

How Different are the Wage Curves for Formal and Informal Workers? Evidence from Turkey

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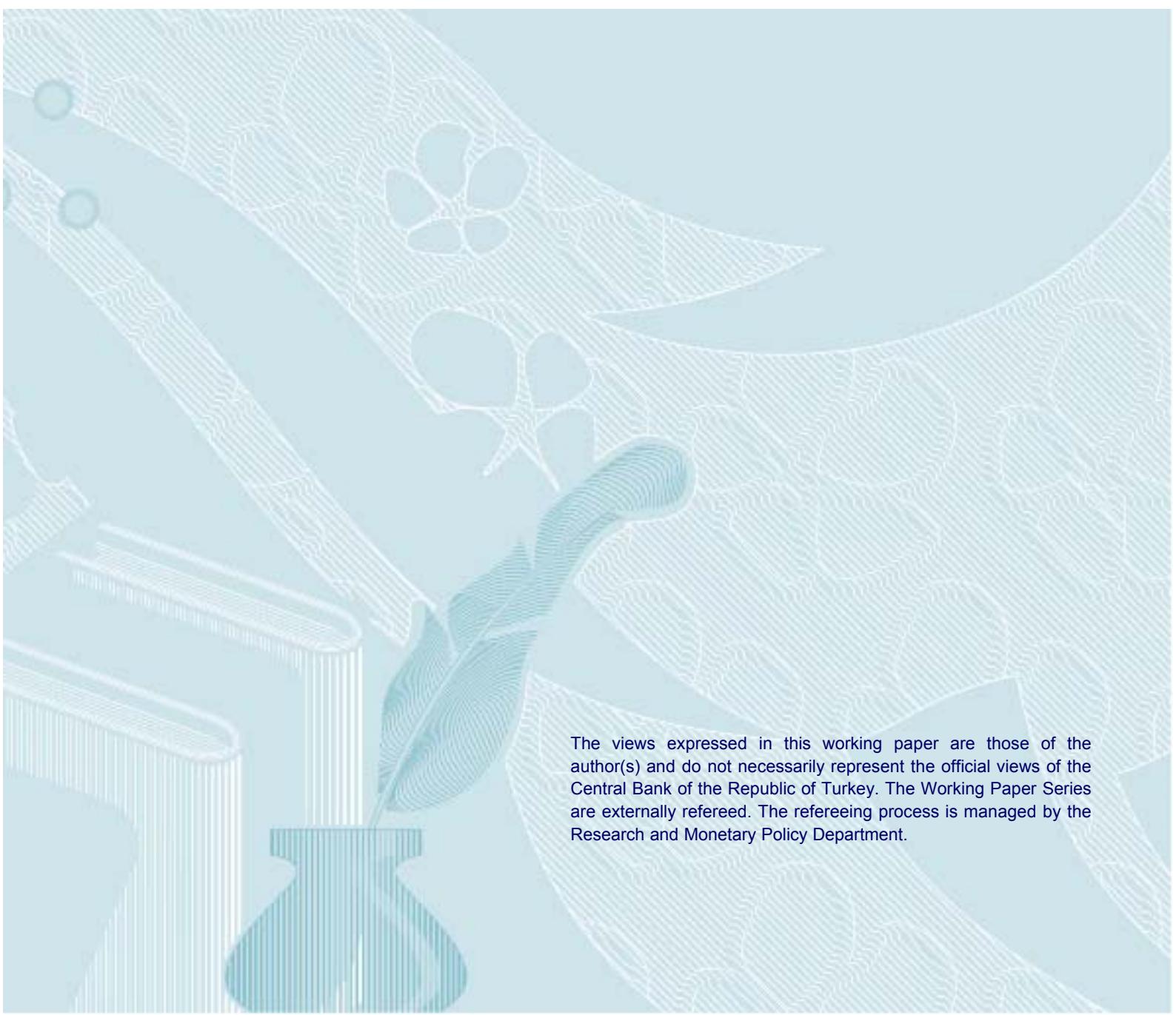
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How Different are the Wage Curves for Formal and Informal Workers? Evidence from Turkey

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Abstract

This paper presents wage curves for formal and informal workers using a rich individual level data for Turkey over the period 2005-2009. The wage curve is an empirical regularity describing a negative relationship between regional unemployment rates and individuals' real wages. While this relationship has been well documented for a number of countries including Turkey, less attention has focused on how this relationship differs for informal versus formal employment. This is of utmost importance for less developed countries where informal employment plays a significant role in the economy. Using the Turkish Household Labor Force Survey observed over 26 NUTS-2 regions, we find that real hourly wages of informal workers in Turkey are more sensitive to variations in regional unemployment rates than wages of formal workers. This is true for all workers as well as for different gender and age groups.

