The effect of social security taxes and minimum wages on employment growth in Turkey

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Using both individual-level panel data and synthetic panel data from the Turkish Household Labour Force Survey, this paper analyses the employment effects of increases in both the social security taxes paid by employers and the minimum wage 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 suggest that social security taxes and the minimum wage have a significant negative effect on both employment levels and the formal/informal employment ratio. A 1 percentage point increase in the total labour cost/wage ratio yields a 1 percentage point decrease in the employment rate and a 2.2 percentage point decrease in the fraction of jobs that are registered for social security purposes. Women, urban-dwellers and those under 30 have the strongest overall disemployment effects, however rural workers are more likely than urban workers to switch from formal to informal employment in response to an increase in labour costs.

1. Introduction

Job creation has lagged behind population growth in Turkey and unemployment has remained high, despite strong economic growth in recent years. Moreover, only about one-half of the employed labour force is in the formal sector (*i.e.* registered with the social security system). Figure 1 shows that Gross National Income per capita increased significantly and steadily between 2001 (when the Turkish financial crisis ended) and 2005, however the labour force participation rate and the fraction of jobs in the formal sector both failed to rise appreciably over this period. Moreover, the unemployment rate actually rose by about 4 percentage points between 2000 and 2005.

While many factors are contributing to the employment problem, one potential cause 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. Analyses by the OECD and the World Bank have concluded that Turkey's "tax wedge" is high compared to most other European and other OECD countries. Reducing social insurance contributions

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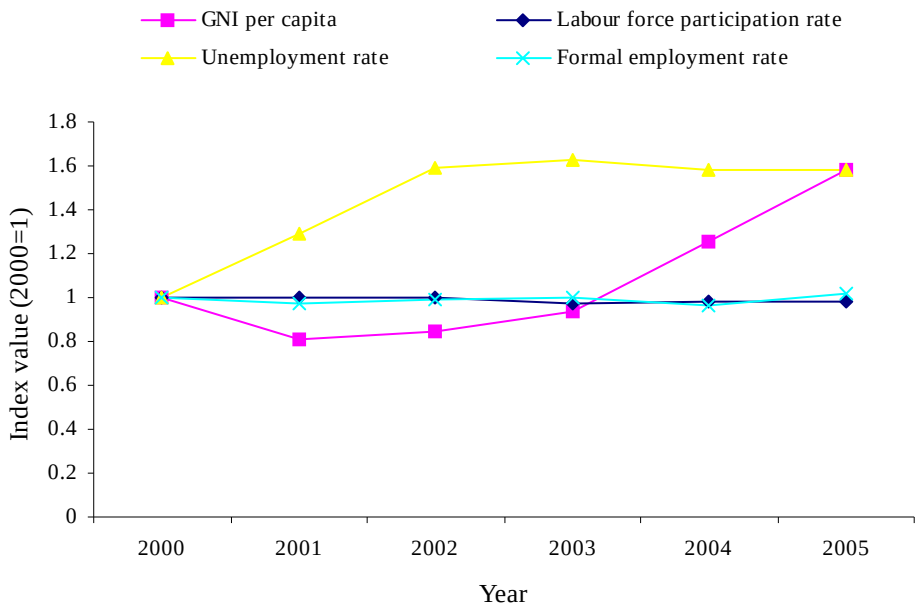
Figure 1
Labour force indicators and production in Turkey



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

and/or income taxes could encourage employment, especially in the formal sector. However, empirical evidence does not exist to quantify the likely employment impacts if these taxes were decreased.

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 natural experiment which arises as a result of the structure of the 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 individual-level panel data and "synthetic" panel data are used to examine whether policy changes that influence the relative level of labour costs have a negative effect on employment rates in the following period.

The next section discusses previous empirical research on the relationship between employment and labour costs, followed by an overview of the Turkish social security

system. Section 4 describes the data used in the analysis and Section 5 presents the results of employment equations using the two types of longitudinal dataset.

2. Previous work

Very few previous studies have analysed the impact taxes have on employment in Turkey. These have focused on estimating labour demand elasticities using data collected from formal sector enterprises in manufacturing. For example, Krishna *et al*. (2002) calculated labour demand elasticities plants in 10 manufacturing industries using annual manufacturing census data for 1983-1986. They found a pooled labour demand elasticity of about -0.55, with 6 of the 10 industries having elasticities of between -0.15 and -0.75. This fits into the range of labour demand elasticities calculated in other countries, which are generally between -0.3 and -0.5.

