DISCUSSION PAPER SERIES

The Effects of Social Security Taxes and Minimum Wages on Employment: Evidence from Turkey

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ABSTRACT

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Worker-level panel data are used to analyse the separate employment effects of increases in the social security taxes paid by employers and increases in the minimum wage in Turkey between 2002 and 2005. Variation over time and among low-wage workers in the ratio of total labour costs to the gross wage gives rise to a natural experiment. Regression estimates indicate that a given increase in social security taxes has a larger negative effect on the probability of a worker remaining employed in the next quarter than an equal-sized increase in the minimum wage. This result is incompatible with the textbook model of labour supply and demand and suggests that workers may increase effort in response to an increase in wages. Consistent with this explanation, it is found that groups with the least access to the informal sector experience the smallest disemployment effects of the minimum wage.

NON-TECHNICAL SUMMARY

Minimum wages and payroll taxes both contribute to the labour costs facing employers of low-wage workers. When either is raised, employers must decide whether to retain those workers who have become more expensive to employ as a result. Under the basic labour supply and demand model, the same number of workers should lose their jobs when labour costs rise by a given amount, regardless of what policy is responsible. However, using Turkish data for 2002-2005, evidence is reported indicating that an increase in labour costs caused by a rise in social security tax rates results in greater job loss than an equal-sized increase in costs brought about by a rise in the minimum wage. A possible explanation is that workers respond to minimum wage rises by increasing their effort levels.

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1. Introduction

Turkey experienced a low rate of job creation during the first half-decade of the 21st century, despite strong economic growth during this period. As illustrated in Figure 1, Gross National Income per capita increased steadily between 2001 (when the Turkish financial crisis ended) and 2005, however the unemployment rate actually *rose* during this period and the labour force participation rate remained around 50%. Moreover, among those in employment, only about one half is registered with the social security system. One possible cause of the stubbornly low employment growth is the high level of taxation on labour. Combined employer and employee contributions to finance pensions and disability insurance, health insurance, unemployment benefits and workers' compensation equal around 40% of gross wages, which is high compared to other European and OECD countries. Furthermore, a minimum wage also exists and this has increased sharply in recent years. Only two previous papers have examined the effect of changes in labour costs on employment levels in Turkey. Betcherman *et al.* (2010) studied the introduction of regionally-targeted employment subsidies in 1998 and found that they led to significant increases in employment among firms registered with the social security system, however much of this appeared to be the result of existing firms registering rather than the creation of new jobs. Using a structural model, Ozturk (2009) found that the presence of minimum wages, combined with inflexibility in work hours resulted in a much lower level of female of labour force participation than would otherwise have transpired.

This paper examines whether increases in social security taxes and minimum wages in recent years have had an effect on employment levels. This is done by exploiting a unique natural experiment which arises as a result of the structure of the Turkish social security system. Because there is a minimum level of social security contributions for each job, employers who hire workers at the lowest end of the wage distribution face a total labour cost that is proportionately larger than employers of workers with slightly higher wages. In addition, the minimum wage inflates the wage paid to low-skilled workers. Both social security taxes and the minimum wage impose additional costs on employers of low-wage workers; however, the government receives any tax payments whereas the worker is the beneficiary of any minimum wage rise. Hence, any differences

Figure 1

Labor force indicators and production in Turkey
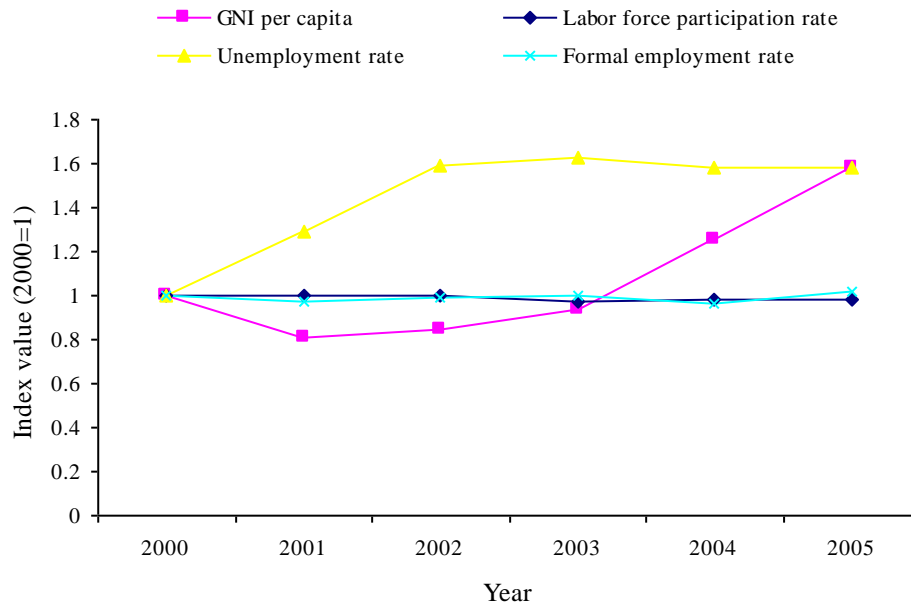
Sources: GNI per capita (current US dollars): World Bank using Atlas method; labor force participation rate, unemployment rate and formal employment rate (fraction of jobs registered with SSK): author's calculations using Household Labor Force Survey data.

in employment outcomes between the two policies may reflect differences in the behaviour of workers in response to changes in their wages. Longitudinal data from the Turkish Household Labour Force Survey are used to examine whether workers affected by increases in employer social security contributions or the minimum wage have a lower probability of being employed in the following quarter.

2. Previous empirical literature

A number of studies have attempted to establish a link between changes in labour costs and employment using longitudinal data on workers. Many of these have focused on the impact of minimum wages. Typically, authors use a treatment variable that is equal to the difference between a person's wage and the new minimum wage for those earning less than the latter and zero for those earning more than the new minimum wage. A key issue has been how to construct an appropriate control group. Among those studying increases in the federal minimum wage in the United States, both Linneman (1982) and Ashenfelter and Card (1981) examined the effect of increases in the minimum

wage in 1973 and 1974. Whereas Linneman compared those earning less than the newly-set minimum wage with those earning higher wages (and hence unaffected by the minimum wage rise), Ashenfelter and Card also compared those earning less than the new minimum wage in covered and uncovered sectors. Currie and Fallick (1996) considered the 1980 and 1981 increases in the federal minimum using both types of control group but with fixed effects models estimated on long-term longitudinal data. Approaches similar to Linneman's have also been taken in developing countries, especially in Latin America (*e.g.* Maloney and Nuñez Mendez 2004, Lemos 2009, Strobl and Walsh 2003). Other studies, such as Bell (1997) and Alatas and Cameron (2008), have used establishment-level data, which addresses the effects minimum wages have on *total* employment rather than on the probability of job loss among employed workers.