Keywords: Formal/Informal Employment; Wage Curve; Regional Labor Markets.

JEL classification: C26; J30; J60; O17

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1 Introduction

Informal employment is one of the key characteristics of developing country labor markets. Large numbers of workers in developing countries accept jobs with lower wages, worse working conditions and/or without access to social security coverage. According to a recent study by the OECD (2009), worldwide informal employment constitutes an average of 60% of total non-agricultural employment. This share varies from nearly 50% in Latin America, the Middle East and North Africa to almost 70% in South and Southeast Asia, and 75% in Sub-Saharan Africa. The majority of workers are expected to be still working in the informal sector in the foreseeable future, which highlights the importance of doing more research in this area, see Freeman (2010).

In this paper we estimate wage curves for formal and informal workers using a rich individual level dataset for Turkey over the period 2005-2009 from Turkstat Household Labor Force Survey. This survey provides information on a large set of demographic and job-related individual characteristics, including whether the individual is registered with the legally mandatory *Sosyal Güvenlik Kurumu* (Social Security Institution, SSI) at his current job.² Following Maloney (2004), OECD(2009) and Ramos et al. (2010), we define formal workers as those who are registered with the social security administration. During the sample period that we investigate, approximately 28 percent of wage earners in Turkey did not have the protection of the mandatory social security system.

Our empirical strategy is to estimate a wage curve for the formal and informal sectors in Turkey and to compare the unemployment elasticity of real wages across these groups. The empirical wage curve, pioneered by Blanchflower and Oswald (1990), estimates the sensitivity of individual wages to regional unemployment rates. By using a long list of countries, Blanchflower and Oswald (1994, 2000) found that the unemployment elasticity of real wages in many countries is around -0.1. This "empirical law" was corroborated by and large for several other countries and data sets.³ In fact, Baltagi et al. (2012) finds that the corresponding estimate for Turkey over the period 2005-2008 is -0.099. This study uses the same data but updated for the period 2005-2009.⁴

Our study is also closely related to the literature comparing wage earnings for formal versus informal workers.⁵ In fact, Baskaya and Hulagu (2011) show that for Turkey, informal

²In Turkey, all workers must be registered in the Social Security Institution. This provides the workers with insurance for work-related accidents and illness, sickness, pregnancy, disability, old age and death as well as a retirement plan. Social security contributions are payable by workers and employers. Workers' contribution is 14 percent of gross salary, which is deductible in determining taxable income, whereas employee contribution is 19.5 percent.

³See Card (1995) for a critique as well as an excellent review.

⁴Although the Turkstat Household Labor Force Survey (THLFS) provides individual level data on a wide range of demographic and job-related characteristics starting from 2002, we focus on the post-2005 period, due to the absence of data on hours worked by the individuals for the 2002-2004 period.

⁵See Mazumdar (1976) for Peru; Mazumdar (1981) for Malaysia; Roberts (1989) and Gong and Van

workers earn approximately 15-20 percent less than their formal counterparts. In contrast to the literature focusing on the wage gap between formal and informal workers, this paper focuses on the sensitivity of formal and informal workers wages to regional unemployment variations in Turkey.⁶

Our findings indicate that workers without SSI coverage in Turkey have a larger unemployment elasticity of hourly wages. The magnitude of the difference between formal and informal workers varies across gender, education, experience and age groups. In almost all cases, we find that informal workers have a higher unemployment elasticity of hourly wages. In addition, wages of informal workers who are younger, less educated or less experienced are more sensitive than those who are older, with more education or with more job experience. Moreover, our results reveal a huge variation across gender groups. In fact, we find that females in the informal labor markets face the highest sensitivity to regional unemployment variations.