Several previous studies have examined the effect of changes in labour costs on the employment using longitudinal data in developed countries. Many of these have focused on the impact of minimum wages, starting with Linneman (1982). Currie and Fallick (1996) examined the effect of increases in the federal minimum wage in the United States on employment using data from the National Longitudinal Survey of Youth 1979. They used workers who earned more than the minimum wage or who worked in uncovered sectors as a control group. Their treatment variable was a "wage gap", which was 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.

Kramarz and Philippon (2000) analysed the employment effects of changes in the minimum wage in France using a similar approach to that of Currie and Fallick. One innovation they make is to compare workers who are directly affected by increases in the minimum wage with workers who earn slightly more than the minimum wage. They claim that the latter provides a good control group. Kramarz and Philippon's results suggest that a 1% increase in the total cost of labour results in a 1.5% increase in the probability of shifting from employment to non-employment.

Studies have also looked at the effects of other policies that influence labour costs. For example, Kugler *et al*. (2002) used a short-term panel to examine the effects of labour market reforms in Spain, which reduced payroll taxes and dismissal costs for

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 549,630,000 TL, however government subsidies meant that the effective base was 423,000,000 TL.
Throughout this period, employers faced a social security contribution rate of 19.5% and an unemployment insurance contribution rate of 2%.

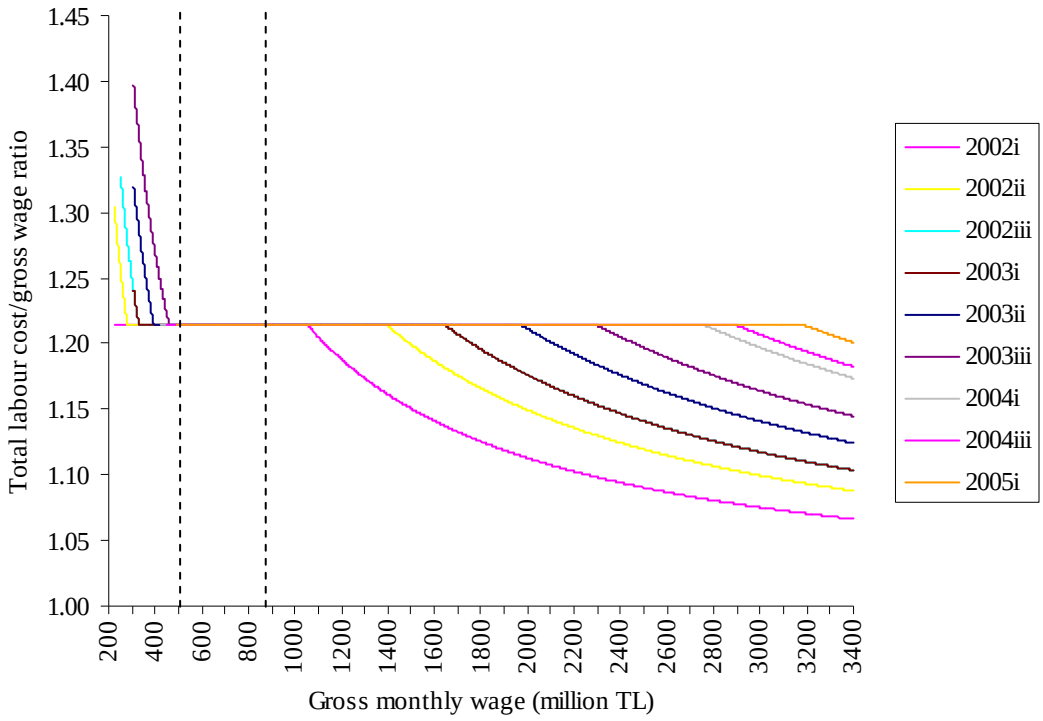
workers on permanent contracts. Since these reforms applied only to certain demographic groups, they are able to construct a natural experiment.

3. Brief description of the Turkish social security tax system

Under the Turkish social security system, both employers and employees contribute a fraction of the gross wage to a social security fund and an unemployment insurance fund. The social security fund covers 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 is 19.5% and the employee contribution rate is 14%. For the unemployment insurance fund, the employer contribution rate is 2% and the employee contribution rate is 1%. However, there are minimum and maximum monthly contribution levels for the two funds. When the wage exceeds a contribution ceiling, both employers and employees contribute a fixed lira amount to the social security system. On the other hand, workers with wages below a contribution base level face the standard contribution rate, however their employers pay 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 have been changed regularly in recent years, as shown in Table 1. In most cases, these levels have been increased in

Figure 2
Ratio of total labour cost to gross wage, 2002-2005



Note: The left dotted line denotes the upper limit for inclusion in estimation sample in 2002i (500 million TL); the right dotted line denotes what this had become by 2005iv (866.44 million TL).