A smaller number of studies have looked at the effects of other policies that influence the labour costs of low-wage workers. Kramarz and Philippon (2001) analyzed the employment effects of changes in the payroll tax and subsidy system (as well as the minimum wage) in France, comparing workers who were directly affected by changes in labour costs with workers who earned slightly more. Kugler *et al*. (2003) used a short-term panel to examine the effects of labour market reforms in Spain, which reduced payroll taxes and dismissal costs for workers on permanent contracts. Since these reforms applied only to certain demographic groups, they were able to construct a natural experiment.

3. A brief description of the Turkish social security tax system

Prior to 2006, the Turkish social security system consisted of three separate institutions, each responsible for a different sector of the workforce: Sosyal Sigortalar Kurumu (SSK) for private sector workers, Emekli Sandiği (ES) for civil servants and Bağ-Kur (BK) for self-employed workers and farmers.[1] SSK accounted for roughly 60% of the insured population, while ES and BK accounted for about 20% each (Organisation for Economic Co-operation and Development 1999). Since this study looks only at wage earners, it will focus on those covered by SSK or ES.

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[1] Under reforms enacted in May 2006 and January 2007, the three systems were merged.

Under the ES system, employers and employees contributed to a single pension and health fund. During the sample period, employers contributed 20% of the gross wage; employees contributed 15% of the gross wage before April 2003 and 16% thereafter. Since the employer contribution rate was unchanged during the period, this group of workers will serve as one comparison group in the regression analysis. In the private sector, which is covered by SSK, both employers and employees contributed a fraction of the gross wage to a social security fund and an unemployment insurance fund. The social security fund covered a variety of forms of insurance: invalidity, old-age and death; employment injury and occupational diseases; sickness; and maternity. The employer contribution rate for this was 19.5% and the employee contribution rate was 14%. For the unemployment insurance fund, the employer contribution rate was 2% and the employee contribution rate was 1%. However, there were minimum and maximum monthly contribution levels for the two funds. When the wage exceeded a contribution ceiling, both employers and employees contributed a fixed lira amount to the social security system. On the other hand, workers with wages below a contribution base level faced the standard contribution rate, while their employers paid an amount in excess of the usual contribution rate in order to cover the shortfall in the combined social security contributions of the two parties.

Both the contribution base and contribution ceiling changed regularly over time, as shown in Table 1. In most cases, these levels were increased in order to keep pace with inflation. A monthly minimum wage also exists. This was raised five times during the sample period, thus adding to total labour costs for employers of low-wage workers. Starting in July 2004, the contribution base and minimum wage were synchronized, meaning that employers never faced a contribution rate above 21.5%. Employees also pay a stamp tax equal to 0.6% of their gross wage and an income tax, which is based on their income net of social security contributions.[2] The income tax system is progressive, with 15%, 20%, 25%, 30%, 35% and 40% marginal tax rates, although the last of these was eliminated in 2005. The income brackets corresponding to these were steadily increased between 2002 and 2005.

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[2] A standard deduction was also applied to every person's gross income prior to 2004.

Table 1
Minimum wages and social security tax parameters

Period introduced	Minimum wage (TL)	Contribution base (TL)	Contribution ceiling (TL)
2002i	222,000,750	210,000,000	1,050,000,000
2002ii	222,000,750	277,872,000	1,389,360,000
2002iii	250,875,000	327,583,290	1,637,916,450
2003i	306,000,000	327,583,290	1,637,916,450
2003ii	306,000,000	393,099,960	1,965,499,800
2003iii	306,000,000	458,015,820	2,290,079,100
2004i	423,000,000	423,000,000	2,748,150,000
2004iii	444,150,000	444,150,000	2,886,975,000
2005i	488,700,000	488,700,000	3,176,700,000

Notes: The contribution base was less than the minimum wage in the first quarter 2002, meaning that it is non-binding.

The actual contribution base in the first half of 2004 was TL 549,630,000, however government subsidies meant that the effective base was TL 423,000,000.

Throughout this period, employers faced a social security contribution rate of 19.5% and an unemployment insurance contribution rate of 2%.

Figure 2 depicts the ratio of the total monthly labour cost faced by employers to the gross wage for those quarters in which the contribution base changed in 2002 and 2003 and for wage rates less than TL 500 million. After 2004, the ratio is always equal to 1.215 in this wage range because the contribution base is set equal to the minimum wage. The downward-sloping sections of the total labour cost curves before 2004 reflect the fact both that employers have to contribute more to the social security system as the wage falls and that this constitutes a larger fraction of the gross wage. This results in an effective tax rate that can be much higher than the standard 21.5% − up to 39.6% in the second half of 2003. In addition to the situation depicted for low wage earners, the total labour cost/wage ratio falls below 1.215 at wages above the contribution ceiling, since employer contributions are fixed in this region. These facts suggest that it may be possible to construct two natural experiments. The employment effects of changes in the contribution base or minimum wage that influence the total labour cost ratio among low-wage workers can be analyzed. Although not depicted in Figure 2, variation in the contribution ceiling can be used in a similar fashion to examine the effect of payroll taxes on the employment of high-wage workers.

Increases in the minimum wage and contribution base both lead to rises in the total cost of labour faced by employers, however these take different forms. The former involves a transfer of money from employers to their employees; the latter a transfer from

Figure 2
Ratio of total labour cost to gross wage in selected quarters
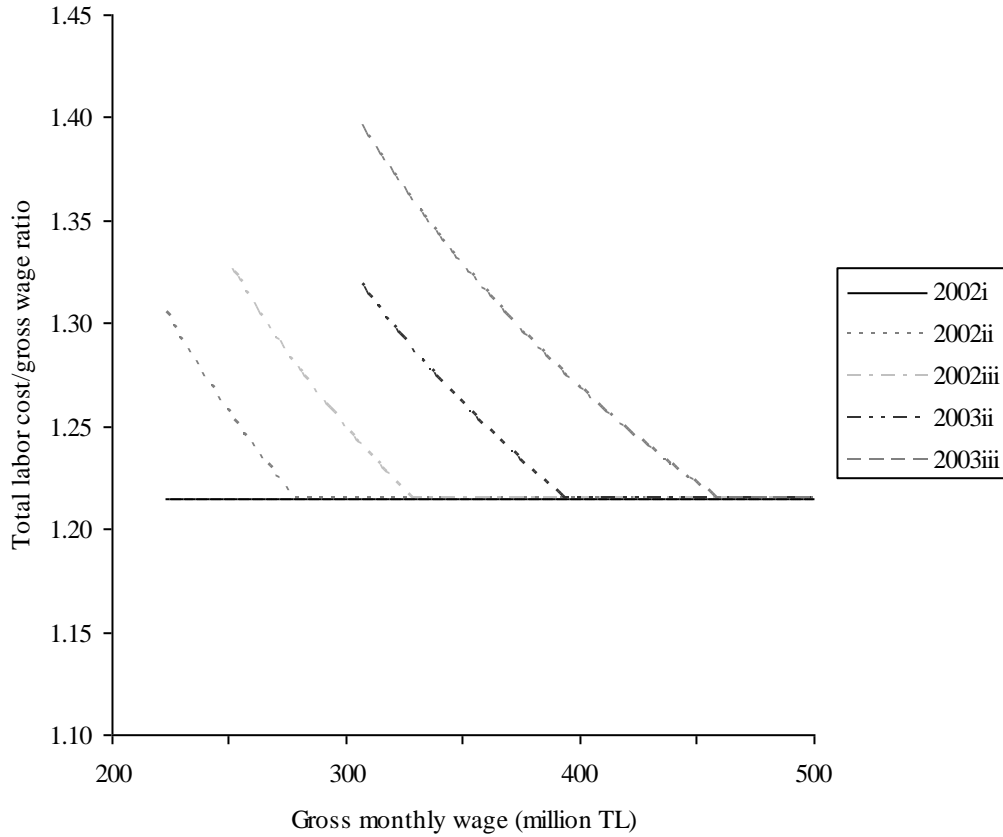
employers to the government. The two cases are illustrated in Figure 3, which assumes that the minimum wage is less than the contribution base so that there is a downward-sloping portion of the total labour cost curve. Figure 3a depicts the case where the minimum wage is increased from w_0 to w_1. This is represented as a movement along the total labour cost curve. The total labour cost incurred by an employer of a minimum wage worker rises from w_0T_0 to w_1T_1.[3] In contrast, an increase in the contribution base is shown in Figure 3b. Here the total labour cost curve itself shifts upwards, from TLC_0 to TLC_1, and the employer of a worker earning a wage, w_0, less than the new contribution base, faces a rise in total labour cost from w_0T_0 to w_0T_1. Since even if both the minimum wage and contribution base rise simultaneously (as in July 2002), the increase in labour costs can be decomposed into a movement along the total labour cost curve (due to the

