therefore, we drop these individuals for our analysis. Finally, workers with a side job are excluded as their wage information could be misleading. Figure 5 shows the wage distributions for the excluded observations and the restricted sample⁴. For the restricted sample, wage distribution is concentrated around the minimum wage. The excluded observations do not exhibit a similar pattern, which justifies our restriction. For the wage estimations, we also report the changes in wages for the overall sample. However, we focus on the restricted sample for the employment effect analysis.

Figure 6 Age and Education Distributions by Wages



The existing literature on minimum wage generally focuses on the young population, low-paid sectors, and unskilled agents. In Turkey, minimum wage earners are younger on average, but the minimum wage affects almost all age groups. Moreover, many high school graduates and even

⁴ For the employment outcome, the full sample size is 4,315,781. After exclusions, we have 3,315,792 observations. For wages, the full sample size is 1,134,589 and the restricted sample contains 759,693 observations.

individuals with a university degree work for a minimum wage. Figure 6 shows the age distribution and education levels by wages. It graphs the distributions for all wage earners and distributions for individuals who get a wage between $\pm 10\%$ of the minimum wage. Due to this feature of Turkey, we do not focus on specific groups in the population.

The gender pay gap is a global phenomenon that is discussed in the economics literature. Figure 7 presents the wage distributions by gender for 2016. Female workers get paid lower than male workers, and their wages are more concentrated around the minimum wage. We should note that this pattern is present for all years. If the Two-Sector Model predictions hold for Turkey, we should see a stronger wage effect for females and more distinct changes in their employment outcomes.

Figure 7 2016 Wage Distribution by Gender

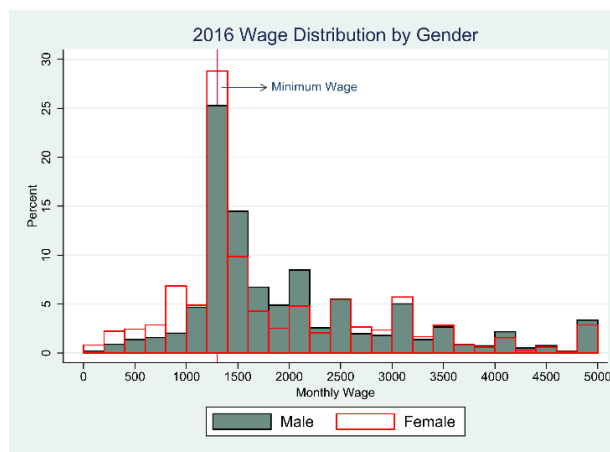
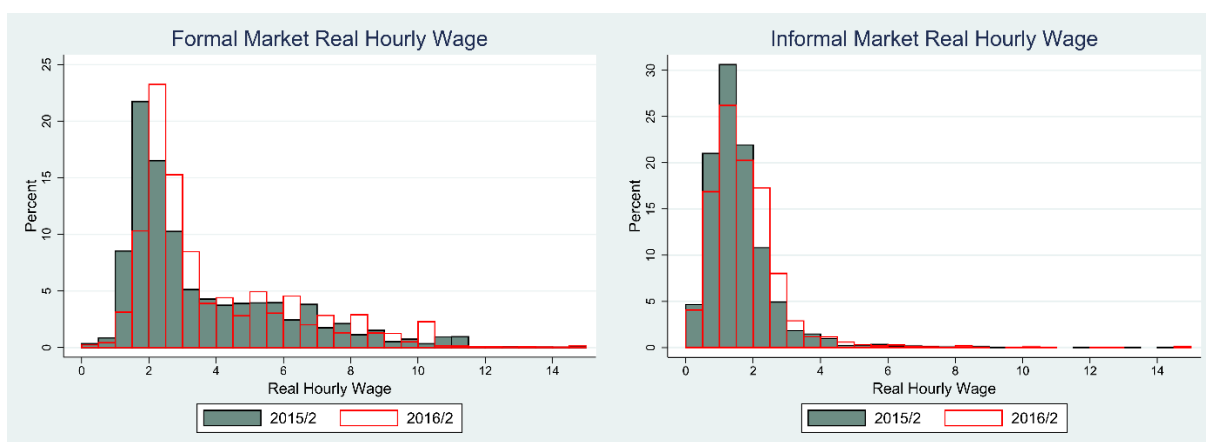


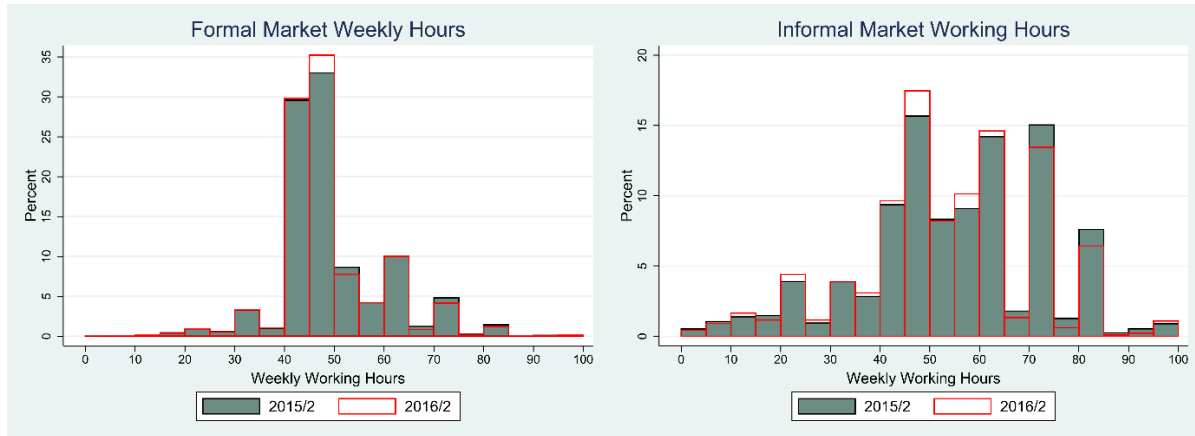
Figure 8 shows the change in real hourly wages for 2015 and 2016. Again, the shifts are visible for both markets, although the rise in the informal hourly wages is smaller in size which could be argued to be a result of an intensive margin response. But the working hour distributions in Figure 9 and summary statistics in Table 1 show that people are working similar hours or slightly fewer hours in both formal and informal markets. Therefore, the intensive margin responses seem limited after the minimum wage hike. For Turkey, the intensive margin analysis needs more attention.

Figure 8 Hourly Wage Distributions for 2015 and 2016



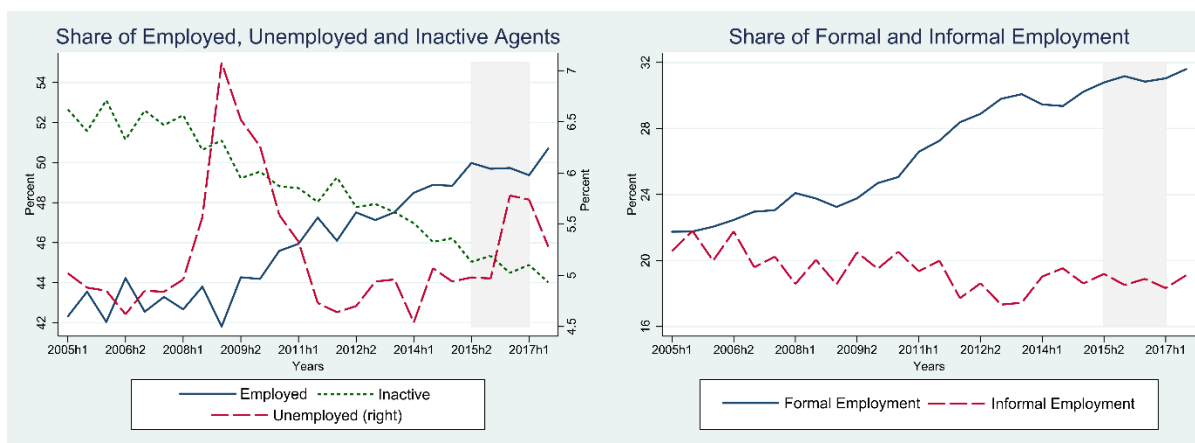
The minimum wage is set for a month and according to the Labour Law weekly working hours cannot exceed 45 hours. Although there is an overtime payment legislation, many companies do not apply this rule and workers with different working hours get the same monthly wage. This feature might affect the employer's working hour demand, but we cannot directly observe it from the distribution of working hours.