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. Since July 2004, the contribution base and minimum wage have been synchronised, meaning that employers never face 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.[1] 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.

Figure 2 depicts the ratio of the total monthly labour cost faced by employers to the gross wage for different quarters between 2002 and 2005. Prior to 2004, the ratio was

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

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	18.45%	–	74.57%	6.98%
2002ii	21.22%	16.35%	58.80%	3.62%
2002iii	23.14%	15.64%	59.22%	2.00%
2002iv	19.18%	16.64%	61.92%	2.26%
2003i	26.05%	3.25%	67.91%	2.79%
2003ii	20.75%	15.52%	61.34%	2.39%
2003iii	16.42%	27.32%	54.00%	2.26%
2003iv	15.31%	25.59%	56.42%	2.68%
2004i	32.90%	–	67.05%	0.05%
2004ii	24.69%	–	74.03%	1.28%
2004iii	23.66%	–	75.12%	1.22%
2004iv	17.23%	–	81.52%	1.24%
2005i	18.13%	–	80.50%	1.37%
2005ii	14.37%	–	84.46%	1.17%
2005iii	13.34%	–	84.94%	1.72%
2005iv	12.33%	–	85.91%	1.76%

Notes: All percentages are restricted to ages 15-64 and use the HLFS sampling weight.

greater than 1.215 at low wages due to the contribution base exceeding the minimum wage. Furthermore, in all periods, the ratio falls below 1.215 at wages above the contribution ceiling, since employer contributions are fixed in this region. Figure 2 suggests 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 analysed. Similarly, variation in the contribution ceiling can be used to examine the effect of payroll taxes on the employment of high-wage workers.

4. Data

Quarterly data from the Household Labour Force Survey (HLFS) for 2002 to 2005 are analysed.[2] 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 the Social Security Institute (SSK). Workers who are registered

[2] 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 labour market in that year. However, the results in the next section are very similar if the sample period is restricted to 2003-2005.

Table 3
Means for the samples

Variable	Total sample, 2002-2005	Individual-level panel sample, 2004	Synthetic panel sample, 2002-2005
Age	34.473	32.588	34.355
Male	0.500	0.808	0.702
Urban	0.629	0.769	0.791
Married	0.675	0.700	0.823
Primary education	0.552	0.520	0.608
Secondary education	0.286	0.405	0.322
Tertiary education	0.071	0.052	0.057
Employed	0.465	0.871	0.650
Employed in registered job	0.225	0.610	0.420
Number of observations	1,008,355	5,121	36,323