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[3] $w_1T_1 > w_0T_0$ because the slope of the total labor cost curve is always less than 1 in absolute value.

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Figure 3
Effects of increases in the minimum wage and contribution base

a. Increase in minimum wage

b. Increase in contribution base
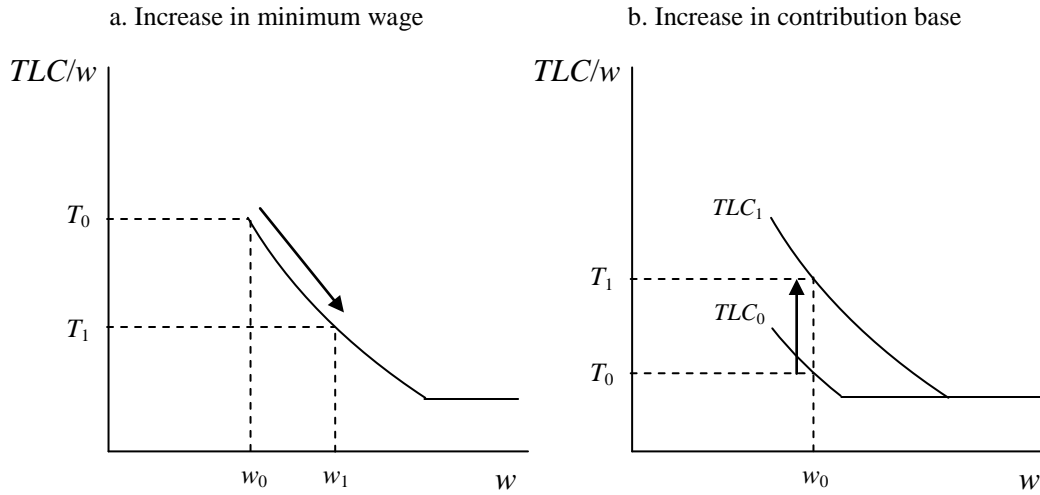
minimum wage) and a shift of the curve (due to the contribution base), separate treatment variables can be constructed for the two sources of cost increase.

4. Data

Quarterly data from the Household Labour Force Survey (HLFS) for 2002 to 2005 are analyzed.[4] In addition to basic demographic information, the survey collects information on whether a person is currently employed and, if so, whether his/her main job is registered with one of the three social security institutions. Workers who are registered with SSK or ES are considered to work in the formal sector and be subject to minimum wage and social security legislation, while employees who are unregistered are considered to be in the informal sector and not bound by this legislation.[5] Self-employed workers (who are covered by BK) are excluded from the analysis.

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[4] Questions on a respondent's income have only been included in the HLFS since 2002. During 2002, the Turkish economy was recovering from the financial crisis, which may have disrupted the labor market in that year. However, the results in the next section are very similar if the sample period is restricted to 2003-2005.

[5] Kanbur (2009) discusses the various concepts of informal employment and classifies them into the cases where regulation is applicable but the firm is non-compliant, where regulation is non-applicable after the firm adjusts its activity and where regulation is non-applicable to the activity. Since all jobs should be registered for social security purposes in Turkey, here informal employment refers only to the first of these classifications; therefore it seems reasonable to assume that the firm will ignore minimum wage legislation too.