Figure 9 Weekly Working Hour Distributions for 2015 and 2016



One of the objectives of this study is to analyse the effects of minimum wage changes on labour market outcomes such as employment (formal and informal), unemployment and participation rates. Figure 10 shows the share of the employed, unemployed and inactive agents for the past 15 years. In 2016, there is a limited negative movement in the share of the employed. The global crisis during 2008 and 2009 creates a huge hike in unemployment, and we observe a significant jump in the second half of 2016. The second panel of Figure 10 shows the share of the formal and informal labour markets. Again, we can observe the reduction in the formal share for the second half of 2016. These features could be associated with possible negative effects of the minimum wage on the labour market. However, there are similar fluctuations for the other years, and visually, it is very hard to conclude that the minimum wage hike in 2016 leads to negative outcomes on the labour market.

Figure 10 Share of Employed, Unemployed and Inactive Agents



To sum up, from the descriptive statistics and graphs, there is a clear change in wages with the minimum wage. However, for the employment outcomes, even for the 2016 minimum wage hike, we do not observe a clear change. The next section estimates the wage and employment effect of the minimum wage for our study period.

2. Econometric Analysis

The existing literature utilizes both the individual level and aggregate data for assessing the effects of the minimum wage. Since the nominal minimum wage is set for the entire country, it is not possible to use individual-level data for Turkey. Therefore, we analyse the correlation of minimum wage with wages and labour market outcomes by aggregating the data for NUTS-2 level regions, which creates a pseudo-panel. In this analysis, identifying variation emerges from regional differences, which depend on the initial condition of different regions.

2.1 Wages

In this section, we focus on the changes in wages with the minimum wage. Figures 2 and 3 show the effect of the rise in 2016 on both the formal and informal markets. Here we evaluate the effect for the 2005-2017 period. Following Machin et al. (2003) and Harasztosi and Lindner (2018), we regress the change in the logarithm of mean real wages on the minimum wage measure. Our regression takes the following form;

$$\Delta \log W_{st} = \alpha + \beta MW_{st-1} + \delta X_{st} + \theta_s + \tau_t + \varepsilon_{st} \quad (1)$$

where $\Delta \log W_{st}$ is the change in the logarithm of average wages⁵ in region s for time t and MW_{st-1} is the measure of the minimum wage in region s at time t . Vector of control variables X_{st} includes unemployment rate in region s at time t , average age, the proportion of females in the region, the proportion of low educated agents, the proportion of singles, the proportion of small firms, the proportion of occupations requiring low skills, the proportion of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services) and proportion of seasonal and part-time workers. θ_s and τ_t are NUTS-2 level region and time fixed effects. All regressions are weighted by the sum of individual's sampling weights of that particular region in time t . In order to create well-defined minimum wage measures, here we aggregate the data for different minimum wage level periods. Namely, we use 6-month periods before 2016, and for 2016 and 2017 we use yearly data.

There are several ways to measure the incidence of minimum wage. Our preferred measure is Fraction Affected (FA), which is the share of agents who get a higher current wage than the actual minimum wage but a lower wage than the following period's minimum wage. This measure assumes agents with a lower wage than the actual minimum wage will not primarily be affected by the subsequent minimum wage increase. Hence, Fraction Affected takes non-compliance into consideration, and we prefer to use this measure for our analysis. To compare with Fraction Affected, we use a second measure Fraction At, which is defined as the fraction of the agents with wage in $0.98MW_t \leq W_t \leq 1.02MW_t$. The Fraction At measure is a subset of Fraction Affected as the increase in the minimum wage is always greater than 2%. Hence, compared to other measures, Fraction At gives the closest estimates to Fraction Affected. To point out the effect of non-compliance, we use a third impact measure: Fraction Lower, which is the fraction of agents whose

⁵ Using log differences could be problematic for large percentage changes, but in our case results are almost identical when we use percentage changes in average real wage as the dependent variable. Since the log difference is symmetrical for the increase and decrease of the same magnitudes, we prefer the change in the log of average wages.

wages are below the minimum wage of the following period. As mentioned above, there is a considerable informal market in Turkey and consequently, the compliance rate differs across regions and sectors. However, Fraction Lower disregards this fact and expects an increase in the wages of agents whose wage is lower than the minimum wage. In robustness section 4.2, we test three other measures that are commonly used in the minimum wage literature. However, all disregard the non-compliance problem to some degree. Table 3 gives a summary of the measures we use for the minimum wage.

Table 3 Minimum Wage Measures of Impact

Name of the Measure		Definition
Fraction Affected	$0.98MW_t \leq W_t \leq MW_{t+1}$	Share of agents with a higher wage than actual MW and a lower wage than the next MW.
Fraction At	$0.98MW_t \leq W_t \leq 1.02MW_t$	Share of agents in the 4% interval of actual MW.
Fraction Lower	$W_t \leq MW_{t+1}$	Share of agents below the next MW.
Kaitz (MW/AW)	$MW_{t+1}/Average W_t$	Ratio of next MW to actual average wage.
Toughness (MW/Median)	$MW_{t+1}/Median W_t$	Ratio of next MW to actual median wage.
Gap	$\frac{\sum_i \max\{MW_{t+1} - W_{it}, 0\}}{\sum_i W_{it}}$	Average increase in actual wages needed to bring workers paid below next MW to next MW.

Here, we exploit the variation in minimum wage measure within and across regions through time. Therefore, the variation comes from the initial condition of the wages. As Machin et al. (2003) mentioned, the identification assumption here is the independence of change in wages and initial wage levels. Namely, there should be no relationship between the change in wages and the initial level of wages. Machin et al. (2003) tests this assumption by comparing the relation of initial wages and wage changes for the minimum wage period (1998/1999) with an earlier period (1992/1993) where no minimum wage was in place. In our case, we have a minimum wage for the whole data period. The minimum wage in Turkey has been updated regularly since 1974. Therefore, it is not possible to test the independence assumption directly. Nevertheless, in the robustness analysis, we have various investigations to check the validity of this assumption.

Table 4 presents the results for equation (1) by using three incidence parameters. Appendix Table A1 reports the results for the full sample and other restricted samples. We present results in Table 4 for formal and informal wages separately. The upper panel shows the results for nominal wages, and in the second panel, we report the change in log real wages. Here, the coefficient of interest gives the elasticity of change in log average wages for minimum wage.

Several studies about Turkey and developing countries with high inflation rates utilize real wages instead of nominal values.⁶ To assess the employment effects of the minimum wage, it would be better to use real minimum wage as the employment decisions of the agents and firms depend on the real values of wages. Therefore, we focus on the change in real wages with the real value of the minimum wage. However, since we deflate the minimum wage and individual wages with the same regional CPI, results are almost the same for real and nominal wages. Since the results for nominal and real wages are very similar, our identification is not affected by the regional CPI.

⁶ See Pelek (2013) for Turkey, Baanante (2004) for Peru, Lemos (2009) for Brazil, Menon and Rodgers (2017) for India.

