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The impact of the minimum wage on the wage distribution: Evidence from Turkey

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Abstract: In this paper, we investigate the effect of the minimum wage on the entire wage distribution. More specifically, we address the issue of wage inequality by taking into account the potential distributional outcomes of the minimum wage legislation. We decompose the wage differences and the changes in the wage inequality before and after the sizeable minimum wage increase in 2004 following the methodology introduced by DiNardo, Fortin and Lemieux (1996). We use a non-parametric reweighting approach to decompose the effects of the minimum wage increase as well as other factors that may have changed the wage distribution. Our main findings confirm that the minimum wage has played the pivotal role in reducing wage inequality for both men and women wage earners between 2003 and 2005.

Key words: Minimum wage, wage inequality, counterfactual distributions

JEL codes: J31, J38

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1. Introduction

Economic Report of the President (2012) has recently reawakened concern about inequality issue. The report highlights rising inequality problems for middle and low income households. Especially in the post-financial crisis era, the council of economic advisors claims that the inequality problems have reached a critical point. As pointed out by Alan Krueger in a speech, the income inequality has become an obstacle to economic growth[2]. Motivated by these remarks, many international organizations such as World Bank, OECD, UN, and IMF put inequality at the center of their public policy agenda. A recent OECD report entitled *Divided We Stand: Why Inequality Keeps Rising* emphasizes that the gap between rich and poor is widened after the global economic crisis and the social contract is starting to unravel even in OECD countries (OECD, 2011). Similarly to Alan Krueger, Houller et al. (2012) emphasize that the main driver of the increase in inequality is the growing wage dispersion. Given that employment earnings constitute the biggest share of total household incomes among the working-age population in most OECD countries, the correlation between wage dispersion and rising inequality is not surprising (OECD, 2011). In this regard, there is a growing interest among economists to study the dynamics of the changes in wage distribution, especially in countries where the income inequality is relatively high such as US or Latin American countries. In this study, we focus on the wage inequality issue in Turkey, as a developing OECD member country, which is less equal than the developed ones (Houller et al., 2012).

The economic literature on wage inequality in developed countries has mostly concentrated on the role of the increasing demand for skilled labor due to the technological changes, international trade and job-search frictions (Juhn et al. 1993; Pierce, 1993; Acemoglu, 2002; Attanasio et al. 2004; Moore and Ranjan, 2005; Kumar and Mishra, 2008; Mortensen, 2005). These studies mostly ignore the potential effects of the institutional factors in the labor market. However, in their influential study, DiNardo et al. (1996) emphasize that labor market institutions, especially minimum wage, are as important as market forces in explaining changes in the wage distribution in U.S in the early 1980s. Another important study by Lee (1999) argues that the

[2] http://www.whitehouse.gov/sites/default/files/krueger_cap_speech_final_remarks.pdf

erosion of the U.S. federal minimum wage in real terms during the 1980s, can account for much of the increase of wage inequality in the lower tail of the distribution, particularly for women. Autor, Katz and Kearney claim also the decline in the real minimum wage is the primary source of the rising wage inequality over recent decades in United States (Autor et al., 2005). In a recent comprehensive paper about the minimum wage effects in UK, Butcher et al. (2012) develop a model in which the minimum wage has an the impact on wage inequality, but no significant effect on employment. Moreover, they suggest that the introduction of the UK minimum wage in 1999, can explain an important part of the evolution of wage inequality between 1998 and 2010. In sum there is growing evidence that under the influence of an efficient minimum wage policy, the difference between high and low wages becomes smaller in favor of the latter ones.

The research on the effect of the minimum wages on the wage distribution in developing countries is scarcer than the developed countries (Gindling and Terrell, 2005). However, the limited evidence from developing countries indicates that wage compression effect of the minimum wage is stronger than in developed countries (Lemos, 2009). The labor market of developing countries such as Latin American Countries as well as Turkey is mainly characterized by a large proportion of informal employment. In this framework, the commonly used theoretical model for testing the distributional effect of the minimum wage is Welch-Gramlich-Mincer Two Sector Model (Welch, 1976; Gramlich 1976; Gramlich, 1976; Mincer, 1976). Under the assumption that the workers are perfectly mobile, this model suggests, a higher minimum wage could decrease the wages in uncovered sector (meaning that the minimum wage legislation is not applied to all sectors) due to the movement of workers from the covered sector to the uncovered sector. Thus, the expected effects of the minimum wage on other wages in covered and uncovered sector go in the opposite directions. However, contrary to the predictions of the Two Sector Model, the evidence from developing countries mainly based on Latin America indicates that the minimum wage has a positive distributional effect not only in the formal sector, but also in the informal sector (Lemos, 2009; Cunningham, 2007; Maloney and Mendez, 2004; Neumark et al., 2006; Fajnzylber, 2001; Khamis, 2008). Furthermore, in their theoretical paper Fugazza and Jacques (2003) develop a model in which the labor

market institutions, including the minimum wage, are efficients for reducing the informal sector and under the certain circumstances, the earnings the wages in the regular and irregular sector move jointly. On the other hand, Meghir et al. (2012) indicate that increasing the cost of informality push up the wages in developing countries using an extended version of wage-posting model with search frictions. Many economists working on emergent labor markets agree that the minimum wage legislation could have far-reaching consequences as it could be a signaling mechanism in the whole labor market including the informal employment (Angel-Urdinola, 2008). As it is a common practice in the literature on developing countries to use the terms uncovered and informal interchangeably (Gindling and Terrell, 2005), so we use them in the same way.

Especially in an emerging economy where there is substantial wage inequality, it is noteworthy to investigate the bindingness of the minimum wage. If a minimum wage is binding, one could get a primary idea about its enforcement or coverage. Theoretically, enforced minimum wage legislation with high compliance generates a censored distribution at the level of the minimum wage with no workers earning below the minimum wage. Nevertheless non compliance is widespread particularly in developing countries (Maloney and Mendez, 2004), thus the truncation at the minimum wage level may not be obvious. However, if a spike appears around the minimum wage in the wage distribution, one can assume that the minimum wage is somewhat binding (Cunningham, 2007).

Albeit an increasing number of empirical studies using Latin American data over the past decade, there has been very little to no research on this issue for many other developing countries as well as Turkey. This study is the first to investigate the effects of minimum wage on the wage distribution in Turkey using micro data provided by the Household Labor Force Surveys (LFS) of TURKSTAT. LFS enables a broad range of information about the socio-economic conditions of both formal and informal workers.

Turkish labor market is known with its late but fast process of urbanization over the last decades. This structural transformation is characterized by a systematic fall over time in the share of agricultural labor force and by an increase in the share of labor force in industry and especially in services related to their sectoral shares in GDP. As in many

other developing countries, e.g. in Latin America, this typical process of sectoral reallocation has been followed by a persistent high unemployment rate in urban areas and a substantial informal employment rate among the salaried workers. Although, we observe a slight decline in the share of informal employment during the last years, this fact is due to the going on process of structural transformation from agriculture towards urban sectors rather than a result of a successful public policy against the informality issue (Ben Salem et al., 2011). An important share of salaried employees, around 26% according to Labor Force Survey in 2010, is still outside of labor market legislation, i.e. has an informal job. The evidence about labor income differentials between the formal/informal segments in Turkish labor market confirms the existence of an informal penalty in line with the traditional theory that the formal salaried workers are paid higher than the informal ones (Tansel and Kan, 2012; Baltagi et al., 2012).

The wage earners in Turkey benefited from the increases in the real minimum wage over the last decade (Figure 1). The highest increase occurred in 2004, when the minimum wage commission decided to raise the minimum wage by 26.6 percent in real terms. However, the other increases occurred after 2004 remained weak. In this paper, we investigate the effects of this sizeable increase on the entire wage distribution. More specifically, we address the issue of wage inequality by taking into account the potential distributional outcomes of the minimum wage legislation. We decompose the wage differences and the changes in the wage inequality before and after the minimum wage increase in 2004 following the methodology introduced by DiNardo, Fortin and Lemieux (1996), DFL hereafter. We use a non-parametric reweighting approach to decompose the effects of the minimum wage increase as well as other factors that may have changed the wage distribution. Our main findings confirm that the minimum wage has played the pivotal role in reducing wage inequality for both men and women wage earners between 2003 and 2005.

This paper is organized as follows. Section 2 discusses the evolution of the minimum wage in the Turkish labor market over recent years. Section 3 describes the data set used and discusses related issues. Section 4 presents a detailed explanation of the methodology used and Section 5 reports our empirical results. Section 6 concludes and offers suggestions for further research.

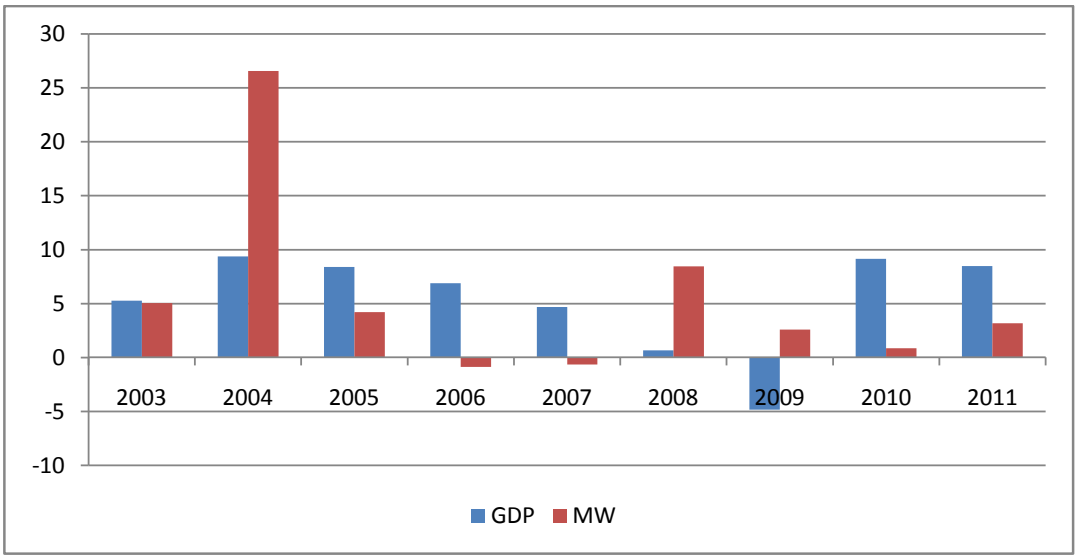
2. The minimum wage in Turkey over the past decade

Turkish economy has performed well over the past decade and has been one of the fastest growing economies in OECD. After a severe crisis in 2001, Turkey entered a speedy recovery period accompanied by a single-party government that has stayed in power since the end of 2002. The growth rates *per capita* average to about 4.1% per year between 2002 and 2011, even including 2009 when GDP contracted. We observed a similar recovery after 2009 as well. However, the minimum wage increases were not in line with the economic growth rates. Figure 1 presents the annual growth rates of GDP and minimum wage in real terms during the period of the Justice and Development Party (abbreviated AKP in Turkish) government between 2003 and 2011[3]. Note that except for 2006 and 2007, the real minimum wage has risen consistently for ten years. The largest increase in the mandatory minimum wage since the single government of AKP came into office was realized in January 2004, just before the local elections. From 2003 to 2011, the real increase in minimum wage levels was 50.4% whereas real GDP growth was also 50.4%.[4] Note that despite the total raise of the real minimum wage is equal to the GDP growth between 2003 and 2011, this fact mainly results from the strong increase in 2004. The main purpose of this paper is to investigate whether and to what extent this substantial increase in the minimum wage has changed the wage distribution and has contributed to decrease in wage inequality.

[3] We exclude the economic crisis years 2000 -2001 and the first year of recovery period 2002. The single-party government formed by AKP came into office by the end of 2002 and provided more stable macroeconomic environment since 2003.

[4] Table A1 summarizes the net minimum wage values and GDP levels both in nominal and real terms for the time covered. This are the monthly net minimum wages for workers aged 16 and older. The average of the minimum wages were taken into account for the years when more than one adjustment occurred and all wage levels were deflated by 2003 prices using Consumer Price Index.

Figure 1 : GDP growth rates and the real minimum wage increases (%, per year)



Source: TUIK and Ministry of Labour and Social Security

Following the earlier literature on minimum wage, we use a more appropriate variable, Kaitz index for measuring the real level of the minimum wage (Burkhauser et al., 2000). This conventional index is firstly formulated by Kaitz (1970) and provides a basis for measuring where the minimum wage "bites". We use both of the mean and median wages as denominator. Nevertheless, we keep in mind that using the median wage instead of the mean wage is widespread in developing countries, as it omits very high earners (Maloney and Mendez, 2004; OECD,1998). Table 1 provides the ratio of the monthly minimum wage to both the mean and median wage for the full time wage earners between 2003 and 2011 in OECD countries. According to the previous literature, a lower Kaitz index indicates that the minimum wage is relatively weak and probably does not affect a large number of employees while a higher Kaitz index generally associates with a bigger share of minimum wage earners i.e. a higher minimum wage relative to the other wages and potentially has some significant impacts in the labor market (Rycx and Kampelmann, 2012).