A person's *net* income from this job in the previous month is also recorded. For people who reported working only part of the month, income was scaled up to reflect a full-month amount. Gross monthly income and total labour cost were calculated from this, using parameters from the income tax and social security systems for the relevant quarter under the assumption that each person earns the same amount in each month of the calendar year. Although the Turkish lira was redenominated in January 2005, all monetary values in this paper are expressed in old lira (TL). 54 observations for workers who earned a very low monthly income (less than TL 10 million in January 2002 lira) and 182 observations for workers who earned a very high income (more than TL 10 billion) were excluded.
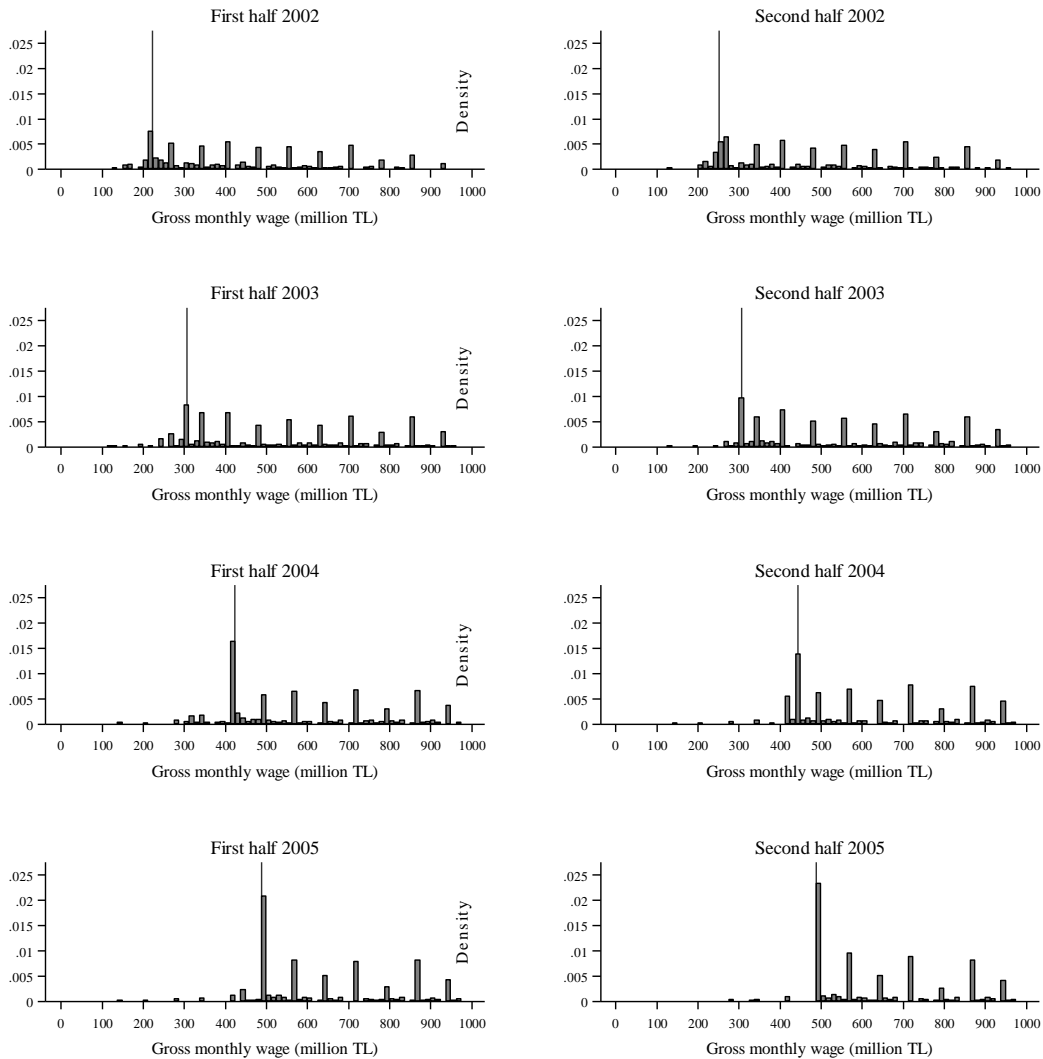
The gross wage distribution among those in the formal sector is depicted in Figure 4, along with the prevailing minimum wage.[6] The histograms are restricted to those observations with gross wages between TL 0 and TL 1 billion. A low level of non-compliance is observed, with few observations significantly below the minimum. The minimum wage did not appear to be a binding constraint during 2002 and 2003, however after a 38% increase in January 2004 it is seen to have a clear impact on the wage distribution. The large spike at the minimum wage suggests that many workers who were previously paid less than the new minimum wage are not laid off but rather are retained and paid a higher amount. This is similar to the pattern Card and Krueger (1995) found in the United States.[7]

Table 2 reveals how the observed wage distribution relates to the social security system, as discussed in the previous section. The majority of people earn a wage that lies between the contribution base and the contribution ceiling and hence have a constant employer contribution rate. A significant number of workers in registered jobs earn less than the minimum wage, although since many of these earn only slightly less than the minimum this does not necessarily indicate non-compliance, given that the gross wage is calculated from the net wage and hence is subject to measurement error. Very few people

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[6] The wage distribution in the informal sector does not appear to be bound by the minimum wage, suggesting that Turkey does not display the so-called "lighthouse effect" seen in Latin America, whereby minimum wages influence wage setting in the unregulated sector (Maloney and Nuñez (2004)).

[7] As Card and Krueger noted, this finding is at odds with a strict interpretation of the neoclassical model of labor supply and demand, in which workers should never be employed at a wage exceeding their marginal product of labor.

Figure 4
Distribution of gross wages and the minimum wage across registered jobs, 2002-2005

First half 2002 · Second half 2002 · First half 2003 · Second half 2003 · First half 2004 · Second half 2004 · First half 2005 · Second half 2005

Gross monthly wage (million TL)

Notes: Vertical spike denotes prevailing minimum wage.
Only individuals with gross monthly wages less than or equal to TL 1 billion are included.

earn a wage in excess of the contribution ceiling. For this reason, the analysis in the next section will focus on the natural experiment that arises from changes in the contribution base and minimum wage.[8]

Households are sampled by the HLFS for two consecutive quarters, then exit for two

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[8] Despite this, similar results were found when the employment effects of changes in the contribution ceiling were analyzed.

Table 2
Wage distribution by quarter

Quarter	Wage less than minimum wage	Wage between minimum wage and contribution base	Wage between contribution base and ceiling	Wage above contribution ceiling
2002i	17.75%	–	75.62%	6.63%
2002ii	20.67%	16.52%	59.50%	3.31%
2002iii	22.45%	15.78%	59.95%	1.82%
2002iv	18.50%	16.73%	62.56%	2.21%
2003i	25.50%	3.28%	68.52%	2.70%
2003ii	20.20%	15.62%	61.89%	2.28%
2003iii	15.82%	27.41%	54.52%	2.24%
2003iv	14.74%	25.62%	57.01%	2.63%
2004i	32.54%	–	67.42%	0.05%
2004ii	24.23%	–	74.52%	1.25%
2004iii	23.20%	–	75.59%	1.21%
2004iv	16.80%	–	81.98%	1.22%
2005i	17.73%	–	80.93%	1.33%
2005ii	13.85%	–	84.99%	1.16%
2005iii	12.83%	–	85.49%	1.68%
2005iv	11.90%	–	86.37%	1.73%

Notes: All percentages are restricted to ages 16-64 and use the HLFS sampling weight.
Observations with real gross wages less than TL 10 million or greater than TL 10 billion (in January 2002 lira) are dropped.

quarters and return for two final quarters. Hence, households are observed in the same two quarters in adjacent years. Unfortunately, however, it was only possible to match households *within* each calendar year, meaning that the minimum wage and contribution base changes that took place in the first quarters of 2003, 2004 (when the contribution base actually *fell*) or 2005 could not be analyzed. Furthermore, a combination of survey attrition and missing longitudinal identification variables means that some households only have one observation in a year and hence cannot be used in the panel analysis.[9] To allow for the facts that the match rates change over time and that the survey was enlarged considerably in 2004, the HLFS sampling weights are adjusted so that the total weight of each quarter's observations is the same.[10]

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[9] Tunalı (2009) examined attrition in the HLFS and found that household heads who are unemployed at the time of their initial interview are significantly more likely than average to exit the survey within three months. This is likely to introduce bias, although by focusing only on those people who are initially employed, this study should largely avoid this. Further confidence is taken from the fact that the matched and non-matched households are very similar in terms of observable characteristics, as can verified by comparing Table A1 with Table 3.

[10] This does not affect any of the regression results that are presented later.