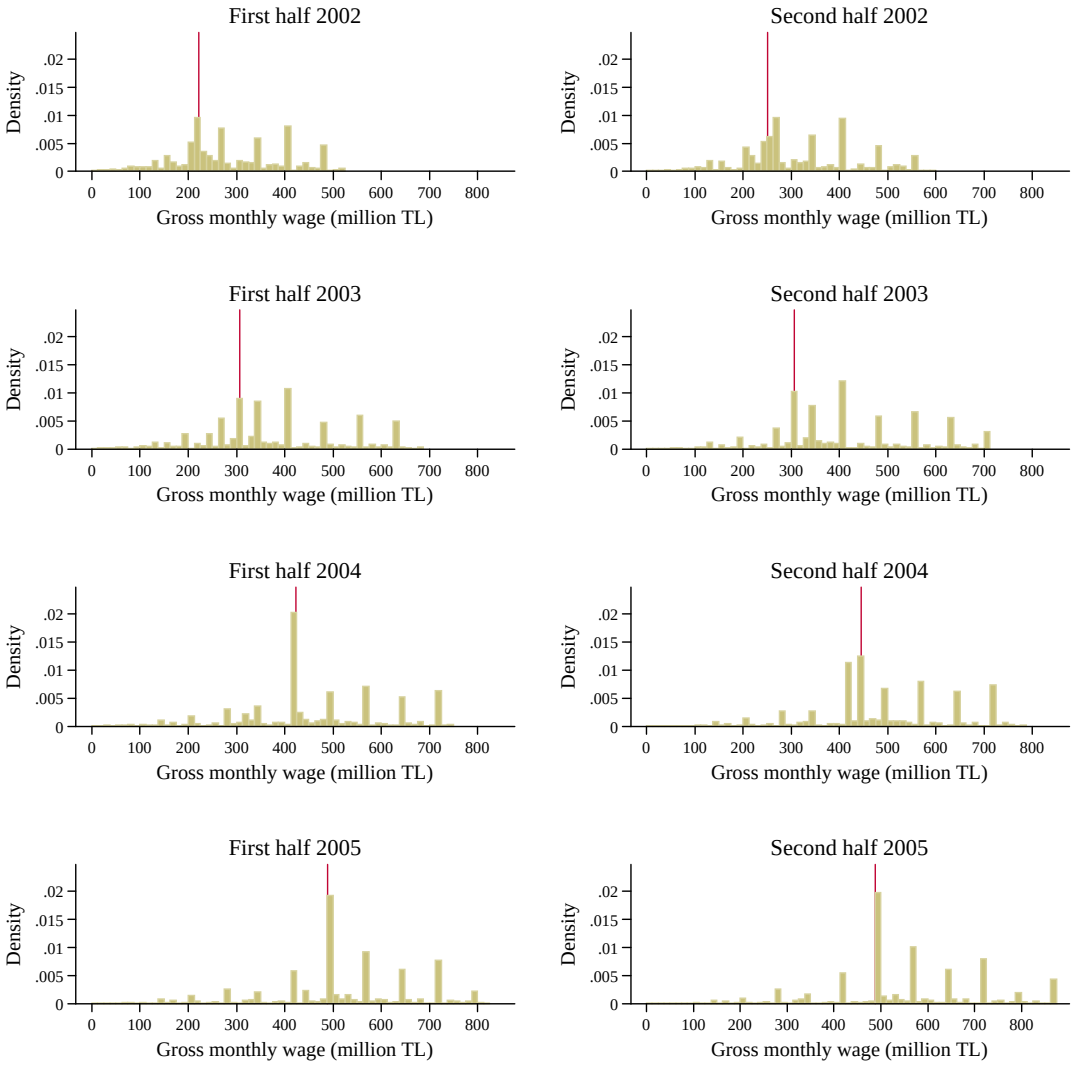
Notes: All samples are restricted to ages 15-64 and use the HLFS sampling weight.

with SSK are considered to work in the formal sector. Furthermore, a person's *net* income from this job in the previous month is 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 revalued in January 2005, all monetary values in this paper are expressed in old lira (TL).

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 fraction earn less than the minimum wage, although this appears to be largely due to rounding error, as most of these workers earn only slightly less than the minimum wage. Very few people earn a wage in excess of the contribution ceiling. For this reason, the analysis in the following section will focus on the natural experiment that arises from changes in the contribution base and minimum wage.

Means for key demographic and employment variables are presented in the first column of Table 3. Less than half of those aged 15-64 are employed and less than half of these are employed in the formal sector. The wage distribution is depicted in Figure 3, along with the prevailing minimum wage. The histograms are restricted to those

Figure 3
Distribution of gross wages and the minimum wage, 2002-2005



Notes: Vertical spike denotes prevailing minimum wage.
Only individuals with gross monthly wages less than or equal to 500 million TL (in January 2002 TL) are included.

observations with real wages (in 2003 TL) between 0 and 500 million TL, which will constitute the estimation sample in the next section. 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.[3]

Households are sampled by the HLFS for two consecutive quarters, then exit for two quarters and return for two final quarters. Hence, households are observed in the same two quarters in adjacent years. Unfortunately, it was not possible to obtain any longitudinal household identification variables, except for the four quarters within 2004 and the four quarters within 2005. This limits the scope for performing a longitudinal analysis. In response, two approaches are taken. Firstly, employment flows are analysed at the individual level, using only the 2004 data.[4] As noted in Table 1, the minimum wage and contribution base changed in July 2004. Therefore, only households that were interviewed in quarters 1 and 4 or 2 and 3 are included. A drawback of this is that it excludes the period during which the minimum wage was effectively lower than the contribution base and, hence, only reflects the effect of changes in the former.

An alternative approach is to average the employment and income variables within narrowly-defined demographic categories and construct a "synthetic" panel dataset.[5] The age, sex and education of every household member were used as demographic categories, along with additional characteristics of the focus person. Full details are given in Appendix 1. Use of the synthetic panel allows data from all four years to be included, since the unit of observation is a demographic cell rather than a person. A result of this is that only the effect of policy changes on the average employment rate within a cell may be examined, rather than an individual's probability of exiting employment. Nevertheless, since the age, sex and education of *every* household member were used as demographic categories, almost 60% of cells contain a single person, meaning that the synthetic panel largely resembles an individual panel.

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

[4] There were no policy changes in 2005 and it is not possible to match households *between* 2004 and 2005.