Table 1: Minimum wages relative to mean and median wages of full time wage earners

		2003	2004	2005	2006	2007	2008	2009	2010	2011
Turkey*	**Mw to Mean W**	**0.31**	**0.40**	**0.40**	**0.38**	**0.38**	**0.38**	**0.38**	**0.38**	**0.38**
	Mw to Median W	**0.58**	**0.75**	**0.75**	**0.73**	**0.72**	**0.71**	**0.71**	**0.71**	**0.71**
United States**	Mw to Mean W	0.26	0.25	0.25	0.24	0.24	0.25	0.27	0.28	0.28
	Mw to Median W	0.33	0.32	0.32	0.31	0.31	0.34	0.37	0.39	0.38
United Kingdom**	Mw to Mean W	0.35	0.36	0.37	0.37	0.38	0.38	0.38	0.38	0.38
	Mw to Median W	0.42	0.43	0.45	0.45	0.47	0.46	0.46	0.46	0.47
Ireland**	Mw to Mean W	0.43	0.45	0.46	0.44	0.45	0.44	0.43	0.44	0.44
	Mw to Median W	0.51	0.53	0.54	0.52	0.53	0.52	0.50	0.48	0.48
France**	Mw to Mean W	0.47	0.47	0.48	0.49	0.48	0.48	0.49	0.48	0.48
	Mw to Median W	0.58	0.59	0.60	0.61	0.60	0.60	0.61	0.60	0.60
Belgium*	Mw to Mean W	0.45	0.44	0.44	0.43	0.43	0.44	0.44	0.43	0.43
	Mw to Median W	0.51	0.51	0.51	0.50	0.50	0.51	0.52	0.51	0.50
Luxembourg*	Mw to Mean W	0.30	0.31	0.33	0.35	0.37	0.39	0.41	0.41	0.41
	Mw to Median W	0.34	0.34	0.34	0.34	0.34	0.33	0.34	0.34	0.35
Netherlands***	Mw to Mean W	0.44	0.43	0.42	0.42	0.41	0.41	0.41	0.42	0.42
	Mw to Median W	0.50	0.49	0.48	0.47	0.47	0.47	0.47	0.47	0.47
Canada**	Mw to Mean W	0.36	0.36	0.36	0.36	0.36	0.37	0.38	0.39	0.40
	Mw to Median W	0.40	0.40	0.40	0.41	0.40	0.41	0.43	0.44	0.45
Australia***	Mw to Mean W	0.50	0.50	0.50	0.46	0.46	0.45	0.45	0.45	0.45
	Mw to Median W	0.58	0.58	0.58	0.54	0.55	0.52	0.54	0.54	0.54
Japan**	Mw to Mean W	0.29	0.30	0.29	0.30	0.30	0.30	0.32	0.33	0.33
	Mw to Median W	0.33	0.34	0.34	0.34	0.34	0.35	0.36	0.37	0.38
Korea*	Mw to Mean W	0.25	0.26	0.28	0.28	0.31	0.31	0.33	0.33	0.34
	Mw to Median W	0.30	0.31	0.33	0.35	0.37	0.39	0.41	0.41	0.41
New Zealand***	Mw to Mean W	0.46	0.47	0.47	0.49	0.49	0.51	0.52	0.51	0.51

	Mw to Median W	0.53	0.53	0.54	0.56	0.57	0.59	0.59	0.59	0.59
Spain*	Mw to Mean W	0.33	0.33	0.35	0.35	0.36	0.35	0.35	0.35	0.35
	Mw to Median W	0.41	0.42	0.44	0.44	0.46	0.44	0.44	0.44	0.44
Portugal*	Mw to Mean W	0.36	0.37	0.37	0.35	0.36	0.36	0.37	0.39	0.39
	Mw to Median W	0.51	0.52	0.53	0.51	0.51	0.52	0.54	0.57	0.57
Greece*	Mw to Mean W	0.34	0.32	0.32	0.31	0.31	0.33	0.33	0.33	0.35
	Mw to Median W	0.45	0.44	0.45	0.45	0.46	0.48	0.48	0.49	0.51
Poland*	Mw to Mean W	0.35	0.35	0.34	0.33	0.31	0.34	0.37	0.36	0.36
	Mw to Median W	0.43	0.42	0.41	0.41	0.39	0.42	0.45	0.45	0.45
Hungary*	Mw to Mean W	0.37	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.36
	Mw to Median W	0.48	0.48	0.48	0.49	0.48	0.48	0.48	0.47	0.50
Czech Republic*	Mw to Mean W	0.32	0.33	0.33	0.34	0.33	0.30	0.30	0.29	0.29
	Mw to Median W	0.37	0.38	0.39	0.40	0.38	0.36	0.36	0.35	0.35
Romania*	Mw to Mean W	0.34	0.33	0.31	0.29	0.26	0.30	0.32	0.31	0.33
	Mw to Median W	0.49	0.47	0.45	0.42	0.38	0.42	0.46	0.45	0.48
Estonia	Mw to Mean W	0.30	0.32	0.31	0.29	0.28	0.32	0.34	0.34	0.32
	Mw to Median W	0.38	0.40	0.38	0.35	0.34	0.39	0.41	0.41	0.39
Slovak Republic*	Mw to Mean W	0.36	0.35	0.35	0.35	0.35	0.34	0.36	0.36	0.36
	Mw to Median W	0.45	0.44	0.43	0.45	0.44	0.43	0.45	0.46	0.46
Slovenia	Mw to Mean W	NA	NA	0.43	0.43	0.42	0.41	0.40	0.46	0.47
	Mw to Median W	NA	NA	0.51	0.51	0.50	0.49	0.49	0.57	0.58
Latvia	Mw to Mean W	0.33	0.35	0.31	0.27	0.27	0.30	0.39	0.40	0.43
	Mw to Median W	0.44	0.48	0.41	0.37	0.36	0.41	0.52	0.54	0.57
Litvania	Mw to Mean W	0.36	0.38	0.37	0.34	0.32	0.32	0.36	0.37	0.36
	Mw to Median W	0.46	0.48	0.47	0.42	0.40	0.39	0.44	0.45	0.48
Mexico**	Mw to Mean W	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.19	0.18
	Mw to Median W	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source : OECD.
Notes: *Monthly earnings, **Hourly earnings, ***Weekly earnings of full time wage earners.

We would like to highlight that Turkey has clearly the highest Kaitz index among the countries considered here. Other countries where the Kaitz index is relatively high are France, Belgium, Ireland, New Zealand, Australia, Slovenia and Latvia. According to OECD stats; another significant point is the ratio of the minimum wage to the median wage is almost two times more than the ratio of the minimum wage to the mean wage. This fact may be due to the existence of the extreme high wages and/or the compression of wages at the bottom of the distribution. Nevertheless, it should be kept in mind that OECD estimates the mean and median wages using Structure of Earnings Survey. This data provided by TURKSTAT covers employees who are registered wage earners in all establishments of enterprises employing 10 and more employees. Thus, the estimated wages, especially mean wages, might be upwardly biased given that the wage earners in the SMEs and informal employees are not covered in the data used. Alternatively to OECD stats, we present the estimated Kaitz index using LFS data for each year 2003-2011 in Annex. With the notable increase in the minimum wage in 2004, the Kaitz index has changed dramatically in Turkey. The ratio of the minimum wage to the median wage rose from 58% to 75% and it has not changed considerably since then. Therefore, it is worth examining the distributional effects of the minimum wage in Turkish labor market where the bite of the minimum wage is significantly higher than the other countries. We focus on the effects of the increase in the minimum wage in 2004 by measuring the changes in the wage distribution between 2003 and 2005.

3. Data

We use the 2003 and 2005 LFS annual micro data provided by TURKSTAT. In Turkey, LFS is the main data source for the labor market statistics as it collects detailed information from labor supply perspective. The definitions and classifications of the variables in LFS have been harmonized with international standards determined by Eurostat and ILO. Economic activities and occupations are coded at four digit levels according to NACE and ISCO-88 classifications and results are given by 9 main groups. This data regularly surveys main demographic and socio economic characteristics of the households, such as age, sex, marital status, labor market status, tenure, hours worked,

income from paid employment, informal employment, and unemployment duration etc. since 1988. Thus one can control some relevant individual characteristics which potentially affect the wages. Using standardized sampling and weighting methods, LFS data is designed to be representative of the whole non institutional population of Turkey. The household sample is selected by a two stage stratified cluster design. Approximately 14100 sample households are visited each month and the weighting coefficients are calculated by using current population projection. Finally, the annual results are published with a cross sectional design. It is a fact that the lack of longitudinal data structure over this period limits somewhat the empirical research; nevertheless we take the advantage of the large sample size of LFS by using appropriate estimation methods for repeated cross sectional data.

The question about the earnings from the paid employment was added to LFS in 2003. However, the date of this adscititious information does not pose a problem since our period of interest covers the large increase of the minimum wage in 2004. By taking into account the potential time-lagged effects of this increase, we investigate the changes in the wage distributions from 2003 to 2005. Note that, our sample includes full time wage earners in non agricultural activities among the working age population (those aged 15 to 65) who declare a net positive salary in the reference month. Therefore, we simply keep out the wage earners who work less than 30 hours per week, i.e. part time workers. This restriction is quite conventional for the research concerning wage structure (Katz and Murphy, 1992; Verdugo and Horny, 2012). Furthermore, the percentage of the part-time employees among the all wage earners is very low (about 0.8 % in 2004, and 1.4% in 2005 according to the labor surveys provided by TURKSTAT; there was no specific question about the employment type in 2003) and negligible in Turkey, contrarily to the industrialized countries. Since the minimum wage and the reported employment earnings in LFS are on a monthly basis, we prefer to work with monthly wages. Finally, we exclude the observations with 1% of the lowest and 1% highest wage distribution in order to avoid the effect of outliers on estimation. In the end, our sample includes 33,023 men and 8,821 women in 2003 and 53,978 men and 13,476 women in 2005. Table 2 reports the summary statistics of the sample.

Table 2: Characteristics of full time wage earners in Turkey (per cent)

	Men		Women	
	2003	**2005**	**2003**	**2005**
Average age	33.5	33.8	30	30.5
Years of schooling	8.5	8.5	10.5	10.3
Education				
Illiterate	1	1	1	2
Literate, but not completed any school	1	2	1	2
Primary school	41	39	23	22
Secondary school	15	17	9	10
High school, vocational or technical high school	27	27	32	31
University, faculty or upper	15	14	34	33
Married	76	75	48	46
Urban population	78	84	85	89
Tenure (year)	19	19.3	13.5	14.2
Sector				
Industry	31	33	31	30
Construction	9	9	1	1
Services	60	58	68	69
Unskilled	13	13	10	12
Informal wage earners	27	28	22	25
Below minimum wage	13	14	17	16
At or near the min. wage	9	16	13	20
Number of obs.	**33023**	**53978**	**8821**	**13476**

Source: LFS 2003 and 2005, own calculations

We do not observe a significant change in the characteristics of full time wage earners from 2003 to 2005 for both men and women workers. It is not surprising by taking into account that two years is not long enough for any structural changes in a labor market. However, the workforce became more educated. The share of primary school graduates

has declined slightly while average years of schooling have remained unchanged[5]. The most remarkable shift has occurred in the share of the urban workers. The urban population among wage earners has expanded correspondingly to the increasing urbanization rate in the whole country while the sectoral decomposition has remained stable. The share of the unskilled wage earners has increased from 10% to 12% among women. The informal employment rate as another important indicator has remained almost stable among men wage earners, while it has expanded from 22% to 25% among women over two years.

The proportion of workers who earn at or near the minimum wage[6] has increased from 9% to 15 % and from 13% to 19 % among men and women wage earners respectively. Considering that the minimum wage hike in 2004, this jump in the minimum wage population seems normal. However it is quite surprising that, the proportion of workers paid below the minimum wage has remained almost unchanged. Furthermore, according to data provided by TURKSTAT, the unemployment rate did not increase, even decreased slightly between 2003 and 2005. The total unemployment rate was 10.5 % (13.8% non agricultural) in 2003 and it was 10.6 % (13.5% non agricultural) in 2005. The unemployment rate by gender was 10.7% (12.6 % non agricultural) in 2003 and 10.5% (12.2% non agricultural) in 2005 for men while it was 10.1 % (18.9% non agricultural) in 2003 and 11.2% (18.7 % non agricultural) in 2005 for women.

In order to get a more detailed examination of workers, we divide our sample into two sub-groups: formal wage earners who are covered by a social security program due to his/her main job and informal wage earners who are not covered. From the 2003 sample, 23,857 men and 6,811 women and from the 2005 sample 38,848 men and 10,055 women full time wage earners are registered to the social security institution. The informal wage earners sample comprises 9,166 men and 2,010 women in 2003 and 15,130 men and 3,421 women in 2005. Table 3 and Table 4 provide the individual and job characteristics of these workers separately.