Table 4 Effect of the Minimum Wage on Wages

		Fraction Affected	Fraction At	Fraction Lower
Nominal Wages				
All Wages		0.113** (0.053)	0.078* (0.046)	0.374*** (0.050)
Formal Wages		0.176** (0.063)	0.113** (0.045)	0.307*** (0.048)
Informal Wages		-0.140 (0.116)	-0.095 (0.102)	0.153** (0.062)
Real Wages				
All Wages		0.119** (0.052)	0.080* (0.046)	0.370*** (0.051)
Formal Wages		0.183*** (0.063)	0.115** (0.046)	0.303*** (0.052)
Informal Wages		-0.136 (0.115)	-0.094 (0.105)	0.149** (0.062)
Separate Incidence Parameters				
Real Wages				
All Wages	MW^F	0.147** (0.055)	0.108* (0.054)	0.299*** (0.062)
	MW^I	-0.184 (0.220)	-0.174 (0.345)	0.501*** (0.052)
Formal Wages	MW^F	0.234*** (0.065)	0.165*** (0.053)	0.363*** (0.068)
	MW^I	-0.368* (0.200)	-0.370 (0.348)	0.192** (0.070)
Informal Wages	MW^F	-0.072 (0.128)	-0.025 (0.121)	0.075 (0.090)
	MW^I	-0.643*** (0.193)	-0.619** (0.246)	0.286*** (0.090)
Observations		546	546	546

Notes: Dependent variable is the change in logarithm of average wages. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

We observe a positive change in overall wages, and this change is more apparent for formal wages. Appendix Table A1 presents results for the full sample, and we still have a significant effect of minimum wage on formal wages. This might be interesting for some other countries. However, in Turkey, the minimum wage has an impact on the formal wage distribution even if we consider all positive wage earners without any restriction. In Appendix Table A1, the coefficients for young workers under 40 and 25 are smaller in magnitude due to the high informality rates for these age groups. The informality rate is around 32% for under 25, which leads to a lower increase in formal wages compared to the average formal wage increase. Manning (2016) points out the consensus on

the wage effect of the minimum wage, and our results suggest that it is still apparent even with a high informality in the labour market.

For the informal market, Fraction Affected and Fraction At measures reveal no significant change in informal wages with the minimum wage, hence, there is no evidence for the presence of a lighthouse effect in Turkey. According to the standard textbook model, this result is not surprising as the standard model anticipates a transition from the formal market to the informal market which leads to a reduction in the informal wages.

On the other hand, the Fraction Lower measure points out the existence of the lighthouse effect, as it gives a positive significant coefficient for the informal wages. In robustness section 4.2 we test other commonly used minimum wage incidence measures in the literature, and they also exhibit significant increase in informal wages with the minimum wage. However, as we analyse in robustness section 4.3, this feature is highly due to their inability to control for non-compliance in the labour market. The lower panel of Table 2 presents the bite of the minimum wage for the informal market. On average, while 75% of the informal workers get a lower wage than the next period's minimum wage, 65% of them are paid lower than the actual minimum wage. Moreover, 55% of these workers are getting lower wages than the previous period's minimum wage. Therefore, it is hard to expect a wage increase for these informal workers with the new minimum wage. Wages in some regions could have a higher growth rate, but this may not be necessarily due to the increases in the minimum wage. To provide further evidence, in robustness section 4.1, we add regional time trends to equation (1). While there is almost no change for the coefficient of Fraction Affected, the informal wage coefficient for the Fraction Lower measure becomes insignificant. As we discuss in the following sections, the Fraction Lower measure ignores the non-compliance in the labour market, and it reflects the effect of being a low wage region instead of a minimum wage impact.

The Fraction Lower covers all agents paid below the minimum wage and is highly correlated with the initial level of wages. There is a perfect linear relationship between the average wage and the Fraction Lower, where the less developed regions (east and south-east) have the highest Fraction Lower measures. We exploit the regional variation in minimum wage incidence parameters, and the identification assumption requires the independence of change in wages and initial wage levels. Considering the perfect linear relationship, this assumption is hard to hold for the Fraction Lower measure. On the other hand, Fraction Affected covers workers who are expected to be primarily affected by the change in the minimum wage and there exist no systematic relationship between Fraction Affected and regional average informal wages. If the agents with a salary closer to the minimum wage are not affected by the minimum wage, it is hard to expect agents with a very low wage to be affected by the change in the minimum wage. If informal wages increase with the minimum wage, we should also observe this change for the agents who are closer to minimum wage.

Minimum wage measures in the first and second panels of Table 4 aggregate formal and informal workers. However, it is very unlikely that the Fraction Affected (FA) in the formal and informal market would affect the outcomes in a similar way. Moreover, the coverage of different minimum wage measures significantly differs for formal and informal workers. Since Fraction Lower covers all workers with a lower wage than the minimum wage, it includes relatively more informal workers compared to Fraction Affected. It is important to note that Fraction Affected does not ignore informal workers, and it captures regional variation of informal workers. Moreover, it covers informal agents who are expected to be primarily influenced by the change in minimum

wage. For the identifying variation; magnitudes differ, but the variations in Fraction Affected and Fraction Lower for informal workers are similar. To be able to check the effect of separate labour markets, we create two different minimum wage measures. Namely, instead of defining one MW_{st-1} measure, we define two separate parameters MW_{st-1}^F and MW_{st-1}^I for formal and informal workers. Then we estimate equation (1), and the results are reported in the third panel of Table 4. The impact of the formal and informal measures differs significantly. If formal FA increases, it leads to an increase in formal wages but a limited, non-significant decrease in informal wages. On the other hand, if informal FA increases, this leads to a reduction in both formal and informal wages. This feature seems reasonable. If formal FA is higher in a region, then once the minimum wage increases, it leads to a higher percentage increase for formal market wages. Moreover, a high formal FA leads more workers to enter the informal market, and this will reduce the informal market wages. This transition from the formal market to the informal market is confirmed by the employment effects of the minimum wage. The negative change in informal wages is driven by the informal FA. When minimum wage increases and if informal FA is high, the competition for an informal job will be stronger, which leads to a further reduction in the informal market wages. Similarly, a higher share of informal FA increases the supply for formal jobs and creates a negative effect on formal wages. It turns out that our results for wage changes are consistent with the predictions of the Two-Sector Model.

Note that a higher informal FA also means that the informal wages in the region are relatively higher. The share, then, of the potential substitutes to a formal worker is higher for that region. This is the reason behind the different signs of the coefficients of informal Fraction Affected and informal Fraction Lower. Fraction Lower takes the share of agents with a wage lower than the minimum wage (almost all informal workers for some regions), and therefore it also measures the effect of being a low wage region on the change in wages.

These results suggest that the effect of the minimum wage is positive and significant for the formal labour market. However, we have weaker evidence to support wage effects for the informal workers in general.

2.2 Hours

In this section, we study whether a change in the minimum wage induces changes in the number of hours worked (intensive margin). We use equation (1), and our dependent variable is the change in log average hours. Table 5 presents the results. We observe a non-significant small reduction in formal working hours and almost no change in the informal hours. The lower panel of Table 5 presents the results when we use separate incidence parameters for the formal and informal markets. Again, we observe no significant change in working hours. Considering the monthly minimum wage in Turkey, one can expect an increase in working hours with the minimum wage hikes. As overtime payments are not common for low paid jobs, firms might have the incentive to increase working hours. However, changes in the minimum wage do not have any effect on the intensive margin, which verifies the pattern in Figure 9. This result might be due to the already high working hours in Turkey. It seems that there is no way to further increase the working hours.

The Fraction Lower measure suggests a significant reduction in working hours with the minimum wage. From Table 2, average working hour in Turkey is around 50 hours, and it is more than 50 hours in the informal labour market. We do not have any reason for a reduction in working hours due to minimum wage, as the minimum wage is set for a month and there are no overtime payments. However, economically less developed regions (low wage regions) have extreme

average working hours (more than 65) and working hours for these regions have been decreasing along the years. Since the Fraction Lower covers almost all informal workers, it reflects this decreasing pattern. Therefore, the negative coefficient is hardly related with the minimum wage.