5. Empirical approach

The objective is to assess the impact of a change in the total labour cost associated with a person's job on his/her future likelihood of being employed. Following Currie and Fallick (1996) and Kramarz and Philippon (2001), this is done by constructing a treatment variable, reflecting the "intensity" of a policy change on each individual. The total labour cost of each worker is first calculated, based on his/her observed gross wage in a given period. The total labour cost that would be incurred by the employer s periods in the future is then calculated, under the assumption that the worker remained employed at the initial period's wage and taking into account any changes in the social security contribution base or minimum wage. The treatment variable, y, is the difference between the two total labour cost values, expressed in billions of lira:

$$y_{it} = \frac{TLC_{t+s}(w_{it}) - TLC_t(w_{it})}{1{,}000{,}000{,}000}, \tag{1}$$

where $TLC_t(\cdot)$ is a function returning the total labour cost in period t for any gross wage. Hence, y reflects a counterfactual change in labour costs that would be faced by a firm if it chose to continue hiring a worker at the same wage. This will be equal to zero for workers whose cost does not change from between periods and, in order to focus on low-wage workers, it is also set equal to zero for workers who are affected by increases in the contribution ceiling. The larger a worker's value of y, the more changes in policies governing payroll taxes or the minimum wage have influenced his/her labour cost. Currie and Fallick referred to y as a "wage gap", although here it is more properly termed a "total labour cost gap". As discussed earlier, the total labour cost gap can be decomposed into the portion due to changes in the minimum wage, y^{MW}, and the portion due to changes in the contribution base, y^{CB}, so that $y_{it} = y_{it}^{MW} + y_{it}^{CB}$. Since the contribution base was set equal to the minimum wage in 2004, $y_{it}^{CB} = 0$ after this point.

In the panel dataset discussed in the previous section, households are observed twice in a given year: in quarters t and $t-s$, where $s=1$ or $s=3$. Similar to Currie and Fallick, the probability that individuals who were employed in quarter $t-s$ were still employed in quarter t is considered. The sample is restricted to those aged between 16 and 64 and the following employment equation is estimated by probit, using the adjusted

survey weights discussed earlier:

$$E_{it} = \alpha y_{i(t-s)} + \mathbf{X}_{i(t-s)}\boldsymbol{\beta} + \lambda_t + \varepsilon_{it}.$$ (2)

The dependent variable here, E_{it}, is a dummy variable for whether person i is employed in quarter t, given that $E_{i(t-s)} = 1$. Quarter dummies, λ, are included to control for macroeconomic factors and $\mathbf{X}$ includes age, sex, urban status, marital status, education level, whether the person was employed in an unregistered job in $t - s$ and a dummy for whether there was a nine month gap between interviews rather than a three month gap (*i.e.* whether $s = 3$).

The treatment group here consists of those workers who were registered with SSK in $t - s$ at a wage between the old contribution base and the new minimum wage (and hence experienced an increase in total labour costs). In periods where neither the contribution base nor the minimum wage changes, this group is empty. The comparison group consists of three subgroups: workers who earned more than the new minimum wage but less than TL 500 million (in January 2002 lira) in $t - s$; workers who were either registered with ES or not registered with any social security institution in $t - s$ and earned a wage between the old contribution base and the new minimum; and wage earners who were not registered in $t - s$ and earned less than the old minimum.[11] Hence, low-wage private sector workers will be compared with slightly higher-earning private sector workers and workers in the public and informal sectors.

6. Results

Means for key demographic and employment variables for the regression sample are presented in the first column of Table 3. Relative to the working-age population, the sample is dominated by men, the more educated, those who are married and those living in cities. In the second and third columns of the table, means for those who are bound by changes in the total cost schedule (so that $y_{it} > 0$) and those who are not bound (so that $y_{it} = 0$) are reported. Not surprisingly, those who are affected by the policy changes are

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[11] A small number of people (1.9% of the sample) were dropped from the dataset because they reported a wage that was less than 95% of the prevailing minimum wage but claimed to be registered with SSK or ES. Those within 5% of the minimum are included because of the measurement error problem discussed earlier.

Table 3
Means for the regression samples

Variable	Total sample	Bound workers	Unbound workers
Age	31.810	31.081	31.953
Male	0.797	0.770	0.802
Urban	0.757	0.794	0.750
Married	0.680	0.699	0.676
Primary education	0.539	0.538	0.540
Secondary education	0.390	0.410	0.386
Tertiary education	0.049	0.043	0.051
Previously employed in registered job	0.573	1	0.489
Total cost gap	0.003	0.018	0
Minimum wage cost gap	0.001	0.005	0
Contribution base cost gap	0.002	0.013	0
Previous gross monthly income	TL 428,240,646	TL 317,015,028	TL 450,269,268
Employed	0.763	0.795	0.756
Number of observations	36,979	3,793	33,186

Notes: The samples are restricted to those aged 16-64 who were employed in the previous quarter surveyed and use the HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

younger and less likely to be married than the comparison group.

The first column of Table 4 presents the results of estimating Equation 2. There is significant evidence that an increase in total labour cost brought about by the minimum wage rise reduces a person's likelihood of remaining employed: at the mean, a TL 1 million (approximately equal to US $0.70) increase in the total labour cost gap reduces the probability of being employed by 0.23%. This implies that a 1% increase in the total labour cost of a treated worker yields a 3.0% fall in the probability of him/her remaining employed a quarter later. The other control variables have the expected signs: being younger, male, married and more educated and living in an urban area all increase the likelihood of employment, as does being in a registered job in the previous quarter.

As discussed earlier, the total labour cost gap can be decomposed into a minimum wage cost gap and a contribution base cost gap. In order to find the separate employment effects of changes in each, the second column of Table 4 reports estimates of the following equation:

$$E_{it} = \alpha^{MW} y^{MW}_{i(t-s)} + \alpha^{CB} y^{CB}_{j(t-s)} + \mathbf{X}_{i(t-s)}\boldsymbol{\beta} + \lambda_t + \varepsilon_{it} . \qquad (3)$$

A TL 1 million increase in labour costs resulting from an increase in the contribution base is found to lead to a 0.28% fall in the probability of remaining employed, whereas

Table 4
Marginal effects from probit estimation of employment equations

Variable	Employed		Employed in same job	
	(i)	(ii)	(iii)	(iv)
Total cost gap	-2.257***	–	-3.160***	–
	(0.279)		(0.310)	
Minimum wage cost gap	–	-1.309***	–	-1.997***
		(0.508)		(0.557)
Contribution base cost gap	–	-2.839***	–	-3.888***
		(0.379)		(0.422)
Age	-0.002***	-0.002***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.127***	0.128***	0.109***	0.109***
	(0.006)	(0.006)	(0.007)	(0.007)
Urban	0.036***	0.036***	0.017***	0.018***
	(0.005)	(0.005)	(0.006)	(0.006)
Married	0.017***	0.017***	0.011*	0.011*
	(0.006)	(0.006)	(0.007)	(0.007)
Secondary education	0.035***	0.034***	0.039***	0.039***
	(0.005)	(0.005)	(0.005)	(0.005)
Tertiary education	0.067***	0.067***	0.075***	0.075***
	(0.009)	(0.009)	(0.011)	(0.011)
Three quarters since previous observation	-0.040***	-0.039***	-0.030***	-0.029***
	(0.009)	(0.009)	(0.010)	(0.010)
Previously in registered job	0.206***	0.207***	0.251***	0.252***
	(0.005)	(0.005)	(0.005)	(0.005)
Pseudo R-squared	0.080	0.080	0.074	0.074
Number of observations	36,979	36,979	36,928	36,928

Notes: All models include dummy variables for each quarter (12 variables).
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

the same increase in costs resulting from an increase in the minimum wage results in only a 0.13% decrease in the probability of employment. This difference is statistically significant at the 5% level and runs counter to the predictions of the basic textbook model of labour demand, in which the disemployment effects that result from the imposition of a payroll tax should never exceed those resulting from the imposition of a minimum wage which increases the equilibrium wage by an equal amount, because in the former case the employer may be able to pass on some of the tax to the worker in the form of lower wages. In contrast, the results here indicate that employers are less likely to shed workers if an increase in labour costs results in a transfer to employees rather than the government.