[5] We do not go into details of the comparison between men and women workers within our framework. However, we would like to highlight that female wage earners are younger, more urbanized and educated than men wage earners: 61 % of female full time wage earners have completed high school or above compared to 41 % for males.

[6] Following the previous literature, we define *at or near the minimum wage workers* as whose monthly salaries are between 0.95 and 1.05 of the minimum wage (Lemos, 2004b).

Table 3 : Characteristics formal full time wage earners in Turkey (per cent)

	Men		Women	
	2003	**2005**	**2003**	**2005**
Average age	34.5	34.7	30.5	31.1
Years of schooling	9.3	9.2	11.4	11.4
Education				
Illiterate	0	0	0	0
Literate, but not completed any school	0	1	0	1
Primary school	33	33	16	16
Secondary school	14	15	7	8
High school, vocational or technical high school	33	32	35	33
University, faculty or upper	20	19	42	42
Married	81	80	51	50
Urban population	79	84	86	90
Tenure (year)	19.2	19.5	13,1	13.7
Sector				
Industry	33	35	27	26
Construction	4	4	1	1
Services	63	61	72	73
Unskilled	12	12	8	9
Below minimum wage	4	3	6	4
At or near the min. wage	9	16	14	20
Number of obs.	**23857**	**38848**	**6811**	**10055**

Source: LFS 2003 and 2005, own calculations

Table 4 : Characteristics of informal full time wage earners in Turkey (per cent)

	Men		Women	
	2003	**2005**	**2003**	**2005**
Average age	30.8	31.5	28	28.7
Years of schooling	6.4	6.7	7	7.1
Education				
Illiterate	2	2	5	6
Literate, but not completed any school	2	5	4	7
Primary school	62	52	48	40
Secondary school	17	21	15	19
High school, vocational or technical high school	13	17	23	23
University, faculty or upper	2	3	5	5
Married	62	61	37	35
Urban population	76	83	82	86
Tenure (year)	18.4	18.9	15	15.6
Sector				
Industry	28	28	42	41
Construction	22	21	1	1
Services	50	51	57	58
Unskilled	15	17	19	21
Below minimum wage	37	39	56	51
At or near the min. wage	7	15	11	19
Number of obs.	**9166**	**15130**	**2010**	**3421**

Source: LFS 2003 and 2005, own calculations

Similarly to the whole wage earners population, except the urban population growth, the characteristics of formal and informal wage earners did not change considerably during the period 2003-2005. However, the minimum wage variables display a noteworthy variation over the same period. Note that a non negligible part of informal wage earners are paid near the minimum wage level. Nevertheless, a half of informal female wage earners and around 40% of informal male wage earners are paid below the minimum wage. Among the formal full time wage earners, around the 3-4 % of men and 4-6 %

women declared that their salary was less than the minimum wage. A part of this unusual finding could be due to a measurement error. On the other hand, keeping in mind that a lower minimum wage (around the 85% of the adult minimum wage) is applied to the workers who are less than 16 years old, one can assume that a part of these workers are between 15 and 16 years old[7]. Another explication could be *over reporting problem* due to the other advantages of being registered to the social security system as retirement or health insurance. After all, it is clearly seen that the minimum wage hike in 2004, increased the share of the minimum wage earners by 7% and 8% among the formal and informal wage earners respectively.

The other way to measure the bindingness of the minimum wage is to examine the distribution of wages. In order to see if the mandatory minimum wage is binding and how the wages are distributed we illustrate a commonly used graphical approach. Kernel density plots provide a clearer representation of the wage levels and show where the minimum wage hikes. Kernel density estimators are essentially a continuous version of discrete histograms and approximate the density $f(w)$ based on observations w. They smooth a line between each observation w_i along the x-axis within in a selected bandwidth. More formally, Kernel density estimation can be expressed as:

$$\widehat{f_h}(w) = \sum_{i=1}^{n} \frac{\theta_i}{h} K\left(\frac{w - w_i}{h}\right)$$

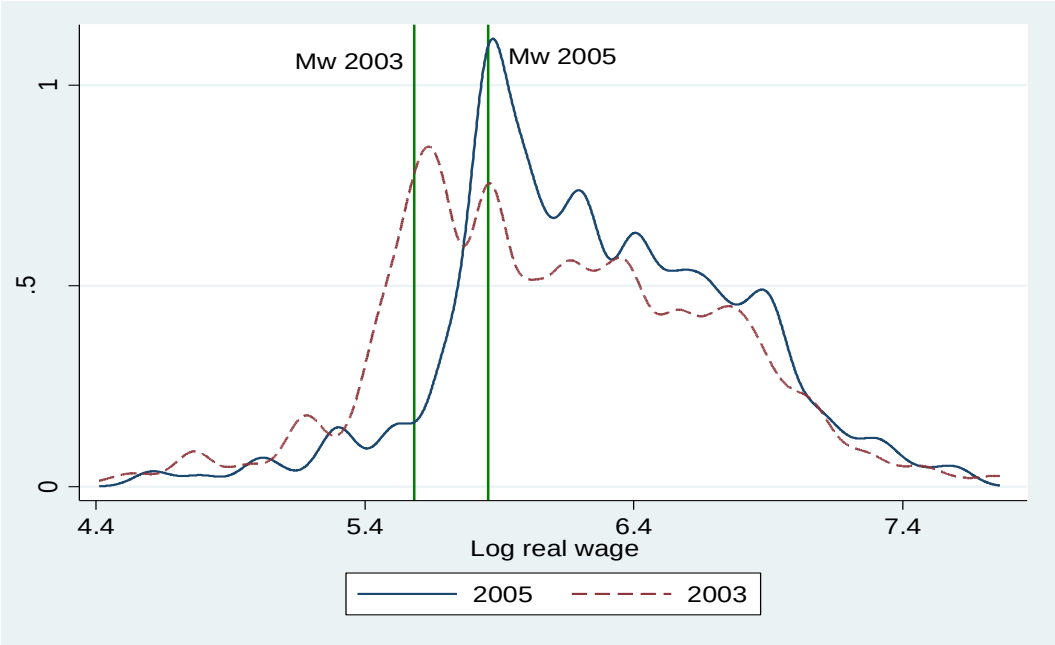
where n is the size of the classes, θ_i is the sample weight of observation i, h is the bandwidth, $K(.)$ is the kernel function and x some point along the x-axis. Kernel function simply estimates the density $\widehat{f_h}(x)$ from the fraction of the sample that is near to x, *i.e.* the fraction that falls into the bandwidth, h. Thus, the choice of the bandwidth is critical since Kernel estimation is sensitive to the bandwidth chosen to smooth. In this paper, we use 2000 point estimates and Gaussian[8] Kernel estimator. The optimal bandwidth is specified with Sheather and Jones' selector based on Silverman's method

[7] Unfortunately we could not exclude them because of the age groups are determinate as 15-19 years old in the LFS. However, the share of the 15-19 age group among the formal wage earners who paid less than the minimum wage is only about 14% among men and 19 % among women. Thus, the wage earners aged between 15 and 16 do not seem to be overrepresented in this group.

[8] Gaussian Kernel function is a conventional choice in literature. However, using the other functions does not change the results dramatically.

(Silverman, 1986)[9]. Figure 2 and Figure 3 display Kernel estimates of the reel monthly wages of full time workers by gender in 2003 and 2005.

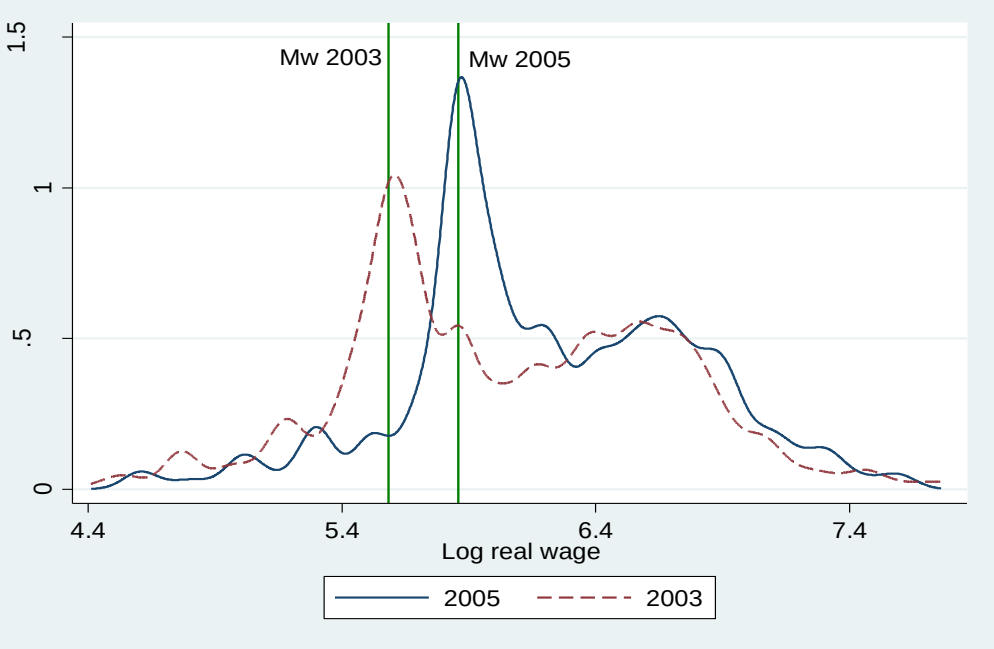
Figure 2: Kernel density plots of full time men wage earners



Source: LFS 2003 and 2005, own calculations

[9] For a more detailed explanation of Kernel estimation, see Deaton (1997), Maloney and Mendez (2004) and Cunningham (2007)

Figure 3: Kernel density plots of full time women wage earners

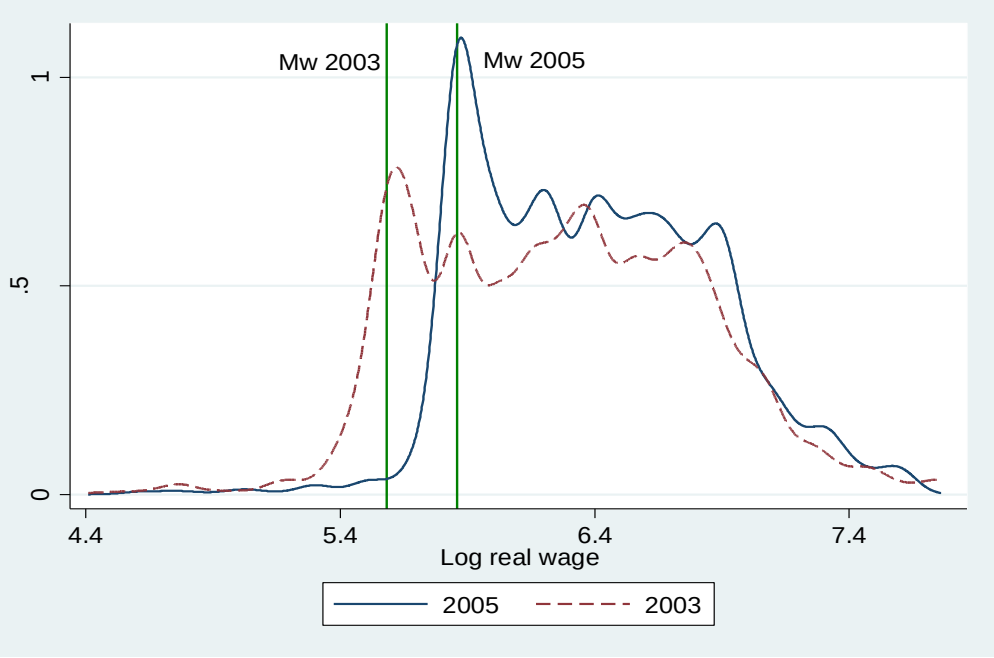


Source: LFS 2003 and 2005, own calculations

It is clearly seen that the minimum wage is somewhat binding in Turkey; however it is not necessarily enforced as a wage floor. A considerable number of fulltime workers are subminimum earners similarly to the other developing countries. It is worth to note that the minimum wage produces sharper spike in the wage distribution of women rather than men. This difference indicates that the wages of women workers are more concentrated around the minimum wage level in accordance with the results suggested by Calavrezo and Pelek (2011) in their research about the low wage workers in Turkey. The most significant change over two years is that the left side of the wage distribution has shifted to the right while the right side has remained almost stable.