Table 5 Effect of the Minimum Wage on Working Hours

		Fraction Affected	Fraction At	Fraction Lower
Hours		-0.028 (0.030)	-0.054* (0.030)	-0.095*** (0.027)
Formal Hours		-0.042 (0.033)	-0.078** (0.029)	-0.067** (0.032)
Informal Hours		0.011 (0.042)	0.034 (0.049)	-0.071* (0.035)
Separate Incidence Parameters				
Hours	MW^F	-0.029 (0.029)	-0.057* (0.031)	-0.067* (0.036)
	MW^I	-0.004 (0.143)	0.013 (0.168)	-0.145*** (0.034)
Formal Hours	MW^F	-0.044 (0.038)	-0.072** (0.032)	-0.065 (0.046)
	MW^I	0.006 (0.140)	-0.089 (0.167)	-0.070** (0.033)
Informal Hours	MW^F	-0.027 (0.041)	-0.026 (0.053)	-0.105** (0.047)
	MW^I	0.381* (0.197)	0.650*** (0.221)	-0.007 (0.073)
Observations		546	546	546

Notes: Dependent variable is the change in logarithm of average hours. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

2.3 Employment

We analyse the employment effects of the minimum wage by using the right-hand side of equation (1) for different dependent employment variables. We apply a similar analysis to capture the change in employment with the minimum wage by estimating the following form of the equation;

$$\Delta \log N_{st} = \alpha + \beta MW_{st-1} + \delta X_{st} + \theta_s + \tau_t + \varepsilon_{st} \quad (2)$$

where the right-hand side of the equation is identical to that of equation (1) and the dependent variable $\Delta \log N_{st}$ is the change in the logarithm of relevant population share at region s in time t . Table 6 presents the results for equation (2). The minimum wage has a limited effect on total employment. While the formal market share decreases, the informal market share increases with the minimum wage. The minimum wage leads to an increase in labour force participation with additional unemployed agents and informal workers. These results are in line with the standard textbook model, which predicts a transition from the formal labour market to the informal labour

market after a hike in the minimum wage. However, the increased informal share is partly due to the higher labour force participation.

Table 6 Effect of the Minimum Wage on Employment

		Fraction Affected	Fraction At	Fraction Lower
Emp Share		-0.054 (0.052)	-0.028 (0.048)	0.075 (0.045)
Formal Share		-0.074** (0.034)	0.003 (0.049)	0.217** (0.083)
Informal Share		0.240** (0.110)	0.060 (0.155)	-0.391** (0.162)
Unemp Share		0.079 (0.182)	-0.087 (0.153)	-0.313** (0.132)
LF Share		0.084* (0.046)	0.096* (0.053)	0.042 (0.052)
Separate Incidence Parameters				
Emp Share	MW^F	-0.011 (0.044)	0.029 (0.043)	0.002 (0.047)
	MW^I	-0.474** (0.189)	-0.534* (0.270)	0.210** (0.078)
Formal Share	MW^F	-0.142*** (0.035)	-0.078* (0.045)	-0.086** (0.039)
	MW^I	0.617*** (0.152)	0.819*** (0.223)	0.772*** (0.120)
Informal Share	MW^F	0.494*** (0.118)	0.355* (0.177)	0.363** (0.135)
	MW^I	-2.147*** (0.567)	-2.643*** (0.567)	-1.775*** (0.263)
Unemp Share	MW^F	-0.003 (0.169)	-0.181 (0.158)	-0.064 (0.147)
	MW^I	0.882 (0.644)	0.878 (0.915)	-0.768*** (0.249)
LF Share	MW^F	0.094 (0.058)	0.077 (0.059)	0.085 (0.061)
	MW^I	-0.007 (0.176)	0.314 (0.218)	-0.038 (0.099)
Observations		546	546	546

Notes: Dependent variable is the change in logarithm of labour market shares. Results are reported for the coefficients on difference minimum wage incidence parameters. Control variables include average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

To understand the different dynamics of formal and informal workers, we utilize separate measures, and the lower panel of Table 6 shows the results for separate incidence parameters. If formal FA increases, there is an increase in the informal market share and a reduction in the formal share. If informal FA increases, we have a reduction in the informal share but an increase in the formal share. Once the minimum wage increases, if the share of affected informal workers is high,

then many of these workers become an either unemployed or formal worker. This is visible from the estimate of MW^I for formal and unemployed shares.

In the upper panel of Table 6, the Fraction Lower parameter reveals a transition from informal market to formal market due to the increase in the minimum wage. This is exactly the opposite of what the Two-Sector model predicts. As we mentioned for the wage effects, this transition is not necessarily due to the minimum wage. The lower panel of Table 6 confirms our suspicion. When we utilize separate incidence parameters, we observe that coefficients for Fraction Affected, and Fraction Lower are consistent with each other. However, since Fraction Lower covers almost all informal workers, i.e., relatively more(less) informal(formal) workers, it amplifies the effect of informal workers. Therefore, this measure reflects the increasing formality and decreasing informality in low wage regions. If this was directly due to the minimum wage, we should also observe it from the Fraction Affected.

Although the LFS has a rotating sampling procedure, TurkStat does not share the panel dimension of the surveys. However, questions about the previous year labour market status let us create panel dummies. We create $[Y_{it} | Y_{it-1}]$ dummy variable depending on this year and last year employment status. Emp_Emp dummy takes the value of 1 if the agent is employed last year and this year as well. Similarly, Emp_Unemp will be 1 if the agent is employed last year but unemployed this year. We aggregate these transitions to create a share of each transition and check the change in these shares with the minimum wage. Table 7 presents the results for the restricted sample. Estimates are consistent with the results in Table 6. Given that the agents are employed at $t-1$, the transition to the informal market is significantly higher than the transition to formal jobs. This pattern is similar when we check agents who are unemployed or out of the labour force previously.

Table 7 Effect of the Minimum Wage on Transitions

	Fraction Affected	Fraction At	Fraction Lower
Emp_Emp Share	-0.015	0.008	0.060***
Emp_Formal Share	-0.064	0.036	0.250***
Emp_Informal Share	0.193	-0.025	-0.325*
Emp_Unemp Share	0.178	-0.273	-0.451
Emp_Out Share	-0.222	-0.221	-0.656***
Emp_Emp Share	-0.430*	-0.500**	-0.039
Emp_Formal Share	-0.828**	-0.646**	0.272
Emp_Informal Share	0.547	-0.071	-0.081
Emp_Unemp Share	0.056	0.005	0.019
Emp_Out Share	0.065	0.308	0.035
Emp_Emp Share	0.372	0.387	-0.367*
Emp_Formal Share	0.308	0.183	-0.162
Emp_Informal Share	0.409	0.623	-0.426
Emp_Unemp Share	0.161	-0.078	-0.409
Emp_Out Share	-0.007	-0.008	0.020*
Observations	546	546	546

Notes: Dependent variable is the change in logarithm of labour market transition shares. Results are reported for the coefficients on difference minimum wage incidence parameters. Control variables include average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the

NUTS-2 level but not reported for presenting purposes. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

In Table 7, we have very few significant coefficients, and this is due to the opposite effects of separate minimum wage measures. Table 8 presents the transition results when we have separate incidence parameters for formal and informal markets. For transition to informal market, while formal FA increases the share, a higher informal FA goes with a reduction in transition to informal labour.