In order to provide more insights into the link between informal labor markets and the sensitivity of the wages to unemployment, we estimate the wage curves for formal and informal workers within the sample of observationally similar individuals. This is important because the steeper wage curves for the informal workers may be due to the fact that the high skilled individuals might have chosen to participate in the formal sector. This in turn may suggest that the steepness of the wage curve among the informal workers may be due to the lower productivity of those individuals. In order to check the sensitivity of our results to potential selection problems, we first estimate a probit model and predict the probability of being a formal employee conditional on observed characteristics of the individuals. Next, we estimate our wage curves for formal and informal workers based on two subsamples characterized by individuals who were above or below the median probability of being a formal worker. The fact that we also find steeper wage curves for informal workers among individuals with similar predicted probabilities of being a formal worker supports the view that the informal employment may be contributing to the flexibility of the labor markets in Turkey. Of course this result is subject to the caveat that the unobserved heterogeneity between formal and informal workers cannot fully be addressed due to data limitations.

The rest of the paper is structured as follows. Section 2 introduces the main features of our dataset. In section 3, we discuss our empirical strategy to estimate the unemployment elasticities of real hourly wages. Section 4 presents our empirical results concerning how informality of employment matters both for the overall sample and with respect to worker types. Section 5 presents our concluding remarks.

Soest (2001) for Mexico; Pradhan and Van Soest (1995) for Bolivia, Tansel (1999) for Turkey; and Pratap and Quintin (2006) for Argentina.

⁶The number of wage curves studies that focus on the formality status of the workers is relatively limited. See Berg and Contreras (2004) for an estimation of the informal wage curve for Chile, and Ramos et al. (2010) for Colombia.

2 Data

The data used in this study is taken from the annual individual level data releases of the Turkstat Household Labor Force Survey (THLFS) for the 2005-2009 period.⁷ As we are interested in how hourly wages of individuals respond to aggregate variations in the regional unemployment rates, we exclude unpaid family workers, self-employed individuals and individuals stated as employers in the survey. Also, due to possible measurement problems about their earnings, individuals younger than 15 years of age are excluded from the sample. Following the OECD (2009), we exclude the workers in the agricultural sector, as it is hard to distinguish between formal and informal employment in this sector. This yields 367,095 workers. In all regressions, we use the population weights provided by Turkstat.

Following the definition by OECD (2009), we categorize workers who are not registered by the SSI as informal workers.⁸ The definition of informal employment by the International Labour Organization (ILO) includes not only the informal employees working in formal sector enterprises, but also all workers employed in informal sector enterprises and households producing goods exclusively for their own final use.⁹ However, according to the McKinsey Global Institute (2003), most of the businesses in Turkey are registered and the informal economic activity mostly takes place in the form of partial reporting of revenues and employment. This provides another rationale for our choice for the informality measure.

The data on hourly wages is obtained by dividing the monthly nominal after tax cash earnings, which exclude SSI contributions, by total hours worked in a month. We deflate the hourly wages into 2008 prices using regional price indices provided by Turkstat.¹⁰ Finally, to measure the labor market activity, we use unemployment rates provided by Turkstat at the NUTS-2 level for 26 regions.¹¹

3 The Model

Following the general practice in the literature, we estimate the wage curve relationship using a Mincerian wage regression extended to allow for the potential wage effects of varia-

⁷All private households who are living in the territory of the Republic of Turkey are covered by the THLFS. Residents of schools, dormitories, kindergartens, rest homes for elderly persons, special hospitals, military barracks and recreation quarters for officers are not covered. For more information, see the Turkstat website.

⁸This definition is also in line with various studies, such as Maloney (2004) and Ramos et al. (2010).

⁹See also Freeman (2010).

¹⁰Turkstat computes regional price indices by aggregating the elementary indices at the regional level, which are simple ratios of geometric mean of prices using the Laspeyres formula. In the aggregation process, the weights used by Turkstat for items in the consumption basket are proportional to expenditure shares obtained in 2004-2005-2006 Household Consumption Surveys.