The estimated coefficients on Currie and Fallick's (1996) wage gap imply an employment elasticity with respect to the minimum wage of -0.23 when OLS is used.

This is remarkably close to the -0.26 figure that is obtained from the regression in the second column of Table 4 (using the fact that bound workers experienced an average 2.7% increase in the minimum wage). Currie and Fallick's elasticity falls slightly to -0.20 when they switch to fixed effects estimation, suggesting that the coefficients in Table 4 may overstate the true values. Since the HLFS data allow only one observation for each person, it is not possible to include individual fixed effects here, however including a dummy for registered job in the previous quarter controls for differences in employment stability between workers in the informal and formal sectors.

The HLFS asks respondents how long they had been employed in their current job; therefore, it is possible to determine whether a person had left a given job since the previous quarter. The last two columns of Table 4 estimate Equations 2 and 3 again, where the dependent variable now indicates whether a person is employed in the *same* job in quarter t as in quarter $t - s$. Not surprisingly, the effects of all treatment variables are larger than in the previous columns. A TL 1 million increase in total labour costs results in a 0.32% increase in the probability of workers leaving their current jobs, but only a 0.23% increase in the probability of them leaving the wage and salary sector altogether, because many find other jobs. Once again, the effects of the minimum wage cost gap and the contribution base cost gap are significantly different from each other.

7. Sensitivity tests

Card and Krueger (1995) criticized Linneman's (1982) decision to compare minimum wage workers with those earning more than the minimum wage, noting that the former group is likely to have more unstable employment histories than the latter, even in years in which the minimum wage did not change. Although the sample excludes those initially earning more than TL 500 million to alleviate this problem, it is still possible that the effects in Table 4 reflect a turnover-wage relationship. One way to circumvent this criticism is to add a person's gross monthly income in the previous period to the set of controls in Equation 3. Although unreported, this is found to reduce the magnitude of the coefficients on the cost gap variables only slightly.

Card and Krueger's preferred approach is to restrict the sample of workers to those who initially have low wage rates, thereby creating a more homogenous comparison

Table 5
Marginal effects from probit estimation of employment equations using different comparison groups

Variable	Choice of comparison group			
	(i) All groups	(ii) High-wage workers	(iii) Low-wage workers	(iv) Uncovered workers
Single treatment variable				
Total cost gap	-2.257***	-1.546***	-1.454***	-1.534**
	(0.279)	(0.253)	(0.504)	(0.631)
Separate treatment variables				
Minimum wage cost gap	-1.309***	-1.244***	-0.256	-0.327
	(0.508)	(0.458)	(0.723)	(0.848)
Contribution base cost gap	-2.839***	-1.739***	-2.396***	-2.786***
	(0.379)	(0.351)	(0.646)	(0.860)
Number of observations	36,979	26,208	12,524	5,833

Notes: All models also include the same regressors as in Table 4.
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

group. Table 5 reports estimates of Equations 2 and 3, using only one of the three comparison groups in each column (except the first column, which repeats the baseline results from Table 4). In the second column, the workers who are bound by the policy changes are compared with those who earn higher wages (but less than TL 500 million). As Card and Krueger predicted, the minimum wage effect is larger in this regression, although interestingly the contribution base effect is smaller and the two are not significantly different. In the third column, the comparison group is comprised of those who earn less than the bound group. In this case, the minimum wage effect is insignificant but the contribution base effect is similar to the baseline case. In the final column, the bound group is compared with workers whose earnings are in the same range but who are either not registered for social security purposes or registered with ES. This is comparable to the approach taken by Ashenfelter and Card (1981). The contribution base effect is larger than in the baseline case although, once again, the minimum wage effect is insignificant. In both the third and fourth columns, the contribution base effect is significantly larger than the minimum wage effect at the 10% level.

Focusing only on changes in employment status precludes the possibility that some of the adjustment in employment levels takes place in terms of the amount of time worked by each worker rather than in the number of workers. To examine this so-called intensive

Table 6
Estimates of equations for changes in the number of days and weekly hours worked

Variables	Employed		Employed in same job	
	(i) Change in days	(ii) Change in hours	(iii) Change in days	(iv) Change in hours
Single treatment variable				
Total cost gap	-25.791***	-40.243***	-14.631***	-47.621***
	(3.839)	(9.710)	(3.016)	(9.929)
Separate treatment variables				
Minimum wage cost gap	-15.563** (6.796)	-22.458 (17.210)	-11.284** (5.371)	-37.607** (17.707)
Contribution base cost gap	-31.998*** (5.130)	-51.010*** (12.973)	-16.601*** (3.993)	-53.501*** (13.142)
Number of observations	28,433	28,340	25,637	25,595

Notes: All models also include the same regressors as in Table 4.
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

margin, in Table 6 the regressions from Table 4 are repeated, but including only those who remain employed in current quarter (in the first two columns) or employed in the same job (in the last two columns). In the first column, the change from the previous quarter in the number of days worked in the previous month is used as a dependent variable. A TL 1 million increase in the minimum wage cost gap leads to a 0.016 decrease in the number of days worked per month but an equal-sized increase in the contribution base cost gap results in a 0.032 fall in days worked. The contribution base is also found to result in a larger fall in the number of hours worked per week than the minimum wage, as seen in the second column of the table. In both the days and hours regressions, the minimum wage and contribution base effects are significantly different from each other, although both are modest in magnitude. Similar patterns are found when the regression is restricted to those who remain in the job they had in the previous quarter, as reported in the third and fourth columns of Table 6.

Another concern is that the results simply capture a trend towards lower labour demand elasticities over time. Since the contribution base changes occurred only during the first part of the sample period, it is possible that they may appear to have large disemployment effects compared to the minimum wage changes, which occurred throughout the sample period. To address this, the two treatment variables were

Table 7
Marginal effects from probit estimation of employment equations with year interactions

Variable	Year			
	2002	2003	2004	2005
Single treatment variable				
Total cost gap	-2.876***	-2.035***	-0.476	–
	(0.369)	(0.451)	(0.694)	
Separate treatment variables				
Minimum wage cost gap	-1.064	–	-0.511	–
	(0.867)		(0.694)	
Contribution base cost gap	-4.374***	-2.069***	–	–
	(0.742)	(0.451)		

Notes: All models also include the same regressors as in Table 4.
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.
It is not possible to obtain separate effects of the minimum wage cost gap in 2003 or 2005 or of the contribution base cost gap in 2004 or 2005, because the variables did not change during those years.

interacted with year dummies, as presented in Table 7. As suspected, the coefficients on the treatment variables declined over time, although the contribution base effect is consistently larger than the minimum wage effect and the difference between the two in 2002 (the only year they are both identified) is significant.