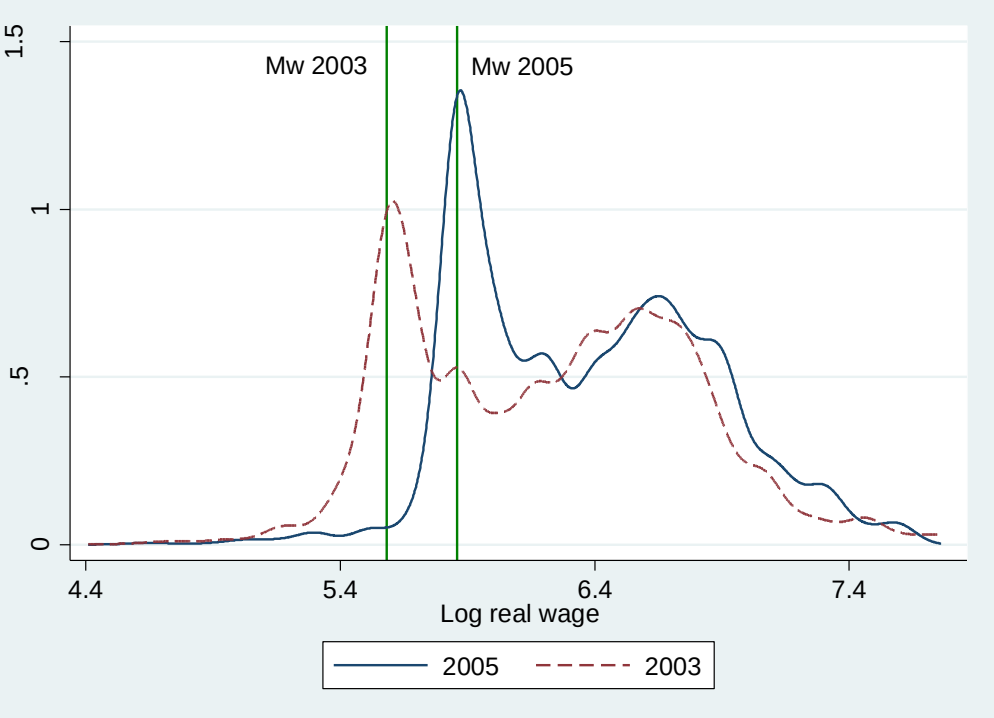
One of the advantages of the LFS dataset is that it allows separating the formal and informal workers as mentioned above. Since the informal wage earners exhibit different characteristics from formal ones, we prefer to divide again our sample into two sub-populations: formal and informal wage earners. Figure 4-7 display the wage distributions of the formal and informal wage earners by gender.

Figure 4: Kernel density plots of full time formal men wage earners



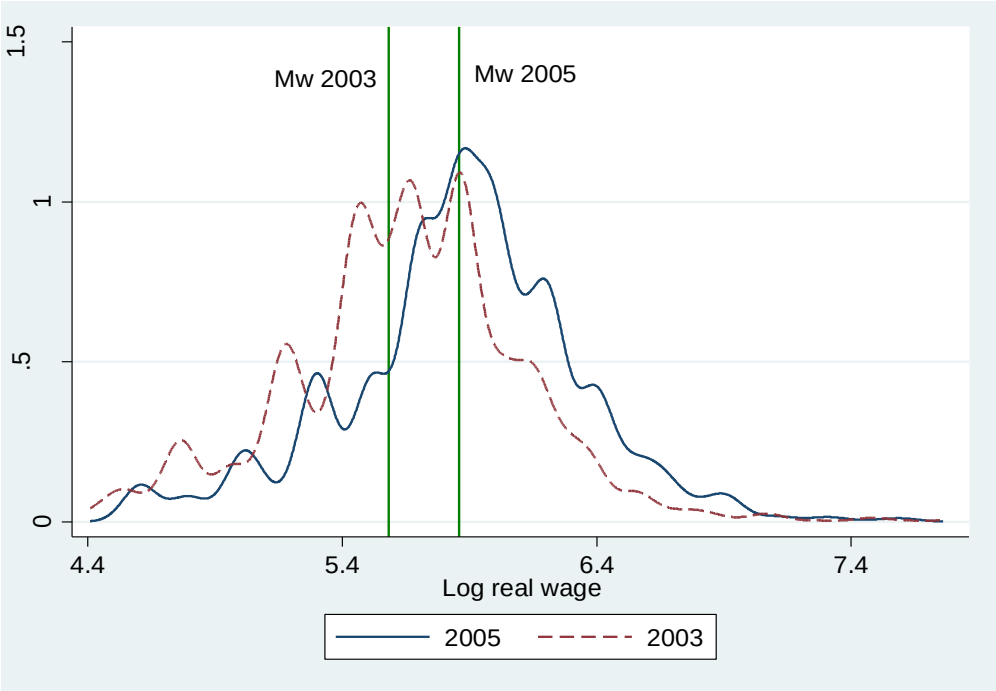
Source: LFS 2003 and 2005, own calculations

Figure 5: Kernel density plots of full time formal women wage earners



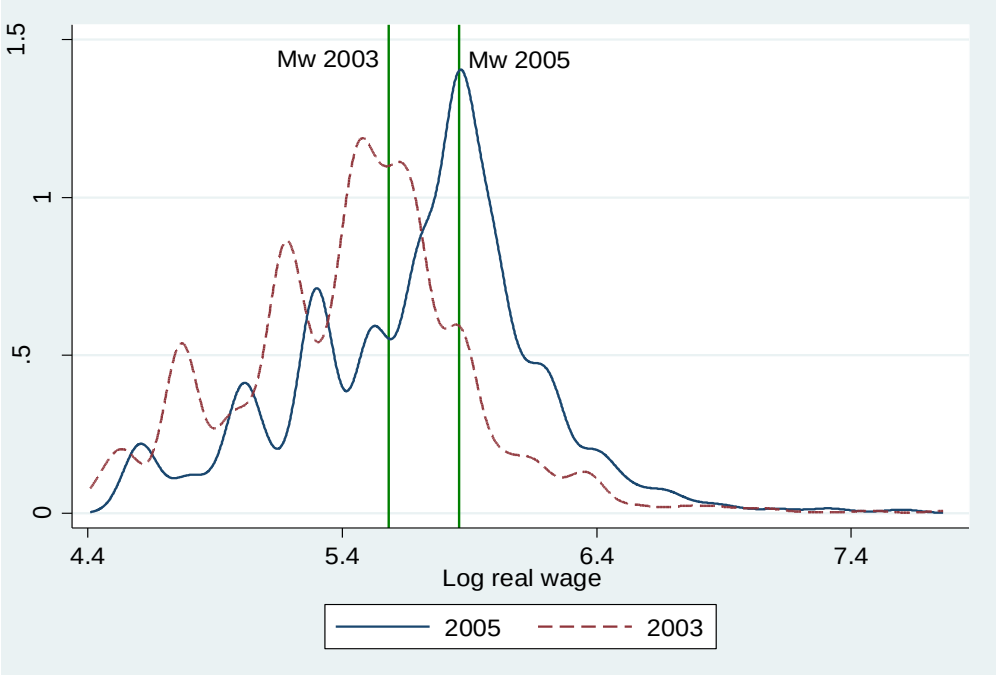
Source: LFS 2003 and 2005, own calculations

Figure 6 : Kernel density plots of full time informal men wage earners



Source: LFS 2003 and 2005, own calculations

Figure 7 : Kernel density plots of full time informal women wage earners



Source: LFS 2003 and 2005, own calculations

Minimum wage clearly truncates the wage distribution of the formal wage earners. The spikes at the minimum wage level occur both for men and women. A significant wage increase is observed at the bottom of the wage distribution of the formal wage earners while the high wages has not varied notably from 2003 to 2005. We would like to highlight that the shift is marked only the left side of the wage distribution. Therefore the minimum wage hike in 2004 seems particularly important on the distribution of wages among formal workers. Besides, the minimum wage is not well enforced as a wage floor in Turkey, given that a significant part of wage earners is not registered to social security system and earns below the minimum wage as mentioned above. However, despite the fact that the informal workers are not covered by labor legislation, the spikes are observed around the minimum wage. Besides, the wage curve of the informal wage earners as a whole has shifted to the right between 2003 and 2005, dissimilarly to formal ones.

Cumulative density plots provide an alternative illustration of the wage distribution. We would like to remind that no assumption about bandwidth is required for plotting cumulative density distribution. If a visible vertical "cliff" appears around the minimum wage level, one can assume that the distribution of wages is not continuous, the minimum wage (or probably multiples) truncates the wage distribution, and thus it is binding. If all of the employees are paid at least the minimum wage, this suggests that the minimum wage is enforced perfectly. Figure 8 - Figure 15 plot the cumulative density functions of the reel monthly wages of full time workers by gender in 2003 and 2005.

Figure 8 : Cumulative density function of log real wages of men in 2003

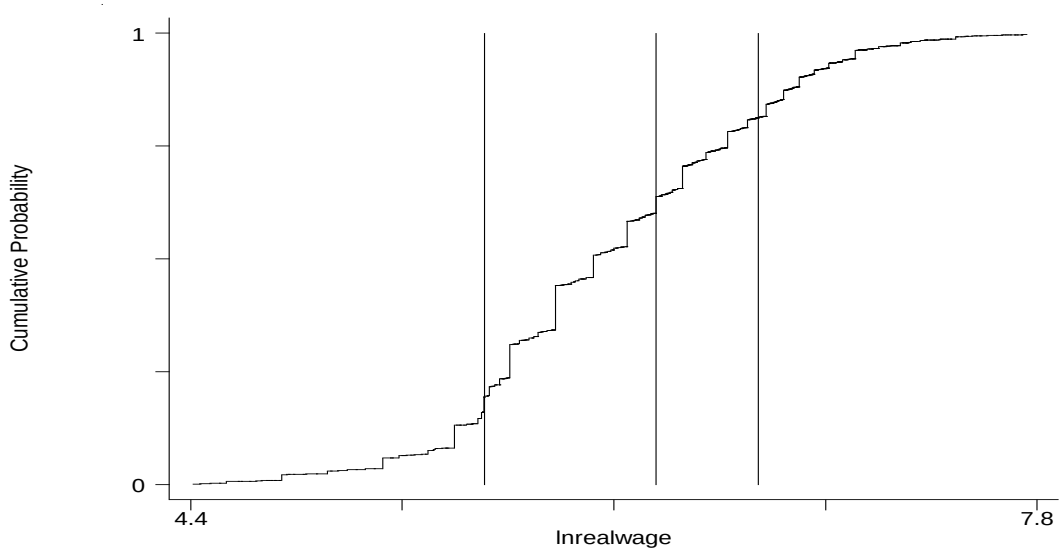


Figure 9 : Cumulative density functions of log real wages of formal and informal men workers in 2003

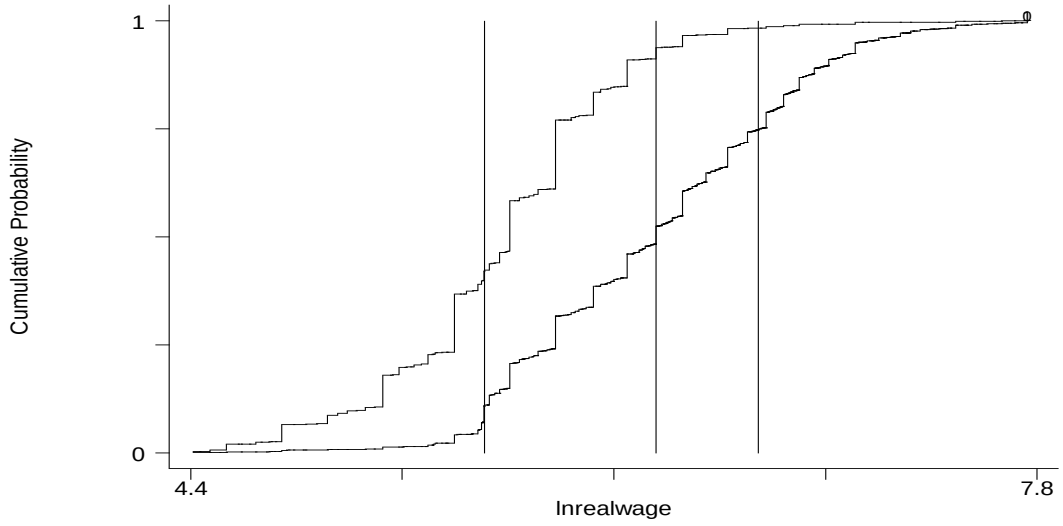


Figure 10 : Cumulative density function of log real wages of men in 2005

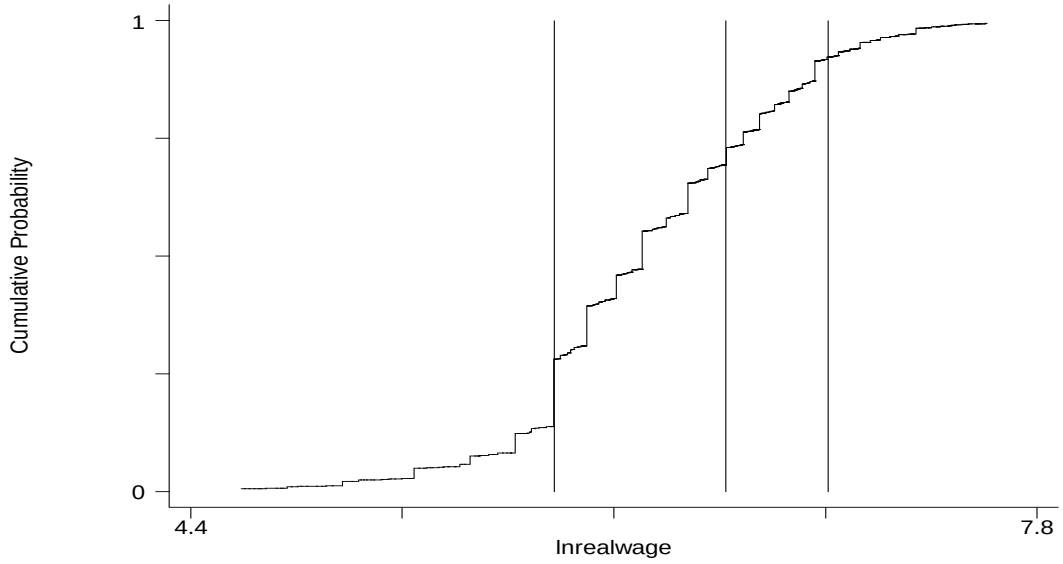


Figure 11: Cumulative density functions of log real wages of formal and informal men workers in 2005