Table 8 Effect of the MW on Transitions with Separate Incidence Parameters

		Fraction Affected	Fraction At	Fraction Lower
Emp_Emp Share	MW^F	-0.018	-0.005	0.001
	MW^I	0.021	0.134	0.166***
Emp_Formal Share	MW^F	-0.130**	-0.050	-0.075
	MW^I	0.634***	0.900***	0.846***
Emp_Informal Share	MW^F	0.447***	0.244	0.355**
	MW^I	-2.236***	-2.498***	-1.570***
Emp_Unemp Share	MW^F	0.213	-0.028	0.125
	MW^I	-0.112	-2.456*	-1.505**
Emp_Out Share	MW^F	-0.174	-0.073	-0.416
	MW^I	-0.722	-1.709	-1.097***
Unemp_Emp Share	MW^F	-0.252	-0.288	-0.093
	MW^I	-2.073***	-2.448**	0.058
Unemp_Formal Share	MW^F	-0.787**	-0.726**	-0.336
	MW^I	-1.384	0.073	1.387***
Unemp_Informal Share	MW^F	1.157*	0.794	0.824
	MW^I	-4.651***	-7.845***	-1.741***
Unemp_Unemp Share	MW^F	-0.011	-0.140	0.123
	MW^I	0.667	1.387*	-0.173
Unemp_Out Share	MW^F	0.195	0.461	0.046
	MW^I	-1.079	-0.923	0.017
Out_Emp Share	MW^F	0.248	0.307	-0.195
	MW^I	1.362	1.108	-0.683
Out_Formal Share	MW^F	0.028	0.116	-0.620*
	MW^I	2.733**	1.076	0.678
Out_Informal Share	MW^F	0.519	0.695	0.418
	MW^I	-0.704	-0.034	-1.975***
Out_Unemp Share	MW^F	0.058	-0.199	-0.156
	MW^I	1.152	1.009	-0.873
Out_Out Share	MW^F	0.001	0.002	0.017
	MW^I	-0.083*	-0.107*	0.026
Observations		546	546	546

Notes: Dependent variable is the change in logarithm of labour market transition shares. All other notes are the same as Table 7. Standard errors clustered at the NUTS-2 level but not reported for presenting purposes. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

To sum up, changes in the minimum wage have a significant increasing effect on formal wages but have no or a limited effect on informal wages. The increased wages in the formal market led to a transition from the formal market to the informal market. Moreover, the increased labour

force participation creates more unemployed agents and informal workers. Finally, we do not observe any change in working hours due to a change in the minimum wage.

2.4 Changes in Wages and Employment by Gender

As noted in the descriptive statistics section, women are paid less than men in Turkey. Moreover, their wages are more concentrated around the minimum wage. The Two-Sector Model, then, predicts a stronger wage effect for women and an increase in informal employment. Table 9 presents the change in wages for men and women separately. As expected, there is an increase in formal wages for women, and the magnitude of the increase is greater than the change in wages for men. On the other hand, while informal wages for women are reduced, there exists no significant change in informal wages for men. Both Fraction Affected and Fraction Lower reveal that formal wages increase with the minimum wage, and the effect is stronger for women. However, Fraction Lower gives inconsistent results for informal workers. If the minimum wage has an increasing effect on informal wages, we should observe a higher increase for women. However, while Fraction Lower gives a significant positive coefficient for men, the coefficient for women is not statistically different from zero.

Table 9 Effect of the Minimum Wage on Wages and Employment - by Gender

	Male			Female		
	Fraction Affected	Fraction At	Fraction Lower	Fraction Affected	Fraction At	Fraction Lower
Real Wages						
All Wages	0.115** (0.054)	0.087 (0.051)	0.349*** (0.050)	0.141 (0.120)	0.046 (0.088)	0.476*** (0.084)
Formal Wages	0.144** (0.056)	0.100* (0.049)	0.277*** (0.048)	0.346** (0.148)	0.178* (0.104)	0.435*** (0.091)
Informal Wages	-0.028 (0.108)	-0.010 (0.127)	0.192** (0.073)	-0.469* (0.246)	-0.397** (0.178)	-0.003 (0.116)
Employment Outcomes						
Emp Share	-0.058 (0.055)	-0.050 (0.051)	0.078* (0.043)	-0.002 (0.076)	0.100 (0.082)	0.026 (0.083)
Formal Share	-0.046 (0.040)	0.025 (0.048)	0.208** (0.090)	-0.222** (0.101)	-0.108 (0.111)	0.251** (0.096)
Informal Share	0.166 (0.121)	-0.010 (0.156)	-0.353** (0.168)	0.473* (0.247)	0.204 (0.245)	-0.650** (0.270)
Unemp Share	0.020 (0.214)	-0.063 (0.202)	-0.365*** (0.121)	-0.170 (0.224)	-0.379* (0.188)	-0.194 (0.218)
LF Share	0.008 (0.047)	0.021 (0.050)	-0.002 (0.057)	0.317** (0.133)	0.410*** (0.137)	0.274 (0.170)
Observations	546	546	546	546	546	546

Notes: Dependent variables are the change in logarithm of average wages and the change in logarithm of labour market shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

The lower panel of Table 9 reports the employment results by gender. The change in labour force share with the minimum wage is very remarkable for women. The increase in minimum wage does not induce a reduction in formal male employment. However, there is a significant increase in informal female employment with a reduction in formal employment. The minimum wage increases women's labour force participation, and they are mainly headed to the informal market. It turns out that both the changes in wages and labour market outcomes are in line with the predictions of the basic theoretical model. However, the increase in informal employment is partly due to increased labour force participation. Comparing with the results in Table 6, we conclude that the significant changes in total employment are mainly driven by the changes in women's employment outcomes.

Appendix Table A2 presents results for wage and employment effects by gender when we define separate minimum wage incidence parameters for formal and informal markets. From Table A2, we observe that the increase in women's wages is driven by the formal FA. As the share of the formal workers increases, it is reasonable to expect higher formal wages with the increase in minimum wage. Moreover, if the share of informal workers is higher in a region, we would expect lower compliance rates and stronger competition for formal jobs, both of which will lower formal wages. For the informal market, both formal and informal FA has a negative effect on women's wages. The lower panel of Table A2 presents the underlying reasoning behind these wage effects. For women, the minimum wage leads to a reduction in formal employment and a significant increase in informal employment. However, the increased informal share is partly due to the increased labour force participation, along with the transition from formal employment as theory predicts.

3. Robustness Checks

3.1 Time Trends

Neumark et al. (2007, 2014) and Allegretto et al. (2011, 2017) mainly discuss time controls. Dube et al. (2010) suggests that a general time fixed effect control is not capable of capturing the heterogeneity in underlying employment patterns. In our baseline model, we control only for time fixed effects. In this section, we add linear time trends for each NUTS-2 region, as there could be differentiated time trends for different regions. Table A3 in the Appendix presents the results for wage and employment effects. There are some limited changes in coefficients, but results are consistent with the case without the trends. The regional trends in wages and employment outcomes do not significantly change the results for the Fraction Affected measure. However, when we consider regional time trends, the Fraction Lower measure wage coefficient becomes insignificant for informal wages. As mentioned, there is a perfect linear relationship between average wages and the Fraction Lower measure, in which low wage regions have a higher Fraction Lower ratio. The percentage increases in wages are higher in these low wage regions. Therefore, when we add regional linear time trend to the estimation, we observe no significant relationship between minimum wage and informal wages.

3.2 Alternative Minimum Wage Incidence Measures

In our main baseline analysis, we provide results for three main minimum wage incidence parameters. However, there are several other ways to measure the incidence of minimum wage. In this section, we test three other measures that are popular in the minimum wage literature. Kaitz index is the ratio of the minimum wage to the average wage, whereas the so-called Toughness

parameter is the ratio of the minimum wage to the median wage. Finally, we compare other parameters with the Machin et al. (2003) Gap⁷ measure. Appendix Table A4 presents the results for wage and employment effects. These three measures cover all wage workers in the labour market. Therefore, they are affected by the other changes in the labour market as well. Moreover, like the Fraction Lower measure, these measures disregard the non-compliance in labour market. Both for wage and employment effects, the coefficients are larger in magnitude but consistent with our baseline Fraction Lower measure. Following the discussions we provide for the Fraction Lower measure; it seems not appropriate to utilize these measures in a labour market with a high level of informality.