8. Possible explanations

Minimum wages have been found to cause only modest reductions in employment levels in other developing countries, as noted by Neumark and Wascher (2007) in their survey of the literature. The most common explanations for this are the presence of monopsonies or the fact that labour demand is very elastic at low wage rates. In either case, *any* given increase in the cost of labour should lead to the same change in employment, regardless of the reason behind it.[12] This is contradicted by the evidence presented above, which indicates that changes in labour costs have more effect on employment probabilities when they are caused by changes in payroll taxes rather than by changes in minimum wages. The obvious difference between these two types of policy

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[12] If anything, a payroll tax increase might have a smaller effect if firms are able to offset the tax by lowering wages. This can be examined using the HLFS data on workers who remain employed between quarters. However, the results from such an analysis were found to be very sensitive to the exclusion of implausibly large wage changes, something that was also noted by Currie and Fallick (1996).

is that a minimum wage rise results in an increase in the take-home pay of the worker, whereas an increase in payroll taxes leaves the worker's pay unchanged. If workers respond to wage increases by putting more effort into their work or by reducing the probability of quitting their job, then employers will actually experience rises in labour productivity as a result of a minimum wage rise, but not from an equal-sized increase in payroll taxes. As shown by Rebitzer and Taylor (1995), they will then be less eager to cut jobs under the former policy than under the latter.[13]

This efficiency wage argument is particularly relevant to Turkey, where the loss of a job in the formal sector often forces workers to find employment in the informal sector, at a much lower wage rate.[14] Since these jobs are unaffected by social security taxes or the minimum wage, they are assumed to pay a worker his/her marginal product. Formal sector workers who do not raise their effort levels (or reduce their probability of turnover) in response to a rise in their wage rates have the option of switching to the informal sector and continuing to earn their old wage in return for a lower effort level.

Certain demographic groups are much more likely to work in the informal sector than others. For example, 31% of workers with a primary education work in the informal sector, while only 14% of secondary-educated workers do. For groups with less recourse to the informal sector, the only alternative to minimum wage employment is likely to be unemployment.[15] Assuming that the unemployment benefit is lower than any informal sector wage, it might be expected that changes in the minimum wage would have larger disemployment effects on these workers. To examine this, Equation 3 is estimated separately for each sex, urban status, age and education group. Table 8 indicates that the contribution base effect continues to dominate the minimum wage effect in all cases. Women are found to be more likely to exit employment in response to a given increase in labour costs than men, consistent with Ashenfelter and Card (1981), but not Wellington

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[13] Georgiadis (2008) found support for the efficiency wage argument, by analyzing a natural experiment arising from the national minimum wage in the United Kingdom. Although Georgiadis's paper remedies some of the limitations of previous studies of efficiency wages, it shares the weakness of not having a counterfactual measure of employment when wages rise but worker incentives are not present.

[14] Controlling for other characteristics, workers in jobs registered with SSK were found to earn 34% more after tax than unregistered workers.

[15] Another possibility is that workers might become self employed, which is also likely to result in a fall in income. The prevalence of self employment across demographic groups follows a similar pattern to that of informal employment.

Table 8
Marginal effects from probit estimation of employment equations for different subgroups

Subgroup	(i) Employed		(ii) Employed in same job			Fraction in informal sector
	$\hat{\alpha}^{MW}$	$\hat{\alpha}^{CB}$	$\hat{\alpha}^{MW}$	$\hat{\alpha}^{CB}$	$\hat{\alpha}^{MW} - \hat{\alpha}^{CB}$	
Women	-1.224	-3.217***	-1.201	-4.050***	2.849	0.170
	(1.112)	(0.913)	(1.164)	(0.955)		
Men	-1.108*	-2.819***	-2.059***	-3.942***	1.883	0.207
	(0.573)	(0.412)	(0.634)	(0.468)		
Rural	-2.515**	-3.820***	-3.197***	-4.535***	1.338	0.232
	(1.159)	(0.959)	(1.241)	(1.031)		
Urban	-0.978***	-2.566***	-1.688***	-3.724***	2.036	0.191
	(0.563)	(0.408)	(0.623)	(0.460)		
Aged 16-29	-1.909***	-2.830***	-2.864***	-3.460***	0.596	0.264
	(0.723)	(0.554)	(0.815)	(0.633)		
Aged 30-64	-0.200	-2.261***	-0.644	-3.707***	3.063	0.162
	(0.723)	(0.527)	(0.772)	(0.570)		
Primary education	-0.898	-1.503***	-1.706**	-2.596***	0.890	0.310
	(0.748)	(0.560)	(0.806)	(0.607)		
Secondary education	-1.342*	-3.149***	-1.513*	-4.020***	2.507	0.143
	(0.705)	(0.529)	(0.800)	(0.615)		
Tertiary education	-1.587	-4.198***	-4.345**	-5.786***	1.441	0.030
	(1.872)	(1.421)	(2.173)	(1.714)		

Notes: All models also include the same regressors as in Table 4.
  Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
  Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

(1991). Rural-dwellers are affected slightly more by rises in labour costs (especially due to the minimum wage) than those living in urban areas. People aged under 30 have higher disemployment probabilities than older workers, however, somewhat surprisingly, people with secondary or tertiary educations are more likely to lose their jobs in response to labour cost increases than less-educated workers. This is likely to be due to the fact that those with more education tend to be younger and, hence, more vulnerable to unemployment than older workers (see Economic Research Forum 2005).

Since changes in the contribution base measures pure changes in labour demand and changes in the minimum wage confound this effect with the productivity responses of workers, the difference in the coefficients on the minimum wage cost gap and the contribution base cost gap can be interpreted as an employee "productivity effect". When the probability of leaving a particular job is used as a dependent variable in the last column of Table 4, the productivity effect is found to increase the probability of

remaining employed by 0.19% in response to a TL 1 million labour cost increase. In Table 7, the largest productivity effects found are for women, urban-dwellers, those aged 30-64 and those with a secondary education. Except for women, these groups all also have significantly lower fractions of informal sector jobs than the rest of the workforce. Since workers who change jobs are likely to find work in the informal sector where possible, the productivity effects should be more similar across groups of workers when the probability of being employed in any job is analyzed. This is found in all cases, as seen in the first column of the table.

If efficiency wages explain the lack of adjustment in employment to changes in minimum wages, workers might be expected to reduce hours spent on additional jobs in response to a minimum wage rise, as they devote more effort to their main job. The HLFS asks questions on a person's usual weekly hours on any secondary job, including unpaid family work. Table A2 presents the results when the change in this variable is regressed on the treatment variables. Unfortunately, only around 2% of workers report having a secondary job in each quarter. Nevertheless, the minimum wage cost gap has a significant negative effect on hours worked on the secondary job (which is zero for those without a secondary job), even though it has little effect on hours worked on the main job. This is consistent with a worker cutting back on other labour market activities in order to devote more effort to his/her main job after the wage on that job rises. The effect is even larger for those who are still employed in the same main job as in the previous period (and who are presumably now receiving a higher wage on that main job). The same result is found if unpaid work is excluded. The contribution base cost gap has no effect on hours worked on the secondary job.