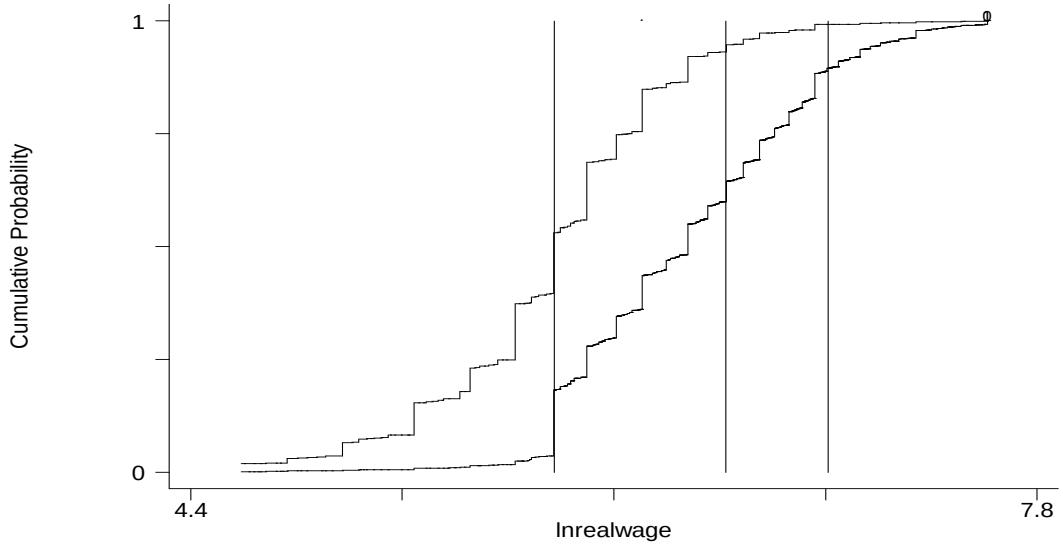


Figure 12 : Cumulative density function of log real wages of women in 2003

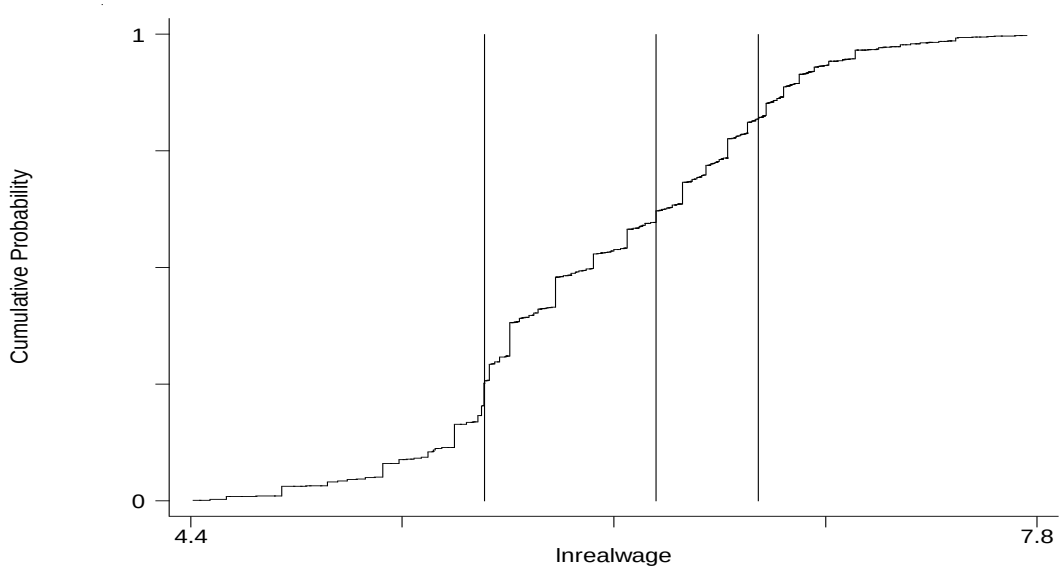


Figure 13 : Cumulative density functions of log real wages of formal and informal women workers in 2003

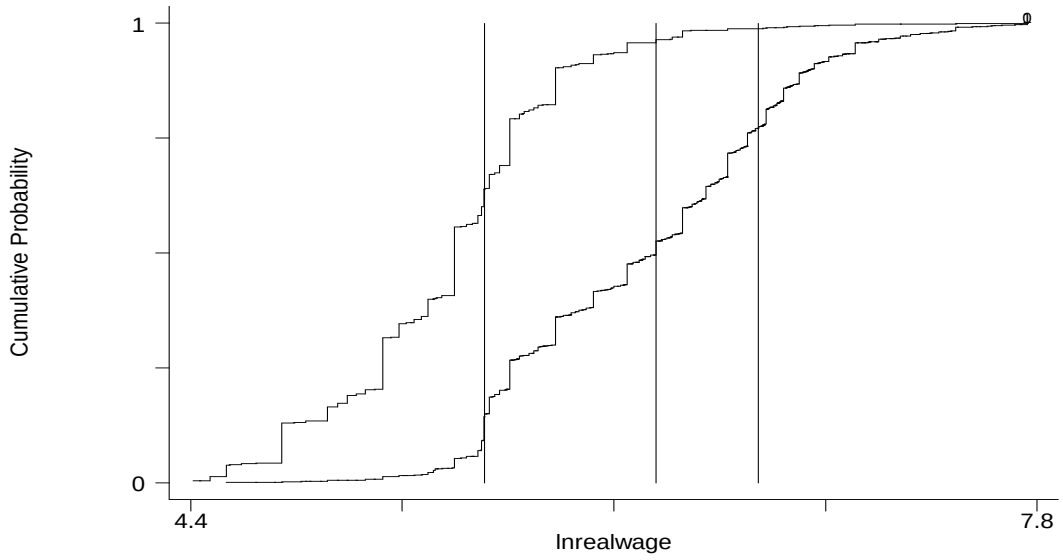


Figure 14 : Cumulative density function of log real wages of women in 2005

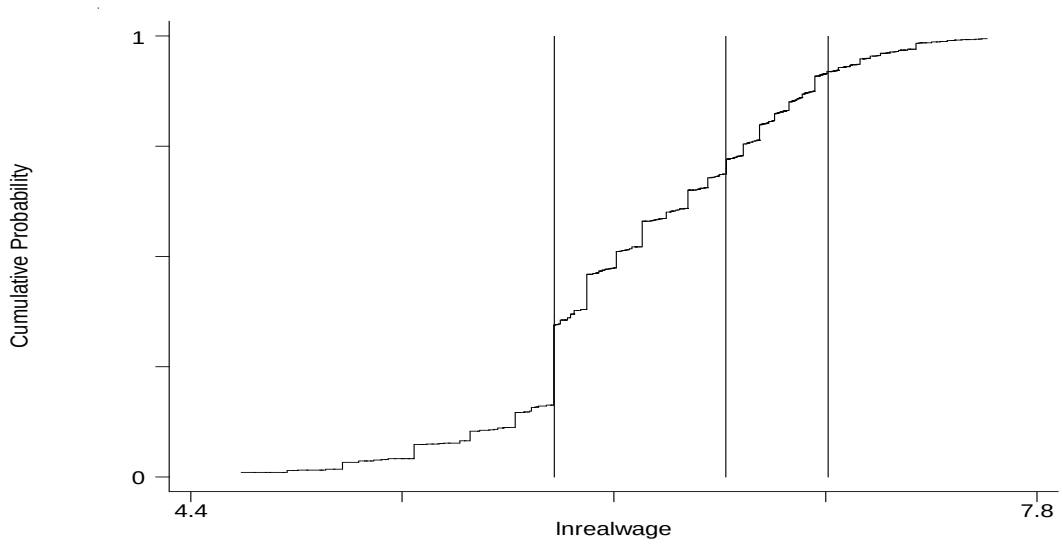
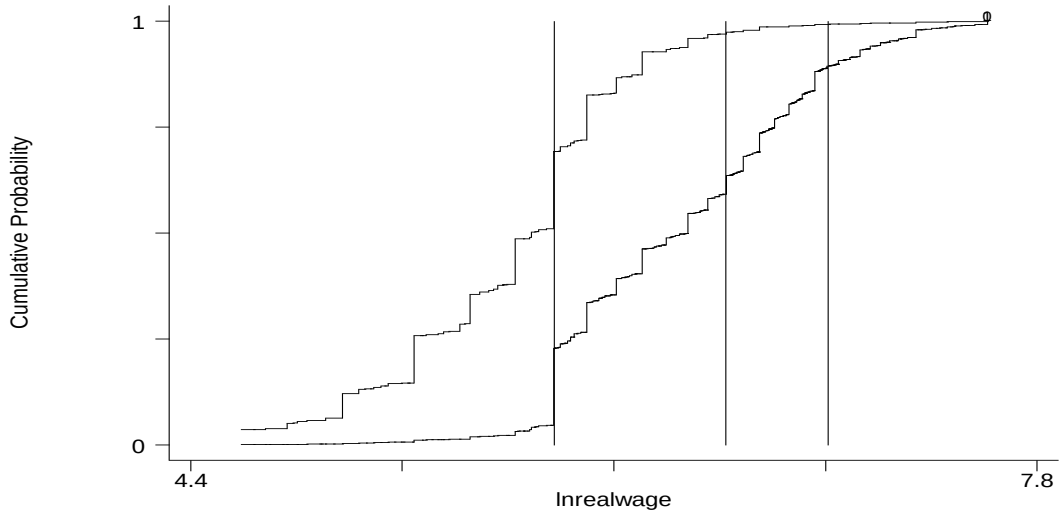


Figure 15 : Cumulative density functions of log real wages of formal and informal women workers in 2005



.

Legend: Vertical lines are minimum wage, two times of the minimum wage and three times of minimum wage respectively.

In figures with two cumulative density functions, left curve illustrates the wages of the informal workers and the right curve illustrates the wages of the formal wage earners.

The vertical cliffs around the minimum wage have become clearer in 2005. Both for men and women wage earners, the vertical cliffs around the 2003's minimum wage are not remarkable. Nevertheless the observed numeraire (ripple) effects are very small, albeit negligible in the wage distribution. Cumulative density functions do not indicate that the wage distribution has cliffs at 3 times the minimum wage while only a hardly visible vertical line appears around 2 times the minimum wage in Turkey. This evidence is in line with the assumption that the minimum wages mainly affect the wages of those who earned at or below it (Brown, 1999; DiNardo et al., 1996).

As for wage inequality trend in Turkish labor market over the period under study, we observe that wage inequality has decreased substantially between 2003 and 2005 according to the standard inequality indicators. Table **5** summarizes the inequality measures for full time wage earners.