3.3 Lighthouse Effect

Several studies (Lemos, 2009; Khamis, 2013; Maloney and Mendez, 2004) on minimum wage reports lighthouse effect, which refers to case where informal wages follow the increase in formal wages due to the minimum wage. While Yüncüler and Yüncüler (2016) comes up with the existence of the lighthouse effect, Papps (2012) finds no sign of lighthouse effect in Turkey. Our baseline results for Fraction Affected also suggest no lighthouse effect in Turkey. However, the Fraction Lower and other three alternative minimum wage incidence parameters reveal a positive relationship between minimum wage and informal wages. As mentioned above, these bite of the minimum wage definitions are not capable of considering non-compliance in Turkey, which leads to differentiated results. To check this idea, we create a non-compliance variable, which is defined as the ratio of agents who are already paid lower than the actual minimum wage. Therefore, it is harder to expect them to be affected by the following minimum wage increase. We estimate our baseline equation by adding the defined non-compliance variable, and the results are presented in Appendix Table A5. While the coefficients for formal wages are not significantly affected by the additional variable, coefficients for informal wages dramatically change for the last four minimum wage incidence parameters. This feature reveals that the increase in informal wages is not related to minimum wage increases.

3.4 Syrian Refugees

The civil war in Syria led to a massive refugee crisis. Turkey received millions of Syrians after 2012 and as of the end of 2017, there were 3.5 million Syrian refugees residing in Turkey. Several studies⁸ analyse the effects of Syrians on native labour market outcomes. Although existing studies issue conflicting results on the direction and the magnitude of possible effects, all agree on the clear impact of refugees on native labour market outcomes. Therefore, in this section, we test whether our results are robust to refugee effect.

First, we add the refugee share to our baseline equation and control for its impact. However, the location choice of the refugees depends on the labour market conditions of each region, which will bias OLS estimates. Therefore, in order to deal with this endogeneity problem, we propose a novel distance-based instrument and estimate parameters by 2SLS.

Following the Syrian civil war, the Turkish government constructed refugee camps along the border cities. Until mid-2013, refugees were generally staying in these camps. However, as the number of refugees exceeded camp capacities, they spread across the country. To account for these two separate settlement patterns, we employ a two-piece distance instrument. The first part of our instrument uses the camp population, whereas the second part utilizes the out-of-camp refugee

⁷ Gap parameter is defined as the average increase in wages needed to bring workers paid below minimum wage to the minimum wage rate.

⁸ For a detailed discussion, see Öztekin (2021).

population. There are 81 cities in Turkey and 13 different governorates in Syria. By using Google Maps, we calculate the travel distance from each city in Turkey to each governorate in Syria and utilize this distance to create an instrument for the refugee share. We define the instrument as follows;

$$IV_{ct} = \mathbb{1}_c \sum_{s=1}^{13} \frac{\pi_s C_t}{d_{cs}} + \sum_{s=1}^{13} \frac{\pi_s T_t}{d_{cs}} \quad (3)$$

where C_t and T_t are the total numbers of refugees living in and out of camps in year t , respectively. Distance parameter d_{cs} is the travel distance from city c in Turkey to region s in Syria. The share of Syrians living in Turkey from governorate s in Syria is denoted by π_s . Since LFS is representative for 26 NUTS-2 regions, we aggregate the city instruments for NUTS-2 levels. For refugees' background information, we utilize DEMA (2014, 2017) which provide the information for refugees' past settlement in Syria for the years before 2015 and after 2015. The first part of the instrument uses the camp population; therefore, the indicator function is equal to 1 if city c has a refugee camp in year t .

Appendix Table A6 presents the OLS and 2SLS results for wage and employment effects of minimum wage when we take refugees into account. We present 2SLS results by gender in Appendix Table A7. Apparently, compared to our baseline results, there is almost no change in estimated coefficients.

Recall that in our baseline estimation, we drop public workers, part-time workers, seasonal workers, agriculture and unpaid family workers. Cengiz and Tekgüç (2018) aggregate the LFS over NUTS2-year level and analyses the effect of Syrian refugees on native wage and employment. Their study reports no significant wage change due to refugees. Similarly, Öztek (2021) suggests no wage effect of Syrians. Therefore, after dropping the mentioned groups from the sample, it seems normal to have no change in minimum wage coefficients.

Aksu et al. (2018), Cengiz and Tekgüç (2018), Del Carpio and Wagner (2016), and Öztek (2021) agree on the reduction of informal employment due to refugees. Moreover, they report that formal employment increases with the Syrians. These studies (Aksu et al., 2018; Öztek, 2021; Del Carpio and Wagner, 2016) suggest that the changes in employment outcomes are mainly due to the significant changes in self-employment and part-time employment. Moreover, employers, public workers, unpaid family workers, temporary workers, irregular workers and workers in the construction and agriculture sectors are the groups significantly affected by the refugees. All these groups are either dropped from our analysis or are not affected by the minimum wage. Therefore, our results are robust to adding Syrian refugees to the estimation.

3.5 Internal Migration Patterns

The regional differences in labour markets in terms of different wage opportunities or better employment options may affect the location choice of agents (Borjas, 2006; Monras, 2015). If the minimum wage leads to a change in internal migration trends, then our baseline coefficients will be biased. The minimum wage in Turkey applies to the whole country and there are no sectoral differences. Therefore, throughout the year, all residents face the same nominal minimum wage. In relation to internal migration, this feature could create two opposing movements inside the country. First, the real value of the minimum wage is higher in smaller or less developed cities. It is hard to survive with minimum wage in cities like İstanbul or Ankara, but the minimum wage could provide better living standards in small cities. Therefore, a higher minimum wage could increase migration to smaller cities. Second, the possibility of getting a better paid job is higher in developed or big

cities. Therefore, with hikes in minimum wage, people may choose to leave their cities and move to developed cities. We believe that these two opposing forces will balance each other and there will be no significant change in internal immigration due to minimum wages.

We test whether a change in the minimum wage leads to a change in inflow, outflow and net immigration rates. Appendix Table A8 presents the results. As expected, we observe no statistically significant relationship between the minimum wage and internal migration. The lower panel of Table A8 uses migration rates instead of differences in rates. Again, there is no change in the internal net migration rate.

One other concern could be the possible change in native location choice due to the massive refugee influx. Both Akgündüz et al. (2019) and Aksu et al. (2018) report no significant change in internal migration due to Syrian refugees. Therefore, we could say our baseline results are robust to both internal and international migration.

3.6 Alternative Pseudo Panel - Grouping Estimator

Our baseline estimation utilizes the aggregated LFS over region-year. An alternative way of creating pseudo panel data is to aggregate LFS over different demographic characteristics. In this section, by following Blundell et al. (1998), we implement a grouping estimator in order to provide further evidence about our baseline results. We allocate agents to demographic groups constructed by the combination of 26 NUTS-2 regions, gender, age in 5 categories (15-24, 25-34, 35-44, 45-54, 55-65), and education in 3 categories (low, medium and high). Groups with less than a thousand observations are dropped from the analysis. We estimate the following group-level equation;

$$\Delta \log N_{gt} = \alpha + \beta MW_{gt-1} + \delta X_{gt} + \theta_g + \tau_t + \varepsilon_{gt} \quad (4)$$

where $\Delta \log N_{gt}$ is the change in the logarithm of relevant population share for group g in time t . The right-hand side variables are similar to equation (2) but defined over demographic groups. Instead of region fixed effects, we include group fixed effects, which also cover region fixed effects. We cluster the standard errors at the group level. All regressions are weighted by the summation of sampling weights for each demographic group.