[5] This approach has been used by other studies where it is not possible to match individuals over time, for example Morrison *et al*. (2006).

5. Analysis

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 (2000), this is done by constructing a treatment variable, reflecting the "intensity" of a policy change on each individual. This involves calculating the total labour cost of each worker in a given period, based on their observed gross wage that period, and the total labour cost their employer would incur if the worker remained employed in the next period at the current period's wage, taking into account any changes in the social security system or minimum wage. The treatment variable, *y*, is the difference between the two total labour cost values, expressed as a fraction of the current period's gross wage, *w*:

$$y_{it} = \frac{\gamma_{t+1}(w_{it}) - \gamma_t(w_{it})}{w_{it}}, \tag{1}$$

where $\gamma_t(\cdot)$ is a function returning the total labour cost in period *t* for any gross wage. Hence, *y* reflects a counterfactual change in labour cost that would be faced by a firm if it chose to continue hiring a worker at the same wage. 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.

The individual-level panel for 2004 is first considered. Individuals are observed twice: in quarters *t* and $t-s$, where $s=1$ or $s=3$. Similar to Currie and Fallick, the following employment equation is estimated:

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

The dependent variable here, E_{it}, is a dummy variable for whether person *i* is employed in quarter *t*. A quarter dummy, λ, is included to control for macroeconomic factors and **X** includes age, sex, urban status, marital status and education level. Equation 2 is restricted to people who were employed in the most recently observed period and who earned a real wage that is more than 95% of the minimum wage but less than 500 million TL (in 2002 TL), in other words individuals for whom $E_{i(t-s)}=1$ and $401{,}850{,}000 < w_{i(t-s)} < 500{,}000{,}000 P_{i(t-s)}$, where $P_{i(t-s)}$ is the Consumer Price Index value for period $t-s$. By selecting only a sample of low-wage workers, a relatively

homogenous control group is constructed. This is designed to circumvent the criticism of Card and Krueger (1995), who noted that workers with higher earnings are less likely to change jobs for reasons that are unrelated to the treatment effect of a policy change. Workers who initially earned slightly less than the minimum wage are included since the gross wage is calculated from the net wage and hence is subject to measurement error, as discussed earlier.

Means of variables for this sample are presented in the second column of Table 3. Compared to the population as a whole, the sample is slightly younger and consists of more men and urban-dwellers. It is not surprising that the sample also has a much higher employment rate than the wider population, since the analysis conditions on people who worked in the previous quarter.

The first two columns of Table 4 present the results of estimating Equation 3 with ordinary least squares, including people who were employed in any low-wage job in the previous period.[6] In the first specification, all people in this sample are assigned a value for the treatment variable, y, regardless of their SSK registration status. There is significant evidence that an increase in total labour cost reduces a person's likelihood of remaining employed: a 1 percentage point in the total labour cost ratio reduces the probability of being employed by 0.64 percentage points. At the mean, this implies that a 1% increase in the labour cost ratio yields a 0.2% fall in the probability of being employed.

Since only registered jobs are likely to be directly affected by changes in social security and the minimum wage, arguably the treatment variable should only be calculated for those people who were employed in *registered* jobs paying between 0 and 5 million TL in the previous period. In the second column, those who were unregistered in the previous period are assigned a value of $y = 0$ and a dummy for previous SSK status is introduced. Under this specification, a 1 percentage point rise in the total labour cost ratio reduces employment (for those initially in a registered job) by 0.46 percentage points. This raises the question about why the the results in the first column of Table 4 are actually stronger than those in the second. One possibility is that, as suggested by evidence from other developing countries, policy changes that directly influence wages in

[6] The results are similar when a probit specification is used.

Table 4
Results from ordinary least squares estimation using the individual-level panel

Variable	Previously employed		Previously employed in registered job	
	(i) Employed	(ii) Employed	(iii) Employed	(iv) Employed in registered job
Treatment variable	-0.635***	–	-0.425**	-0.328
	(0.156)		(0.167)	(0.216)
Treatment variable × previously in registered job	–	-0.455***	–	–
		(0.168)		
Age	-0.003***	-0.003***	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Male	0.137***	0.146***	0.122***	0.091***
	(0.015)	(0.015)	(0.017)	(0.019)
Urban	-0.031**	-0.031***	-0.023*	-0.006
	(0.011)	(0.011)	(0.011)	(0.016)
Married	0.075***	0.060***	0.060***	0.094***
	(0.014)	(0.014)	(0.016)	(0.019)
Secondary education	0.054***	0.031***	0.034***	0.093***
	(0.010)	(0.010)	(0.010)	(0.014)
Tertiary education	0.053**	0.024	0.051**	0.118***
	(0.025)	(0.024)	(0.024)	(0.029)
Fourth quarter	-0.003	-0.006	-0.003	-0.043
	(0.011)	(0.011)	(0.011)	(0.015)
Previously in registered job	–	0.125***	–	–
		(0.012)		
Elasticity of treatment variable at mean	-0.019***	-0.008***	-0.011**	-0.009
	(0.004)	(0.003)	(0.004)	(0.006)
R-squared	0.051	0.072	0.051	0.037
Number of observations	5,121	5,121	3,463	3,463