9. Overall employment changes

The previous results indicate that the likelihood of workers losing their jobs increases when the cost of hiring them rises and by more so when the cost increase is due to an increase in the contribution base than in the minimum wage. One drawback of this approach is that it is unable to determine whether changes in labour costs affect the flow of people *into* employment. It is possible that increases in the contribution base do not reduce overall employment but simply increase the amount of labour turnover, as

employers suddenly find it worthwhile replacing unproductive workers with more carefully selected new hires. An alternative approach is to aggregate the treatment and employment variables within broadly-defined categories and construct a "pseudo-panel" dataset.[16] This allows examination of the effect of changes in the cost gap variables on the total level of employment within specific groups of workers, rather than on just an individual's probability of exiting employment.

Birth cohort, sex, education, urban/rural status and industry were used as categories, in order to identify workers who are broadly similar in productive characteristics and who do similar jobs.[17] The total number of employed workers within each cell was calculated, using the survey weights, so that the values reflect the national level of employment within each category. Table 9 reports the results of estimating employment equations using the pseudo-panel. Since the actual number of workers in each cell is not of interest, elasticities are reported in the table instead. Fixed effects estimation is used to control for persistent differences in employment between the cells. In the first column, total employment in each cell (excluding self employment, as before) is used as the dependent variable. A 1% increase in the contribution base cost gap is seen to result in a 0.02% decrease in employment, while the minimum wage cost gap is found to have no significant effect on employment. As with the individual-level analysis, the difference between the two effects is significant. These results suggest that although employers might seek out new workers in response to increases in labour costs, the overall effect of increases in the contribution base on employment is negative.

Table 9 also presents estimates of the effects of the cost gap variables on three subcategories of employment: formal private sector employment (*i.e.* registered jobs), government sector employment and informal private sector employment (*i.e.* unregistered jobs). The minimum wage cost gap has no effect on employment in any of these categories. The contribution base cost gap has a significant negative effect on

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[16] This approach has been used by studies in cases where it is not possible to match individuals over time, for example Blundell *et al*. (1990) and Morrison *et al*. (2006).

[17] 11 birth cohort categories (pre-1940 and 5-year intervals thereafter), 8 education categories (no education, primary school, other primary education, junior high school, high school, undergraduate study, post-graduate study) and 9 industry categories (ISIC 1-digit categories) were used. Industry in quarter *t–s* was used for people who were not employed at time *t*. The unweighted average cell size was 14 and the weighted average cell size was 10,350.

Table 9
Elasticities from fixed effects estimation of employment equations using pseudo-panel

Variable	(i) All non-self employment	(ii) Formal employment	(iii) Government employment	(iv) Informal employment	(v) Self employment
Minimum wage cost gap	0.001	0.004	0.001	-0.002	-0.004
	(0.003)	(0.005)	(0.006)	(0.004)	(0.004)
Contribution base cost gap	-0.019***	-0.032***	-0.022***	-0.005	0.015***
	(0.004)	(0.006)	(0.008)	(0.005)	(0.005)
Fraction previously in registered job	0.084***	0.270***	0.213***	-0.133***	-0.048*
	(0.021)	(0.031)	(0.038)	(0.024)	(0.026)
R-squared	0.794	0.790	0.742	0.741	0.886
Number of observations	6,925	6,925	6,925	6,925	6,925

Notes: All models also include fixed effects for each cell and dummy variables for each quarter (12 variables).
Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

employment in both the formal and government sectors but no effect on informal employment. Finally, Table 9 also reports the effects of the cost gap variables on self employment. The contribution base cost gap has a significant positive elasticity, suggesting that workers displaced from formal sector jobs are more likely to become self-employed than to enter the informal sector. In contrast, the minimum wage cost gap has an insignificant effect on self employment.

10. Conclusion

This paper has examined the effects the minimum wage and the level of social security taxes paid by firms in Turkey have on the employment levels. Variation over time and among low-wage workers in the ratio of total labour costs to the gross wage gives rise to a natural experiment. Using a longitudinal dataset constructed from the Turkish Household Labour Force Survey for 2002-2005, estimates were obtained indicating that a TL 1 million (or US $0.70) increase in a worker's labour costs arising from a minimum wage rise results in a 0.13% decrease in the probability of him/her remaining employed in the following quarter, whereas a TL 1 million increase in costs resulting from an increase in social security contributions results in a 0.28% fall in employment probability. The difference between the two effects is even larger when only low-wage workers are used as a comparison group. Certain demographic groups, including women, rural-dwellers and those under 30, are found to be more vulnerable to

policy changes than others. The results indicate that employers are less likely to dismiss workers in response to a given increase in labour costs when the increase results in higher wages for their workers rather than in a transfer payment to the government, possibly because workers are likely to put more in more effort in the former case.

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Appendix

Table A1
Means for the full HLFS sample

Variable	Total sample	Bound workers	Unbound workers
Age	31.214	30.488	31.304
Male	0.793	0.761	0.797
Urban	0.749	0.774	0.746
Married	0.643	0.645	0.642
Primary education	0.528	0.509	0.531
Secondary education	0.400	0.440	0.395
Tertiary education	0.049	0.040	0.050
Employed in registered job	0.568	1	0.514
Gross monthly income	TL 429,211,669	TL 314,211,669	TL 443,535,803
Number of observations	99,131	9,793	89,338

Notes: The samples are restricted to those aged 16-64 who are employed with monthly incomes less than TL 500 million in January 2002 lira. They use the HLFS sampling weights, adjusted so that the total weight in each quarter is the same.

The fourth quarter of each year is excluded, as observations from these quarters can never be matched to a later quarter.

The age restrictions do not agree with those in the regression sample exactly, as the latter uses those aged 16-64 as of the second quarter a person is observed, not the first quarter.

Table A2
Estimates of equations for change in usual weekly hours worked on secondary job

Variables	Employed		Employed in same main job	
	(i) Hours on any work	(ii) Hours on paid work	(iii) Hours on any work	(iv) Hours on paid work
Single treatment variable				
Total cost gap	-2.631	-1.736	-3.441	-2.355
	(2.548)	(2.396)	(2.732)	(2.575)
Separate treatment variables				
Minimum wage cost gap	-7.597*	-7.697*	-9.075*	-9.115**
	(4.516)	(4.247)	(4.872)	(4.592)
Contribution base cost gap	0.375	1.874	-0.132	1.615
	(3.404)	(3.201)	(3.616)	(3.408)
Number of observations	28,340	28,340	25,595	25,595

Notes: All models also include the same regressors as in Table 4.

Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Regressions use HLFS sampling weights, adjusted so that the total weight in each quarter is the same.