Table 5 : Inequality measures of full time wage earners

Men	**2003**	**2005**	**Difference**
Standard Deviation*	0.583	0.527	-0.055
p95-p5**	1.877	1.723	-0.154
p90-p10**	1.437	1.240	-0.196
p90-p50**	0.826	0.729	-0.097
p75-p25**	0.865	0.731	-0.134
p75-p50**	0.476	0.421	-0.055
p50-p5**	0.860	0.811	-0.049
p50-p10**	0.610	0.511	-0.099
p50-p25**	0.389	0.310	-0.079
Gini***	0.326	0.287	-0.039
Theil***	0.175	0.135	-0.04
Atkinson***	0.084	0.066	-0.018
Women	**2003**	**2005**	**Difference**
Standard Deviation*	0.617	0.565	-0.051
p95-p5**	1.948	1.871	-0.077
p90-p10**	1.500	1.369	-0.131
p90-p50**	0.858	0.810	-0.049
p75-p25**	0.957	0.781	-0.176
p75-p50**	0.565	0.508	-0.057
p50-p5**	0.890	0.862	-0.028
p50-p10**	0.642	0.560	-0.082
p50-p25**	0.392	0.273	-0.119
Gini***	0.341	0.306	-0.035
Theil***	0.190	0.153	-0.037
Atkinson***	0.092	0.074	-0.017

Source: LFS, own calculations;
* Standard deviation of log wages;

**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages.

The standard deviation of log wages; the differences between log wages at the 95th and 5th percentiles, between log wages at the 90th and 10th percentiles, between log wages at the 90th and 50th percentiles, between log wages at the 75th and 25th percentiles, between log wages at the 75th and 50th percentiles, between log wages at the 50th and 5th percentiles, between log wages at the 50th and 10th percentiles, between log wages at the 50th and 25th percentiles; Gini, Theil, and Atkinson coefficients of real wages indicate that the wage inequality decreased over the period both for men and women. It should be noted that the inequality decreases are sharper for the lower tail of the distribution. For instance, the wage gap between at the 90th and 10th percentiles has decreased considerably as the wage gap between at the 90th and 50th percentiles has not changed notably. Gini, Theil and Atkinson coefficients have reduced queasily by the same amount for male and female wage earners. In sum, all inequality measures suggest that the wages are compressed from 2003 to 2005 both for men and women. This compression seems to be based on a relative increase of the real wages in the lower tails whereas there is no remarkable change in the upper tails of the wage distributions. In order to refine the descriptive analysis, we report separately the inequality measures for formal and informal workers in Table 6 and Table 7.

Table 6 : Inequality measures of full time formal wage earners

Men	**2003**	**2005**	***Difference***
Standard Deviation*	0.536	0.468	-0.067
p95-p5**	1.631	1.411	-0.220
p90-p10**	1.373	1.158	-0.215
p90-p50**	0.697	0.630	-0.067
p75-p25**	0.853	0.743	-0.111
p75-p50**	0.411	0.372	-0.039
p50-p5**	0.759	0.588	-0.171
p50-p10**	0.676	0.528	-0.148
p50-p25**	0.443	0.370	-0.072
Gini***	0.301	0.263	-0.038
Theil***	0.146	0.111	-0.035
Atkinson***	0.071	0.054	-0.017
Women	**2003**	**2005**	**Difference**
Standard Deviation*	0.546	0.486	-0.060
p95-p5**	1.632	1.444	-0.188
p90-p10**	1.354	1.185	-0.169
p90-p50**	0.657	0.655	-0.002
p75-p25**	0.929	0.795	-0.134
p75-p50**	0.398	0.386	-0.011
p50-p5**	0.779	0.589	-0.190
p50-p10**	0.697	0.530	-0.167
p50-p25**	0.531	0.409	-0.122
Gini***	0.306	0.273	-0.033
Theil***	0.152	0.120	-0.032
Atkinson***	0.073	0.058	-0.015

Source: LFS, own calculations;
* Standard deviation of log wages;
**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages

Table 7 : Inequality measures of full time informal wage earners

Men	2003	2005	Difference
Standard Deviation*	0.462	0.471	0.009
p95-p5**	1.586	1.601	0.015
p90-p10**	1.138	1.160	0.022
p90-p50**	0.540	0.531	-0.008
p75-p25**	0.526	0.530	0.003
p75-p50**	0.260	0.265	0.005
p50-p5**	0.873	0.882	0.008
p50-p10**	0.598	0.629	0.030
p50-p25**	0.267	0.265	-0.002
Gini***	0.253	0.249	-0.004
Theil***	0.116	0.108	-0.008
Atkinson***	0.055	0.052	-0.003
Women	**2003**	**2005**	**Difference**
Standard Deviation*	0.452	0.476	0.024
p95-p5**	1.515	1.581	0.065
p90-p10**	1.155	1.192	0.037
p90-p50**	0.478	0.448	-0.030
p75-p25**	0.541	0.597	0.055
p75-p50**	0.226	0.201	-0.025
p50-p5**	0.783	0.947	0.164
p50-p10**	0.677	0.744	0.067
p50-p25**	0.315	0.396	0.080
Gini***	0.256	0.251	-0.005
Theil***	0.127	0.114	-0.013
Atkinson***	0.058	0.055	-0.003

Source: LFS, own calculations;
* Standard deviation of log wages;
**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages.

As the tables above indicate, the wage inequality trends have gone in the opposite direction for formal and informal wage earners during the period 2003-2005. The wage gap has decreased sharply with reference to all inequality measures among formal wage earners while this evolution is not observed among informal wage earners. This fact strengthens our intuition that the increase in the minimum wage has played a key role in decreasing wage inequality between 2003 and 2005 given that the minimum wage laws cover only the registered workers. Among the informal wage earners, only the differences between the log wages around the middle of the wage distributions have slightly reduced while the gap between at the top and bottom of the wage distribution has somewhat widened. This result is in line with the Kernel density estimations indicating that the minimum wage is located somewhere in the middle of the wage

distribution in the informal sector. However, we would like to highlight that the three inequality parameters, Gini, Theil and Atkinson coefficients are a little lower in 2005 than in 2003 both for men and women informal wage earners.

In sum, these results suggest that the minimum wage increase in 2004 was accompanied by a reduction in wage inequality, especially among the formal wage earners. However, a part of this equalizing trend could be due to the changes in the individual characteristics of workers. In the next section, we estimate a hypothetical density which assumes that the individual characteristics of workers remain at 2003 level in order to investigate the potential effects behind this compression of the wage distribution. DFL (1996) methodology allows us to decompose the effects of the institutional factors such as minimum wage or unions and the individual characteristics on the wage distribution under some specific assumptions. We present the methodology in detail and discuss the assumptions of the model.

4. Methodology

We follow the decomposition method developed by DiNardo et al. (1996) as already mentioned above. DFL is a semi-parametric decomposition approach which is an extended version of standard Oaxaca Blinder method (OB hereafter). OB analyzes only the counterfactual differences in mean wages while DFL generalizes the method by taking into account the whole distribution. The estimated counterfactual distributions should be called "the density that would have prevailed if individual attributes had remained at their $t-1$ level and workers had been paid according to the wage schedule observed in t." (DiNardo et al., 1996). In our research, we obtain the counterfactual distributions which give the density of wages in 2005 if the characteristics of workers had been the same as those observed in 2003. Therefore, the difference between the actual density of wages in 2005 and the counterfactual density estimated by DFL methodology enables the potential effect of any factor i.e. minimum wage, unionization rate. Before getting into details of the methodology, it is helpful to provide the basic illustration of the wage decomposition.

The standard assumption in the OB decomposition is that the outcome variable *Y* of two groups *A* and *B* is linearly related to the covariates, *X*, and the error term *v* is independent of *X*:

$$Y_{gi} = \beta_{go} + \sum_{k=1}^{K} X_{ik}\beta_{gk} + v_{gi}, \quad g=A,B$$

where $E(v_{gi}|X_i) = 0$ and *X* is the vector of covariates for each observation i. Thus, the overall difference in average outcomes between two groups can be written as:

$$\widehat{\Delta_O} = \overline{Y_B} - \overline{Y_A}$$

$$\widehat{\Delta_O} = (\widehat{\beta_{BO}} - \widehat{\beta_{AO}}) + \sum_{k=1}^{K} \bar{X}_{Bk}\,(\hat{\beta}_{Bk} - \hat{\beta}_{Ak}) + \sum_{k=1}^{K} (\bar{X}_{Bk} - \bar{X}_{Ak})\,\hat{\beta}_{Ak}$$

$$\widehat{\Delta_O} = \widehat{\Delta_S} + \widehat{\Delta_X}$$

where $\hat{\beta}_{gO}$ and $\hat{\beta}_{gk}$ are estimated intercept and slope coefficients respectively. The first term is typically referred to the *wage structure* effect ($\widehat{\Delta_S}$) and the second term is the *composition effect* ($\widehat{\Delta_X}$) , which is also called the *explained effect* in the OB decomposition.

In their comprehensive review, Firpo et al. (2010) suggest that the wage structure effect could be interpreted as a treatment effect which captures an observed changes of a policy over time such as unionization status or a minimum wage hike. In this study, we attempt to decompose the changes in the wage distribution into two components : the composition effect linked to the indiviudal attributes and the wage structure effect linked to the minimum wage hike in 2004.

An important limitation of OB decomposition is that it could estimate the wage structure and composition effect on the average outcome which is linear. However, goying beyond the mean is broadly discussed among economists in order to get a more detailed idea for explaining the effects of a treatment on overall distribution. DFL methodology provides an extended version of OB decomposition by reweighting procedure summarized below.

We begin with the illustration of each observation as a joint density function f over (w, z, mw_t, t); wages, individual attributes, minimum wages and dates. In this study, our groups are determined in terms of date; *t* and *t-1*. The density of wages $f_t(w)$ at a given date t, can be expressed as the integral of the density of wages at date t_w conditional on a set of individual attributes z, and the minimum wage mw_t, over the distribution of individual attributes z, at date t_z.

$$f_t(w) = \int_{z \in \Omega_z} f(w|z, mw_t, t_w = t) dF(z|t_z = t)$$

$$\equiv f(w; mw_t, t_w = t, t_z = t)$$

where Ω_z is the domain of definition of the individual characteristics. Under the assumption that the distribution of individual characteristics does not depend on the level of the minimum wage, the hypothetical density of wages that would have prevailed if the individual attributes had remained as it was at time $t-1$ can be expressed as:

$$f_t^{z_{t-1}}(w) = \int_{z \in \Omega_z} f(w|z, t_w = t; mw_t) dF(z|t_z = t-1)$$

$$\equiv \int_{z \in \Omega_z} f(w|z, t_w = t; mw_t) \psi_z(z) dF(z|t_z = t)$$

where the reweighting function $\psi_z(z)$ is defined as :

$$\psi_z(z) \equiv dF(z|t_z = t-1) / dF(z|t_z = t).$$

One can see that the unobservable counterfactual density is identical to the actual density at *t* except for the reweighting function, $\psi_z(z)$. Therefore, the critical point is the estimation of this reweighting function $\hat{\psi}(z)$.

Applying Bayes' rule, this reweighting function can be specified as:

$$\psi_z(z) = \frac{\Pr(t_z = t-1|z)}{\Pr(t_z = t|z)} \frac{\Pr(t_z = t)}{\Pr(t_z = t-1)}$$

The probability of being in period *t*, given individual attributes *z*, could be estimated using a simple probit model:

$$\Pr(t_z = t|z) = \Pr\left(\epsilon > -\beta' H(z)\right) = 1 - \Phi(-\beta' H(z))$$

where $\Phi(.)$ is the cumulative normal distribution and *H(z)* is a vector of covariates that is a function of *z*.

Consider the actual density function for group belonging to date *t*, $f_t(w)$ and the counterfactual density $f_t^{z_{t-1}}(w)$. We can decompose the overall changes into the composition effect and the wage structure effect by the following specification:

$$\widehat{\Delta_O} = f_t(w) - f_{t-1}(w)$$
$$\widehat{\Delta_O} = \left(f_t(w) - f_t^{z_{t-1}}(w)\right) + \left(f_t^{z_{t-1}}(w) - f_{t-1}(w)\right)$$

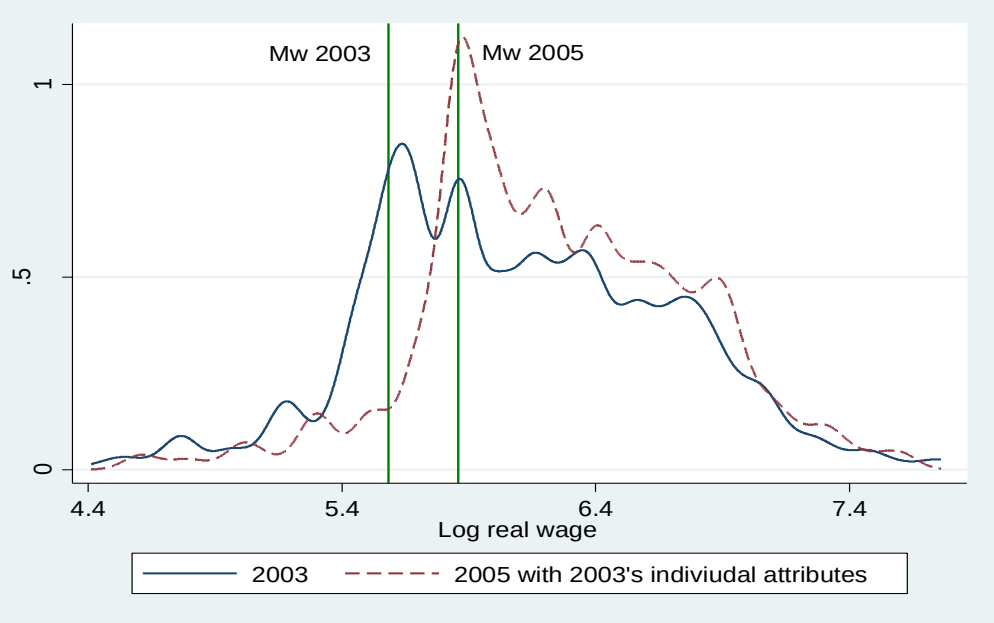
where the first term is the composition effect and the second term is the wage structure effect referring to the minimum wage in our case. The obtained results are presented in the next section.