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

the formal sector may have spillover effects on the informal sector (see Maloney and Nuñez (2004)).

In the final two columns of Table 4, the sample is restricted to exclude those people who were previously in unregistered jobs, rather than simply assigning these people zero values for the treatment variable. The treatment variable continues to have a negative effect on the probability of remaining in employment using this sample. On the other hand, when the dependent variable is a dummy for exit from registered employment the treatment variable has a coefficient with a significance level that is just over 10%. This suggests that increases in total labour costs reduce overall employment but have a less clear effect on the likelihood of a person moving to the informal sector.

Again, the results in the last two columns of Table 4 may seem contradictory.

However, those workers who are still employed a quarter or three later are found to have similar values for the treatment variable, regardless of whether they move into the informal sector or not, whereas those who exit employment have significantly larger values of the treatment variable. This means that the regression line will be steeper when those in informal employment are grouped with those in formal jobs, as in the third column of the table.[7]

To avoid the problems caused by the lack of inter-year longitudinal match variables, Table 5 presents results using the synthetic panel, where each observation refers to a combination of demographic characteristics, *j*, in a quarter, *t*. The average value of *E* within a cell is an employment rate between 0 and 1. Hence, unlike the case of the individual-level panel where there are only four types of employment flow between periods, here *E* can increase or decrease by *any* amount between periods. For that reason, the dependent variable used is the *change* in the average employment rate for a particular demographic cell, $\overline{E}$, between two periods and the treatment variable is the average value of *y* within the cell, $\bar{y}$. The following two-way fixed effects model is estimated, where both quarter dummies and cell dummies are included:[8]

$$\overline{E}_{jt} - \overline{E}_{j(t-1)} = \alpha \bar{y}_{j(t-1)} + \mu_j + \lambda_t + \varepsilon_{it} . \qquad (3)$$

The coefficient of interest, α, is now interpreted as the percentage point effect on the employment rate that is caused by a 1 percentage point increase in the treatment variable. Similar to the individual-level analysis, this is expected to be negative. Note that only changes in employment and the treatment variable between two consecutive quarters are considered here. Once again, to ensure a homogenous sample, only cells with an average real wage in *t*-1 that was between 0 and 500 million TL are included in the regressions. Since these are cell-mean data, it is appropriate to weight observations by the number of individuals contained within each cell.[9] However, the dependent variable in Equation 3 involves the employment rate in both periods $t-1$ and *t*. For this reason, observations are

[7] More generally, this result could reflect the fact that the 2004 panel encompasses only a single change in the minimum wage and lacks much variation in total labour costs.

[8] The estimates of α in the first and third columns of Table 5 are scarcely affected if the fraction of registered jobs in the previous quarter is included as an additional regressor.

[9] Results similar to those in Table 5 are obtained when only cells containing a single person are used, although the treatment variable coefficients are not all significant.

Table 5
Results from fixed effects estimation using the synthetic panel

Variable	All employed are treated		Only registered employed are treated	
	(i) Employment rate	(ii) Fraction of registered jobs	(iii) Employment rate	(iv) Fraction of registered jobs
Treatment variable	-1.144*** (0.098)	-0.554*** (0.176)	-1.000*** (0.109)	-2.220*** (0.193)
Quarter effects	Yes	Yes	Yes	Yes
Cell effects	Yes	Yes	Yes	Yes
R-squared	0.543	0.318	0.541	0.325
Number of observations	36,323	30,006	36,323	30,006
Number of cells	20,483	17,062	20,483	17,062

Notes: Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Observations are weighted by the minimum of the cell count in the current and previous period, where the cell counts are, in turn, weighted by the HLFS sampling weight.

weighted by the *minimum* of the number of individuals in the two periods.