Appendix Table A9 presents the key results. While formal wages increase with the minimum wage, there is no change in informal market wages. For employment outcomes, we observe the same transition from formal employment to informal employment due to increases in minimum wage. Moreover, labour force participation increases with the minimum wage. Although it is hard to compare the magnitudes of coefficients in baseline and grouping estimations, all estimates are consistent with each other.

The grouping estimator estimates the effect of the minimum more noisily for several reasons. First, LFS is representative at NUTS-2 level and the grouping estimator compares subgroups in these regions, which might lead to bias. Second, attenuation bias is more present in the grouping estimator compared to a NUTS-2 level comparison. However, since the results in Appendix Table A9 are in line with the results in Tables 4 and 6, we could say that our results are robust to using alternative data sources and identification procedures.

4. Conclusion

In this study, we focus on the consequences of the minimum wage in Turkey and explore its effects on wages and employment for both formal and informal labour markets.

Following the literature, we analyse the change in labour market outcomes by using the regional variation in the bite of minimum wage. Our results are in line with the predictions of the Two-Sector Model. We show that minimum wage has a significant positive effect on formal wages. However, there is weaker evidence for a significant change in informal market wages. The minimum wage leads to a significant reduction in formal employment and a significant increase in informal employment. The increased share of informal labour is partly due to the increased labour force participation. The wage and employment effects are stronger for women, as their wages are highly concentrated around the minimum wage. Working hours in formal and informal labour markets are not affected by the minimum wage, even though the minimum wage is set for a calendar month.

In a labour market with a high informality, the choice of the minimum wage incidence parameter significantly affects the results. We test several measures in this study. Robustness analysis showed that measures that ignore non-compliance in the labour market are not capable of reflecting the true impact of the minimum wage.

We propose a novel approach that differentiates the effects of formal and informal workers. Studies in developed countries utilize a single measure for the bite of the minimum wage. However, under a high informality rate, it is better to use separate minimum wage parameters for the formal and informal labour markets. We show that formal and informal incidence parameters have different consequences on wage and employment outcomes. These separate incidence parameters clarify our understanding of the effect of minimum wage under the presence of high informality.

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Appendix

Table A1 Effect of the Minimum Wage on Wages - Full Sample

	Fraction Affected	Fraction At	Fraction Lower
Full Sample			
All Wages	0.098	0.176**	0.341***
Formal Wages	0.168**	0.177**	0.191***
Informal Wages	-0.015	0.040	0.230***
Restricted Sample			
All Wages	0.119**	0.080*	0.370***
Formal Wages	0.183***	0.115**	0.303***
Informal Wages	-0.136	-0.094	0.149**
Restricted Sample under 40			
All Wages	0.042	0.036	0.333***
Formal Wages	0.104**	0.078	0.263***
Informal Wages	-0.154	-0.114	0.168**
Restricted Sample under 25			
All Wages	0.027	0.032	0.304***
Formal Wages	0.135**	0.179***	0.220***
Informal Wages	-0.074	-0.126	0.321***
Observations	546	546	546

Notes: Dependent variable is the change in logarithm of average real wages. Results are reported for the coefficients on difference minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A2 Effect of the MW with Separate Incidence Parameters - by Gender

		Male			Female		
		Fraction Affected	Fraction At	Fraction Lower	Fraction Affected	Fraction At	Fraction Lower
Real Wages							
All Wages	MW^F	0.139** (0.060)	0.106 (0.066)	0.281*** (0.063)	0.171 (0.129)	0.146 (0.116)	0.389*** (0.114)
	MW^I	-0.158 (0.234)	-0.079 (0.389)	0.474*** (0.059)	-0.136 (0.454)	-0.833 (0.716)	0.637*** (0.117)
Formal Wages	MW^F	0.192*** (0.060)	0.134** (0.062)	0.326*** (0.065)	0.364** (0.158)	0.306** (0.124)	0.503*** (0.121)
	MW^I	-0.396 (0.234)	-0.252 (0.396)	0.187** (0.072)	-0.243 (0.457)	-0.875* (0.512)	0.310*** (0.101)
Informal Wages	MW^F	0.033 (0.122)	0.079 (0.142)	0.133 (0.101)	-0.356 (0.268)	-0.387* (0.190)	-0.108 (0.135)
	MW^I	-0.462* (0.249)	-0.630** (0.305)	0.299** (0.143)	-1.514** (0.687)	-0.496 (0.466)	0.191 (0.216)
Employment Outcomes							
Emp Share	MW^F	-0.012 (0.050)	0.016 (0.049)	0.014 (0.048)	0.025 (0.079)	0.077 (0.114)	-0.087 (0.093)
	MW^I	-0.491** (0.192)	-0.622** (0.258)	0.196** (0.071)	-0.249 (0.442)	0.351 (0.693)	0.233 (0.168)
Formal Share	MW^F	-0.108** (0.040)	-0.054 (0.041)	-0.069* (0.040)	-0.340** (0.125)	-0.187 (0.142)	-0.225 (0.150)
	MW^I	0.610*** (0.171)	0.848*** (0.279)	0.715*** (0.137)	0.795 (0.604)	0.562 (0.855)	1.124*** (0.180)
Informal Share	MW^F	0.448*** (0.122)	0.331* (0.175)	0.386** (0.145)	0.697** (0.294)	0.326 (0.330)	0.312 (0.294)
	MW^I	-2.542*** (0.665)	-3.195*** (0.690)	-1.709*** (0.264)	-1.435 (1.032)	-0.738 (1.309)	-2.414*** (0.523)
LF Share	MW^F	0.024 (0.052)	0.009 (0.053)	0.045 (0.053)	0.272* (0.145)	0.299* (0.158)	0.199 (0.148)
	MW^I	-0.169 (0.183)	0.124 (0.163)	-0.089 (0.093)	0.861** (0.415)	1.592* (0.832)	0.412 (0.349)
Observations		546	546	546	546	546	546

Notes: Dependent variables are the change in logarithm of average wages and the change in logarithm of labour market shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A3 Effect of the Minimum Wage with Time Trends

		Fraction Affected	Fraction At	Fraction Lower
Real Wages				
All Wages		0.128** (0.056)	0.078* (0.040)	0.381*** (0.052)
Formal Wages		0.192** (0.071)	0.119** (0.043)	0.329*** (0.045)
Informal Wages		-0.142 (0.124)	-0.118 (0.112)	0.120 (0.084)
Employment Outcomes				
Emp Share		-0.068 (0.061)	-0.046 (0.054)	0.070* (0.041)
Formal Share		-0.074* (0.039)	-0.008 (0.050)	0.197*** (0.066)
Informal Share		0.217* (0.118)	0.066 (0.166)	-0.362** (0.137)
Unemp Share		0.145 (0.205)	-0.004 (0.172)	-0.248** (0.113)
LF Share		0.043 (0.055)	0.044 (0.060)	0.025 (0.054)
Separate Incidence Parameters				
Formal Share	MW^F	-0.135*** (0.037)	-0.082 (0.048)	-0.075* (0.036)
	MW^I	0.593*** (0.167)	0.790** (0.311)	0.740*** (0.127)
Informal Share	MW^F	0.460*** (0.119)	0.359* (0.185)	0.318** (0.132)
	MW^I	-2.186*** (0.614)	-2.745*** (0.585)	-1.723*** (0.318)
Observations		546	546	546
Region Trends		Yes	Yes	Yes

Notes: Dependent variables are the change in logarithm of average wages and employment shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A4 Effect of the Minimum Wage - Alternative Minimum Wage Measures