5. Results

To decompose the effects of the changes in the wage distribution, we obtain a counterfactual distribution by holding the individual characteristics constant as in 2003. The individual attributes used in the probit regressions are educational level, marital status, living area (urban or rural), experience, experience squared, activity (industry, construction, and services), occupation, and being registered to social security system. Figure 16 and

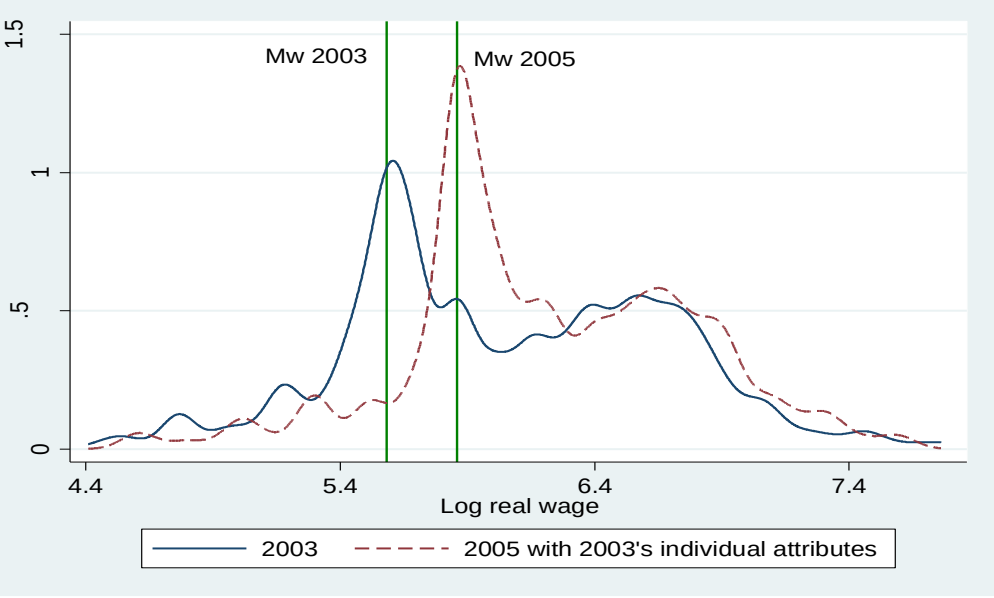
Figure **17** plot actual Kernel density estimations of full time wage earners in 2003 and counterfactual Kernel density estimations in 2005 if the individual characteristics had remained constant as in 2003.

Figure 16 : Kernel density plots of men full time workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Figure 17 : Kernel density plots of full time women workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Figures above show that the bottom part of the wage distribution has shifted to the right even if the individual characteristics held constant in their 2003 level. Thus, the wage structure effect seems to be the driving force in this equalizing period both for men and women full time wage earners. We suggest that if the measurable characteristics of full time wage earners in 2005 had been the same as in 2003, we would observe again a remarkable shift to the right of wages located at the bottom part of the wage distribution. We use the two sample Kolmogorov-Smirnov test (K-S test) to indicate whether these two distributions are statistically different or not. The K-S test is a non parametric test with null hypothesis that the equality of two distributions. We reject the null hypothesis that the Kernel estimates of the wages in 2003 and in 2005 with the 2003's attributes are equal at a significance level of 1 percent both for men and women. Table A2 in Annex, reports the K-S statistics of all distributions obtained with the reweighted procedure.

In order to clarify the counterfactual analysis, one can estimate the inequality measures using hypothetical density of wages. Table 8 reports the inequality measures in 2005 obtained by holding constant the individual attributes in 2003.

Table 8: Estimated inequality measures of full time wage earners using counterfactual density in 2005

Men	**2003**	**2005CF**	**Difference**
Standard Deviation*	0.583	0.526	-0.056
p95-p5**	1.877	1.713	-0.164
p90-p10**	1.437	1.237	-0.199
p90-p50**	0.826	0.726	-0.101
p75-p25**	0.865	0.733	-0.132
p75-p50**	0.476	0.421	-0.055
p50-p5**	0.860	0.810	-0.050
p50-p10**	0.610	0.511	-0.099
p50-p25**	0.389	0.312	-0.077
Gini***	0.326	0.286	-0.04
Theil***	0.175	0.133	-0.042
Atkinson***	0.084	0.065	-0.019
Women	**2003**	**2005CF**	**Difference**
Standard Deviation*	0.617	0.562	-0.055
p95-p5**	1.948	1.861	-0.087
p90-p10**	1.500	1.341	-0.159
p90-p50**	0.858	0.800	-0.059
p75-p25**	0.957	0.781	-0.176
p75-p50**	0.565	0.503	-0.062
p50-p5**	0.890	0.862	-0.028
p50-p10**	0.642	0.541	-0.101
p50-p25**	0.392	0.278	-0.114
Gini***	0.341	0.303	-0.038
Theil***	0.190	0.150	-0.040
Atkinson***	0.092	0.073	-0.019

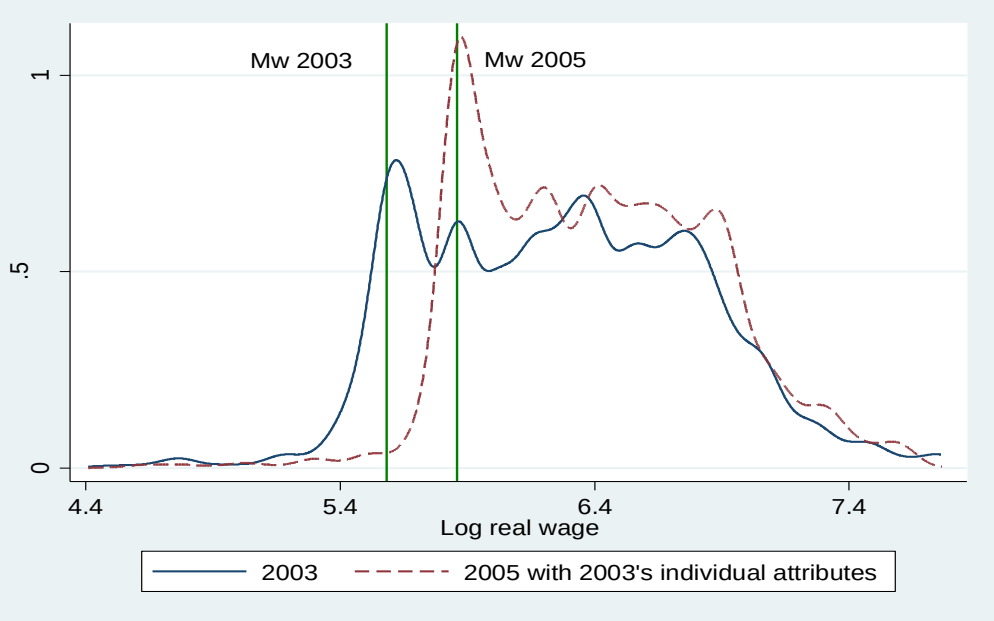
Note: 2005 is weighted to individual characteristics in 2003.
* Standard deviation of log wages;
**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages.

The estimated inequality measures confirm that the wage structure effect has played a key role in this equalizing period rather than the composition effect. Both for women and men the differences between the actual and hypothetical inequality measures are too small, albeit close to zero. These results suggest, for all full time wage earners changes in the structure of wages had a much larger impact on the wage distribution than the changes in individual attributes. Keeping in mind that two years are not enough for a robust evolution of individual or demographic attributes in a labor market, it is not surprising that the wage structure effect explains almost the total change in the wage distribution. Another interesting point is that the wage differentials between at the lower

percentiles have been mostly reduced among men while this fact has occurred between at the middle percentiles among women.

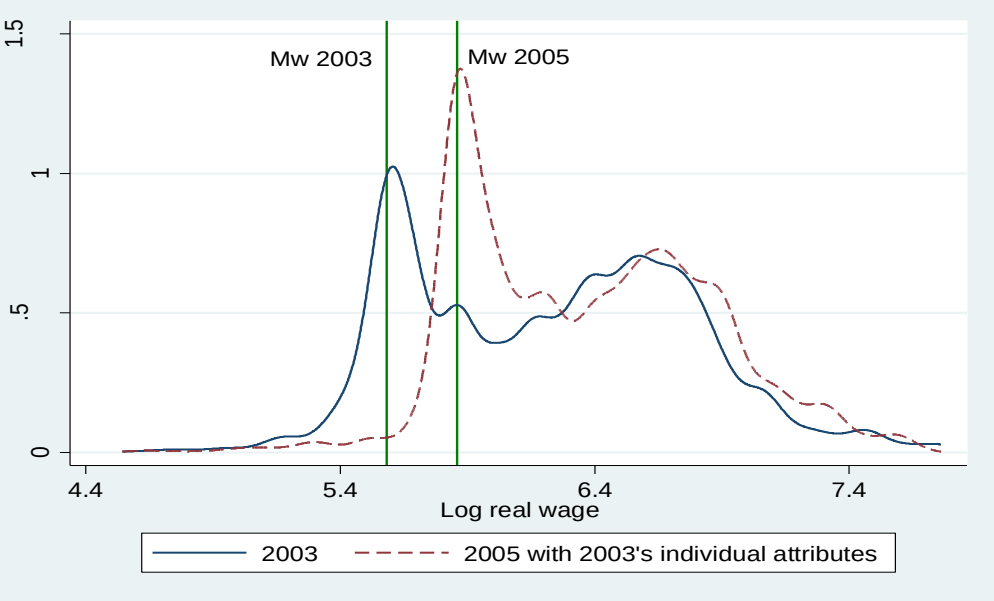
Similarly to the descriptive part, we prefer to repeat our analysis for two sub-groups of full time wage earners. Figure 18, Figure 19 and Table 9 report the results for the formal workers. Figure 20, Figure 21 and Table 10 report the results about the full time informal workers. We keep the same variables for control the individual attributes in probit regressions.

Figure 18 : Kernel density plots of men full time formal workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Figure 19: Kernel density plots of women full time formal workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Table 9: Estimated inequality measures of formal full time wage earners using counterfactual density in 2005

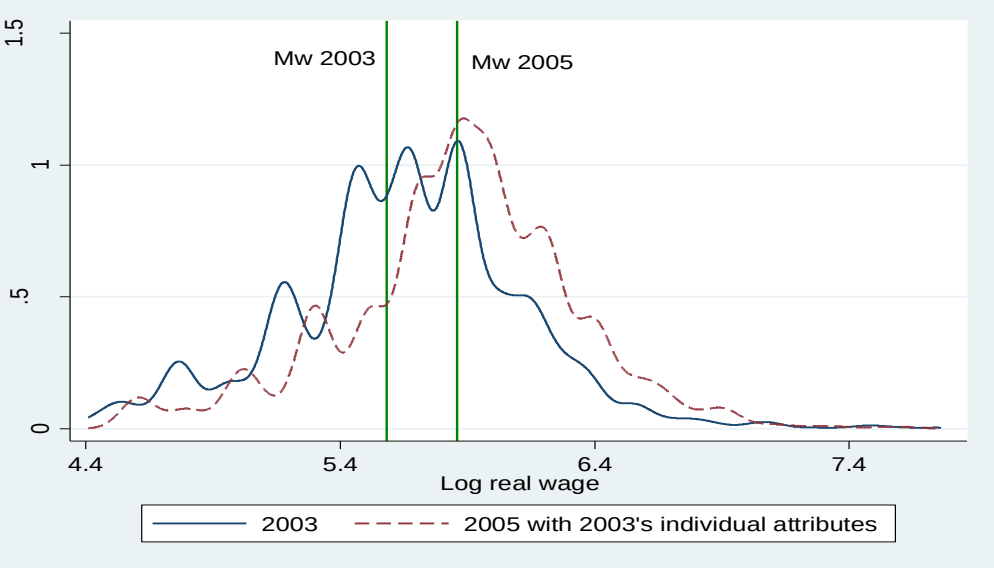
Men	**2003**	**2005CF**	**Difference**
Standard Deviation*	0.536	0.469	-0.066
p95-p5**	1.631	1.408	-0.223
p90-p10**	1.373	1.158	-0.215
p90-p50**	0.697	0.625	-0.072
p75-p25**	0.853	0.748	-0.106
p75-p50**	0.411	0.372	-0.039
p50-p5**	0.759	0.593	-0.166
p50-p10**	0.676	0.533	-0.142
p50-p25**	0.443	0.375	-0.067
Gini***	0.301	0.263	-0.038
Theil***	0.146	0.111	-0.035
Atkinson***	0.071	0.054	-0.017
Women	**2003**	**2005CF**	**Difference**
Standard Deviation*	0.546	0.486	-0.060
p95-p5**	1.632	1.440	-0.192
p90-p10**	1.354	1.175	-0.179
p90-p50**	0.657	0.660	0.003
p75-p25**	0.929	0.792	-0.137
p75-p50**	0.398	0.394	-0.003
p50-p5**	0.779	0.578	-0.201
p50-p10**	0.697	0.515	-0.182
p50-p25**	0.531	0.398	-0.134
Gini***	0.306	0.272	-0.034
Theil***	0.152	0.120	-0.032
Atkinson***	0.073	0.058	-0.015

Note: 2005 is weighted to individual characteristics in 2003.
* Standard deviation of log wages;
**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages.