The first column of Table 5 indicates that a 1 percentage point increase in the total labour cost ratio will reduce the employment rate by 1.1 percentage points. This is a somewhat larger disemployment effect than found using the individual-level data.[10] The second column of Table 5 uses as a dependent variable the fraction of employed people who work in registered jobs.[11] The results suggest that the fraction of jobs that are registered for social security purposes will decrease by 0.6 percentage points in response to a 1 percentage point rise in total labour cost ratios.

The third and fourth columns of Table 5 set $y = 0$ for workers in informal employment when constructing $\bar{y}$. Since, by definition, non-registered jobs are not covered by the social security system, this should give a more accurate measure of the average labour costs faced by employers of a particular type of worker. This definition of the treatment variable is seen to have a similar effect on overall employment as the previous one, however it has a much bigger effect on the share of jobs that are registered.

[10] If all cells contained one person, the interpretation of the treatment variable coefficient would be the same as in the first column of Table 4, since the dependent variable would only take the values -1 or 0. As noted earlier, the majority of cells fall into this category and the results are similar when the sample is restricted to these cases.

[11] Hence, it is not comparable with the second column of Table 4, in which the dependent variable was a dummy variable for whether a person had a registered job or not and therefore grouped informal employment and non-employment in the same category.

Table 6
Fixed effects estimates with interactions of the treatment variable

Variable	All employed are treated		Only registered employed are treated	
	(i) Employment rate	(ii) Fraction of registered jobs	(iii) Employment rate	(iv) Fraction of registered jobs
Women	-2.001***	-1.337***	-1.842***	-3.904***
	(0.228)	(0.537)	(0.253)	(0.583)
Men	-0.985***	-0.481**	-0.833***	-2.046***
	(0.105)	(0.182)	(0.118)	(0.202)
Rural	-1.090***	-0.394**	-0.961***	-2.855***
	(0.223)	(0.390)	(0.253)	(0.440)
Urban	-1.155***	-0.369*	-1.007***	-2.084***
	(0.107)	(0.192)	(0.119)	(0.211)
Aged 15-29	-1.416***	-0.707*	-1.368***	-2.960***
	(0.213)	(0.400)	(0.254)	(0.487)
Aged 30-64	-1.082***	-0.525***	-0.926***	-2.100***
	(0.107)	(0.189)	(0.118)	(0.206)
Primary education	-1.148***	-0.742***	-0.979***	-2.598***
	(0.122)	(0.217)	(0.139)	(0.245)
Secondary education	-1.113***	-0.281	-1.021***	-1.703***
	(0.153)	(0.2747)	(0.166)	(0.294)
Tertiary education	-1.581**	-0.084	-1.110	-1.064
	(0.682)	(1.335)	(0.730)	(1.458)

Notes: Standard errors are presented in. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Observations are weighted by the minimum of the cell count in the current and previous period, where the cell counts are, in turn, weighted by the HLFS sampling weight.

A 1 percentage point increase in the labour cost ratio yields a 2.2 percentage point fall in the registration rate. Taken in tandem, the estimates suggest that the increases in labour costs between 2002 and 2005 reduced overall employment and also shifted jobs from the formal sector to the informal sector. Hence, these results are stronger than those found using the individual-level panel, where there was no conclusive evidence that the minimum wage influenced the formal/informal employment mix.

It is possible that changes in labour costs have larger disemployment effects on certain demographic groups. To examine this, Table 6 repeats the regressions in Table 5 interacting the treatment variable by, in turn, sex, urban status, age group and education level. A given change in the treatment variable is found to have a bigger effect on the employment rates of women than those of men. In addition, women are more likely to shift from the formal sector to the informal sector in response to an increase in labour costs. In contrast, people living in urban areas, where non-registered jobs are relatively

scarce, are most likely to exit employment in response to a rise in labour costs, whereas rural-dwellers tend to switch to jobs in the non-registered sector.

People aged under 30 are more likely to switch from formal to informal employment than older workers, but they also have a higher disemployment rate. Somewhat surprisingly, people with a secondary education are as likely to lose their jobs in response to labour cost increases as less-educated workers. This is likely to be due to the fact that those with a secondary education tend to be younger and, hence, more vulnerable to unemployment than older workers (see also Economic Research Forum (2005)).