	Kaitz (MW/AW)	Toughness (MW/Median)	Gap
Real Wages			
All Wages	0.718*** (0.090)	0.269*** (0.056)	0.853*** (0.116)
Formal Wages	0.706*** (0.122)	0.227*** (0.066)	0.679*** (0.155)
Informal Wages	0.148** (0.062)	0.052 (0.044)	0.369* (0.212)
Employment Outcomes			
Emp Share	0.104** (0.043)	0.061* (0.032)	0.348* (0.200)
Formal Share	0.285*** (0.075)	0.171** (0.069)	0.658*** (0.195)
Informal Share	-0.502*** (0.135)	-0.322** (0.132)	-1.211*** (0.415)
Unemp Share	-0.263 (0.165)	-0.310*** (0.097)	-0.895 (0.533)
LF Share	0.075 (0.055)	0.018 (0.052)	0.083 (0.110)
Observations	546	546	546

Notes: Dependent variables are the change in logarithm of average wages and employment shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A5 Effect of the Minimum Wage on Wages - Lighthouse Effect

	Fraction Affected	Fraction At	Fraction Lower	Kaitz (MW/AW)	Toughness (MW/Median)	Gap
Real Wages						
All Wages	0.086 (0.051)	-0.009 (0.047)	0.389*** (0.101)	0.772*** (0.099)	0.229*** (0.079)	0.787*** (0.204)
Formal Wages	0.164** (0.067)	0.069 (0.053)	0.395*** (0.119)	0.813*** (0.116)	0.220** (0.092)	0.725*** (0.258)
Informal Wages	-0.175 (0.114)	-0.204* (0.110)	-0.062 (0.146)	0.043 (0.071)	-0.047 (0.052)	0.043 (0.280)
Observations	546	546	546	546	546	546

Notes: Dependent variable is the change in logarithm of average wages. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include non-compliance variable, unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A6 Effect of the Minimum Wage - Results with Refugees - OLS and 2SLS

	OLS			2SLS		
	Fraction Affected	Fraction At	Fraction Lower	Fraction Affected	Fraction At	Fraction Lower
Real Wages						
All Wages	0.119** (0.052)	0.081* (0.046)	0.370*** (0.050)	0.119** (0.049)	0.081* (0.043)	0.370*** (0.047)
Formal Wages	0.182*** (0.063)	0.115** (0.046)	0.303*** (0.052)	0.182*** (0.059)	0.115*** (0.043)	0.303*** (0.048)
Informal Wages	-0.136 (0.116)	-0.094 (0.105)	0.149** (0.062)	-0.136 (0.108)	-0.094 (0.098)	0.149** (0.058)
Employment Outcomes						
Emp Share	-0.054 (0.050)	-0.031 (0.047)	0.075 (0.044)	-0.054 (0.048)	-0.028 (0.044)	0.075* (0.042)
Formal Share	-0.075** (0.034)	0.004 (0.049)	0.217** (0.083)	-0.075** (0.032)	0.004 (0.046)	0.217*** (0.077)
Informal Share	0.241** (0.111)	0.058 (0.155)	-0.392** (0.161)	0.241** (0.103)	0.058 (0.144)	-0.392*** (0.150)
Unemp Share	0.075 (0.179)	-0.081 (0.151)	-0.312** (0.130)	0.079 (0.170)	-0.087 (0.140)	-0.313** (0.123)
LF Share	0.086* (0.048)	0.093 (0.056)	0.041 (0.041)	0.087* (0.046)	0.091* (0.053)	0.041 (0.048)
First Stage F-Stat				64.762	64.762	64.762
Observations	546	546	546	546	546	546

Notes: Dependent variables are the change in logarithm of average wages and the change in logarithm of labour market shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include refugee share, unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A7 Effect of the Minimum Wage - Results with Refugees by Gender - 2SLS

	2SLS - Male			2SLS - Female		
	Fraction Affected	Fraction At	Fraction Lower	Fraction Affected	Fraction At	Fraction Lower
Real Wages						
All Wages	0.114** (0.050)	0.088* (0.048)	0.349*** (0.046)	0.140 (0.113)	0.046 (0.081)	0.476*** (0.078)
Formal Wages	0.144** (0.052)	0.100** (0.046)	0.277*** (0.045)	0.346** (0.138)	0.178* (0.097)	0.435*** (0.085)
Informal Wages	-0.029 (0.101)	-0.009 (0.118)	0.192*** (0.069)	-0.467** (0.228)	-0.401** (0.165)	-0.003 (0.107)
Employment Outcomes						
Emp Share	-0.057 (0.050)	-0.051 (0.046)	0.078* (0.040)	-0.005 (0.068)	0.104 (0.077)	0.027 (0.078)
Formal Share	-0.046 (0.037)	0.026 (0.044)	0.208** (0.084)	-0.222** (0.093)	-0.107 (0.105)	0.251*** (0.089)
Informal Share	0.165 (0.113)	-0.010 (0.144)	-0.353** (0.156)	0.475** (0.229)	0.201 (0.230)	-0.651*** (0.249)
Unemp Share	0.017 (0.198)	-0.058 (0.183)	-0.364*** (0.111)	-0.163 (0.198)	-0.392** (0.171)	-0.195 (0.203)
LF Share	0.010 (0.045)	0.018 (0.049)	-0.002 (0.054)	0.325** (0.128)	0.399*** (0.136)	0.272* (0.158)
Observations	546	546	546	546	546	546

Notes: Dependent variables are the change in logarithm of average wages and the change in logarithm of labour market shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include refugee share, unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A8 Effect of the Minimum Wage on Internal Migration

	Fraction Affected	Fraction At	Fraction Lower
Change in Migration Rate			
Δ Inflow Rate	0.005 (0.007)	0.003 (0.009)	0.006 (0.007)
Δ Outflow Rate	0.002 (0.007)	0.004 (0.009)	0.002 (0.006)
Δ Net Rate	0.003 (0.013)	-0.001 (0.017)	0.004 (0.012)
Observations	234	234	234
Migration Rate			
Inflow Rate	0.011* (0.006)	0.012* (0.006)	0.002 (0.005)
Outflow Rate	0.003 (0.004)	0.003 (0.005)	0.004 (0.003)
Net Rate	0.008 (0.008)	0.009 (0.009)	-0.002 (0.006)
Observations	260	260	260

Notes: Dependent variables are the change in logarithm of inflow, outflow and net internal migration rates. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include region fixed effects and time fixed effects. Standard errors clustered at the NUTS-2 level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.

Table A9 Effect of the MW on Wages and Employment - Grouping Estimator

	Fraction Affected	Fraction At	Fraction Lower
Real Wages			
All Wages	0.054* (0.029)	0.045 (0.031)	0.446*** (0.023)
Formal Wages	0.128*** (0.025)	0.136*** (0.027)	0.343*** (0.019)
Informal Wages	-0.029 (0.049)	-0.072 (0.057)	0.335*** (0.043)
Employment Outcomes			
Emp Share	0.061 (0.037)	0.106** (0.049)	0.055** (0.025)
Formal Share	-0.301*** (0.064)	-0.291*** (0.071)	0.255*** (0.055)
Informal Share	0.254*** (0.061)	0.222*** (0.072)	-0.415*** (0.069)
Unemp Share	-0.145* (0.077)	-0.182** (0.090)	-0.126 (0.103)
LF Share	0.157*** (0.058)	0.203*** (0.062)	0.117** (0.046)
Observations	11,781	11,781	11,781

Notes: Dependent variables are the change in logarithm of average wages and the change in logarithm of labour market shares. Results are reported for the coefficients on different minimum wage incidence parameters. Control variables include unemployment rate, average age, share of women, share of low educated agents, share of singles, share of small firms, share of occupations requiring low skills, share of low paid sectors (includes manufacturing, wholesale and retail trade, accommodation and food services), share of seasonal and part-time workers. All regressions include group-region fixed effects and time fixed effects. Standard errors clustered at the group level are reported in parentheses. Significance levels are denoted as follows: ***1 percent, **5 percent, *10 percent.