The results about the full time formal wage earners confirm that the wage structure effect has played a key role in the changes of the wage distribution between 2003 and 2005. Both for males and females, the Kernel plots do not change notably while the individual characteristics held constant as their 2003 levels. Besides, we reject the null hypothesis that the wage distribution in 2003 and the counterfactual wage distribution in 2005 are equal at the 1% level of significance both for men and women (Table A2). The estimated inequality measures suggest that the change in the measurable individual characteristics explains a very small part of the changes in the wage distribution. On the other side, we argue that the low wage earners in formal jobs have benefited from the minimum wage hike in 2004. The wage differentials between the upper and lower tails of the wage distribution have been reduced substantially both for men and women. Very

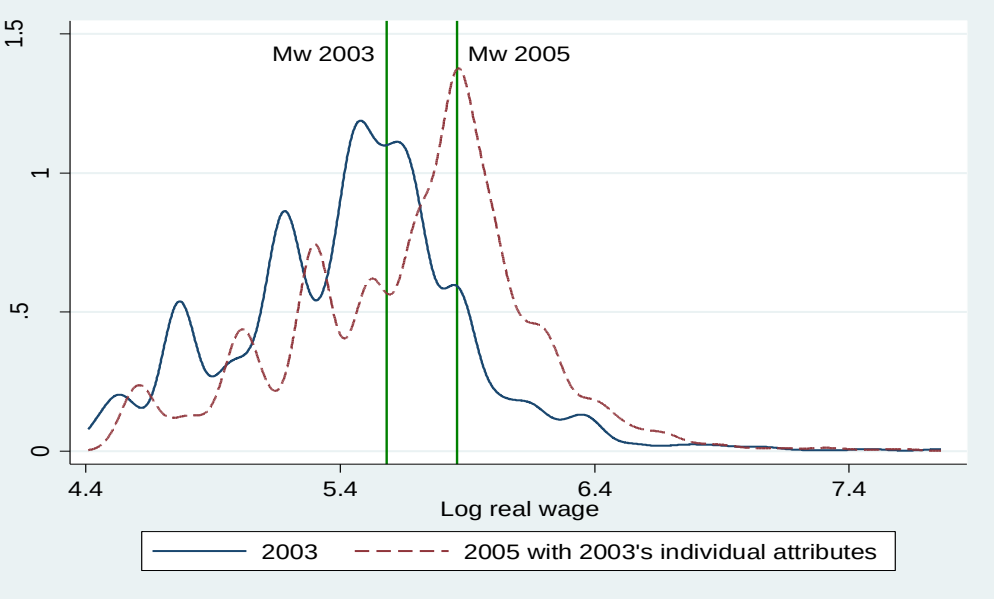
small changes occur in the upper side of the wage distribution while we control the individual attributes as they were in 2003. For instance, the wage differentials between at 90^{th} percentiles and at 50^{th} percentiles become positive among females, albeit it is very close to zero. Both for male and female wage earners, the major declines have occurred between at the lower percentiles of the wage distribution.

Figure 20 : Kernel density plots of men full time informal workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Figure 21: Kernel density plots of women full time informal workers in 2003 and 2005 with 2003's individual attributes



The null hypothesis of equal distributions on Kolmogorov-Smirnov test is rejected at the 1% level.

Table 10 : Estimated inequality measures of informal full time wage earners using counterfactual density in 2005

Men	2003	2005CF	Difference
Standard Deviation*	0.462	0.464	0.002
p95-p5**	1.586	1.576	-0.010
p90-p10**	1.138	1.147	0.008
p90-p50**	0.540	0.518	-0.022
p75-p25**	0.526	0.523	-0.003
p75-p50**	0.260	0.258	-0.002
p50-p5**	0.873	0.878	0.005
p50-p10**	0.598	0.629	0.030
p50-p25**	0.267	0.265	-0.002
Gini***	0.253	0.243	-0.010
Theil***	0.116	0.102	-0.014
Atkinson***	0.055	0.049	-0.006
Women	**2003**	**2005CF**	**Difference**
Standard Deviation*	0.452	0.473	0.021
p95-p5**	1.515	1.579	0.064
p90-p10**	1.155	1.190	0.035
p90-p50**	0.478	0.448	-0.030
p75-p25**	0.541	0.612	0.070
p75-p50**	0.226	0.206	-0.020
p50-p5**	0.783	0.957	0.174
p50-p10**	0.677	0.743	0.065
p50-p25**	0.315	0.406	0.091
Gini***	0.256	0.248	-0.008
Theil***	0.127	0.109	-0.018
Atkinson***	0.058	0.053	-0.005

Note: 2005 is weighted to individual characteristics in 2003.
* Standard deviation of log wages;
**Difference between the 90th and the 10th percentiles of the log wage distribution. Similarly for the other measures.
*** Gini, Theil and Atkinson coefficients of real wages.

As mentioned above, the changes in the wage distributions of the informal wage earners are small in comparison with the formal ones. The changes in individual attributes explain a part of the change in wage distribution among the informal workers. Note that this result is plausible given that the wage structure effect does not cover the informal sector. The wage distribution in 2003 and the counterfactual wage distribution in 2005 are statistically different at the 1% level of significance with respect to the K-S test (Table A2). According to wage differentials as an inequality measure, one could suggest that the wage inequality among female informal workers would be slightly increased if the individual characteristics had remained at 2003 level. Nevertheless, the estimated measures for men have mostly negative signs, though they are very close to zero, indicating that the wage differentials have minimized over the period under study.

However, the shift in the wage distribution of informal workers needs to be explained by other factors in the labor market such as low-high productivity or supply side changes.

6. Conclusion

In this paper, we focus on the wage distribution in Turkey as a developing country with a dynamic labor market. We assess the changes in the wage distribution between 2003 and 2005. This relatively short period is interesting to investigate due to the remarkable minimum wage hike in 2004. The wage distribution indicates that the minimum wage is somewhat binding in Turkey. However, a significant part of the full time wage earners is paid below the minimum wage due to the informality issue. Furthermore, Turkey has the highest Kaitz index among the OECD countries indicating that the wages are clustered to some extent around the minimum wage. The results obtained by using LFS data suggest that the minimum wage has compressed the wage distribution in Turkey between 2003 and 2005. The wage inequality has decreased clearly over the period. We argue that the driving force of the decline in wage inequality is the rise of the wages in the lower tail of the wage distribution related to the minimum wage hike. The results also indicate that the higher wages have not varied notably. We estimate a counterfactual distribution by holding the measurable individual attributes constant at their 2003 level. The econometric results confirm that the hike in the minimum wage in 2004 as a wage structure effect has played a key role on the decline in wage inequality especially in the formal sector. The changes in the individual attributes do not explain the wage distribution trend over the period under study. However, the lighthouse effect of the minimum wage in informal sector seems to be small. The distributional effect of the minimum wage has not been reflected to the informal side of the labor market. As for the gender issue, the results indicate that the equalizing trend is observed queasily by the same amount among men and women wage earners.

Nevertheless, we would like to highlight that the research on the wage inequality in Turkey needs to contribute by other studies using different databases and methodologies. Even though the lack of panel data limits the empirical studies, the researches which investigate conjointly the employment and distributional effect of the

minimum wage are required. On the other hand, the future research could seek the impact of the minimum wage on the inequality in a more broad sense, such as poverty or income inequality. In this paper, we argue that the minimum wage is an effective tool for reducing the wage inequality; nevertheless there is no evidence from Turkey about the impact of the minimum wage on income inequality.

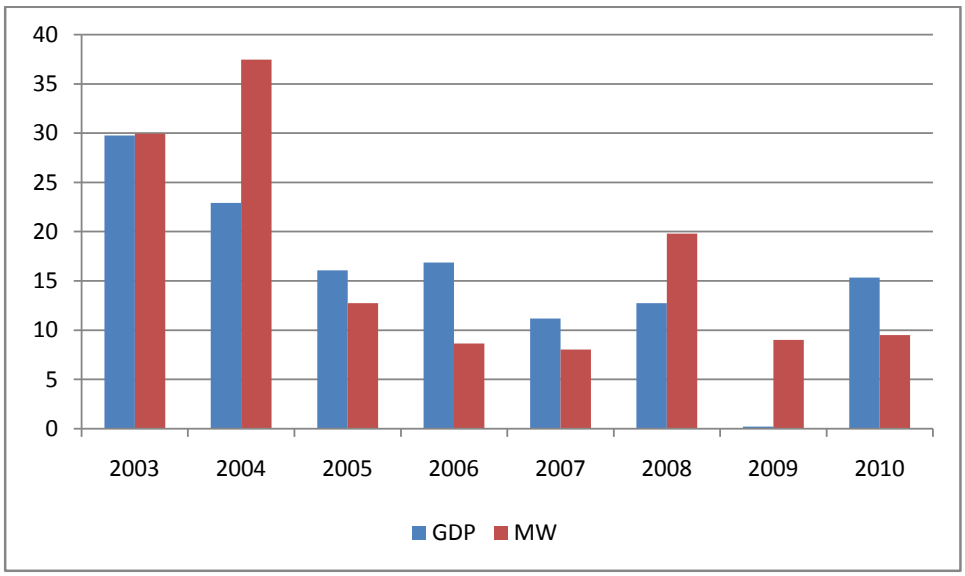
ANNEX

Table A1: Minimum wage and GDP between 2002 and 2010

	Nominal GDP	Reel GDP	Nominal MW (net)	Reel MW	CPI
2002 (1)	148446440.3	32684428.92	163.6	214.9	76.1
2002 (2)	202029649.2	39835402.08	184.2	220.7	83.5
2002 TOTAL	**350476089.5**	**72519831.01**	**173.9**	**217.9**	**79.8**
2003 (1)	203749155.6	34615263.71	226	230.5	98.1
2003 (2)	251031503.8	41722928.83	226	221.7	101.9
2003 TOTAL	**454780659.4**	**76338192.55**	**226**	**226.0**	**100.0**
2004 (1)	250500910.5	38415618.5	303.1	285.1	106.3
2004 (2)	308532115.4	45069972.11	318.2	287.0	110.9
2004 TOTAL	**559033025.9**	**83485590.61**	**310.65**	**286.1**	**108.6**
2005 (1)	294849685.5	41524846.21	350.2	303.2	115.5
2005 (2)	354082026.3	48974884.69	350.2	293.1	119.5
2005 TOTAL	**648931711.8**	**90499730.9**	**350.2**	**298.1**	**117.5**
2006 (1)	343724694.5	44811479.17	380.5	302.7	125.7
2006 (2)	414666090.7	51926841.04	380.5	288.7	131.8
2006 TOTAL	**758390785.2**	**96738320.21**	**380.5**	**295.5**	**128.8**
2007 (1)	391230399.2	47425228.68	403	291.7	138.2
2007 (2)	451948022.2	53829396.79	419.2	295.4	141.9
2007 TOTAL	**843178421.4**	**101254625.5**	**411.1**	**293.6**	**140.0**
2008 (1)	454969087.3	49671887.64	481.6	318.1	151.4
2008 (2)	495565163.4	52249842.28	503.3	318.7	157.9
2008 TOTAL	**950534250.7**	**101921729.9**	**492.45**	**318.4**	**154.7**
2009 (1)	436497889.2	44110023.25	527.1	325.3	162.0
2009 (2)	516060689.7	52893091.16	546.5	328.0	166.6
2009 TOTAL	**952558578.8**	**97003114.41**	**536.8**	**326.7**	**164.3**
2010 (1)	507022885.3	49159581.18	576.6	325.8	177.0
2010 (2)	591776463.1	56726062.76	599.1	333.2	179.8
2010 TOTAL	**1098799348**	**105885643.9**	**587.85**	**329.5**	**178.4**

Source: The Ministry of Labour and Social Security and TURKSTAT (CPI, 2003=100)

Figure A1: Nominal GDP growth rates and nominal minimum wage increases (%, per year)



Source: The Ministry of Labour and Social Security and TURKSTAT

Table A2: The Kolmogorov-Smirnov test for the equality of wage distributions

	D Statistic	P value
2003 and 2005 CF wage distributions of male workers	0.230	0.000
2003 and 2005 CF wage distributions of female workers	0.276	0.000
2003 and 2005 CF wage distributions of formal male workers	0.203	0.000
2003 and 2005 CF wage distributions of formal female workers	0.252	0.000
2003 and 2005 CF wage distributions of informal male workers	0.330	0.000
2003 and 2005 CF wage distributions of informal female workers	0.389	0.000