Only *increases* in payroll taxes are observed during the period analysed in this paper meaning that it is impossible to know whether tax cuts would have quantitative effects that are symmetric to those of tax increases. If it is assumed that they do, the results in Tables 5 and 6 suggest that tax cuts may be more effective if targeted at particular groups. For example, under the scenario where only those with registered jobs are affected by policy changes, a 1 percentage point reduction in the labour cost ratio across the board is predicted to yield a 1 percentage point increase in the employment rate. However, the labour cost elasticity among those aged under 30 is greater than among older workers. Since young workers comprise 17% of the workforce, the coefficients in Table 6 indicate that a 4 percentage point reduction in the labour cost ratio among only young workers would result in a 0.9 percentage point increase in the overall employment rate.[12] In other words, such a tax cut would have approximately the same effect as a universal 1 percentage point reduction, although it would entail only an average 0.7 percentage point reduction in labour costs across the entire workforce. Similarly, tax cuts targeted at women and urban workers are likely to be more cost-effective than across-the-board cuts.

Finally, the analysis was repeated using only observations from the upper end of the wage distribution, where changes in the contribution ceiling between 2002 and 2005 gave rise to variation in the total labour cost ratio. The same treatment variable as before was constructed, however now only cells with an average real wage in the previous quarter above 1 billion TL are included. The results of these regressions are presented in Table A1. As expected, the coefficients are negative in all cases, indicating that demographic groups that experience an increase in labour costs tend to also suffer a fall in the

[12] This is because $0.17 \times 1.368 \times 4 = 0.93$.

employment rate and the fraction of jobs in the formal sector. The relationship is only significant in the final specification, however, which is not surprising in light of the small number of high-wage earners, as discussed in the previous section.

6. Conclusion

This paper has examined the relationship between the level of social security taxes paid by firms in Turkey and both the level of employment and the fraction of jobs that are in the formal sector, as well as the effect of minimum wage increases. 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 synthetic panel dataset constructed from the Turkish Household Labour Force Survey for 2002-2005, estimates were obtained that indicate that a 1 percentage point increase in the total labour cost/wage ratio yields a 1 percentage point decrease in the employment rate. Furthermore, a 1 percentage point increase in the labour cost ratio will result in a 2.2 percentage point decrease in the fraction of jobs that are registered for social security purposes. By interacting the treatment variable with demographic characteristics, it is found that some groups are more vulnerable to policy changes than others. Women, urban-dwellers and those under 30 have the strongest overall disemployment effects. Females, young workers and rural workers are also most likely to switch from formal to informal employment in response to an increase in labour costs.

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Appendix 1: Construction of the synthetic panel

The first step was to order individuals within households by their relationship to the head, age and sex, with the household head always listed first. This means that household members should retain the same position within the household over time. Next, the employment, gross wage and treatment variables are averages within narrowly-defined demographic categories. These categories are defined by a person's relationship to the household head, age category (5-year interval), sex, marital status, illiteracy status, education level, urban status, household size, as well as the age category, sex and education level of *each* person within the household, using their position number as defined above. These cell means are weighted by the HLFS sampling weights.

The weighted number of individuals within each cell is also calculated and this forms the basis for the regression weights used in Section 5. The distribution of the unweighted cell counts is presented in Table A2. These vary between 1 and 60, with a mean of 2.80, and are equal to 1 in almost 60% of cases, implying that the synthetic panel largely coincides with the true panel. However, in those instances where there are multiple potential longitudinal matches, an average across all candidate households is used, thus avoiding the problems associated with incorrect matches.

Appendix 2: Supplementary tables

Table A1
Results from fixed effects estimation using the synthetic panel of high earners

Variable	All employed are treated		Only registered employed are treated	
	(i) Employment rate	(ii) Fraction of registered jobs	(iii) Employment rate	(iv) Fraction of registered jobs
Treatment variable	-0.306	-0.778	-0.074	-3.749**
	(1.443)	(1.724)	(1.448)	(1.726)
Quarter effects	Yes	Yes	Yes	Yes
Cell effects	Yes	Yes	Yes	Yes
R-squared	0.774	0.796	0.819	0.797
Number of observations	3,519	3,308	3,519	3,308
Number of cells	2,690	2,525	2,690	2,525

Notes: Standard errors are presented in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.
Observations are weighted by the minimum of the cell count in the current and previous period, where the cell counts are, in turn, weighted by the HLFS sampling weight.

Table A2
Distribution of cell counts in synthetic panel dataset

Unweighted cell count	Number of cells	Unweighted fraction of cells (%)	Weighted fraction of cells (%)
1	20,826	57.34	23.88
2	5,845	16.09	11.39
3	2,777	7.65	7.68
4	1,757	4.84	6.37
5	1,180	3.25	5.33
6	841	2.32	4.71
7	589	1.62	3.89
8	427	1.18	3.05
9	310	0.85	2.62
10	272	0.75	2.49
More than 10	1499	4.13	28.62
Total	36,323	100.00	100.00