¹¹When calculating the NUTS-2 level regional unemployment rates, Turkstat includes both types of workers in terms of registry status to SSI.

tions in the aggregate regional unemployment rates.¹² As our main focus is on whether the wage curve relationship differs with respect to the formality status of the workers, we estimate this equation separately for formal and informal workers. Using the binary indicator f , equal to 1 for formal workers and 0 for informal workers, our statistical model becomes:

$$\log W_{irt} = \alpha^f + \beta^f \log U_{rt} + X'_{irt} \gamma^f + \mu_r^f + \lambda_t^f + \nu_{irt}^f, \quad f = 0, 1 \quad (1)$$

where W_{irt} is the real hourly wage rate of individual i observed in region r at time t , U_{rt} is the non-agricultural unemployment rate in region r at time t . X_{irt} represents the set of individuals' observed characteristics including age, gender, marital status, employment location, years of education, enrollment in school, years of tenure at the firm, firm size, industry of employment according to the NACE Rev. 1.1 classification, occupational group according to the ISCO-88 classification, permanency of the job and part-time work.¹³ In addition, we make use of whether the individuals had another job from the one reported as the main activity, and whether the individual was employed in the same month of last year. These variables are highly correlated with formality status and wages and can be viewed as proxy variables partially controlling for the unobserved skill and preference differences between formal and informal workers.¹⁴ In order to account for the unobserved time-invariant regional differences and the shocks common across all regions within worker types, we also include region effects and year fixed effects denoted by μ_r^f and λ_t^f respectively. Finally, ν_{irt} is the remainder error term.

4 Empirical Results Regarding the Wage Curves for Formal and Informal Workers

4.1 Fixed Effects Results Treating Unemployment Rates as Predetermined

Table 1 presents the estimation results for the unemployment elasticity of real wages β , for all workers as well as formal and informal workers.¹⁵ Panel A, denoted by FE, present the estimation results with region and time fixed effects, treating the regional unemployment rates as predetermined. The results show that the unemployment elasticity of real wages are low, yielding -0.040 for non-agricultural workers. Table 1 also finds that the elasticity for

¹²See Blanchflower and Oswald (1990, 1994, 2000) for pioneering work on the wage curve. See Baltagi et al. (2012) for recent evidence on the existence of a wage curve relationship in Turkey.

¹³These variables are explained in details in the Data Appendix.

¹⁴As we later present in Table 3, having more than one job is negatively associated with being a formal worker, whereas being employed in the previous year is positively associated with being a formal worker.

¹⁵In order to save space, we only report β . However, the complete set of results are available upon request from the authors.

Table 1: The Unemployment Elasticity of Real Hourly Wages By Formality/Informality Status

| | All | Formal | Informal |
|------------------|----------------------|----------------------|----------------------|
| Panel A: FE | -0.040 (0.008)*** | -0.029 (0.009)*** | -0.049 (0.018)*** |
| R^2 | 0.599 | 0.585 | 0.309 |
| | All | Formal | Informal |
| Panel B: FE-2SLS | -0.105 (0.020)*** | -0.069 (0.021)*** | -0.264 (0.045)*** |
| R^2 | 0.599 | 0.585 | 0.308 |
| K-P F stat. | 5.0e04 | 3.7e04 | 1.2e04 |
| Obs. | 367,095 | 274,495 | 92,600 |

Notes:

- a) Robust standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1%, respectively.
- b) In FE-2SLS specification, the logarithm of non-agricultural unemployment rate by region in the previous year is used as an instrument for the logarithm of non-agricultural unemployment rate by region at time t.
- c) The set of observed characteristics which are used to control for individual heterogeneity include age, gender, marital status, employment location, years of education, enrollment to a school, years of tenure at the firm, firm size, industry of employment according to the NACE Rev. 1.1 classification, occupational group according to the ISCO-88 classification, permanency of the job, part-time work, other activity to earn income and employment status in the same month of last year.
- d) Robust Kleibergen-Paap Wald rk F statistics suggest that the hypothesis that lagged value of regional unemployment rates is a weak instrument for contemporaneous value of regional unemployment rates is rejected, considering the Stock-Yogo "rule-of-thumb" critical value for weak instrument is 10.

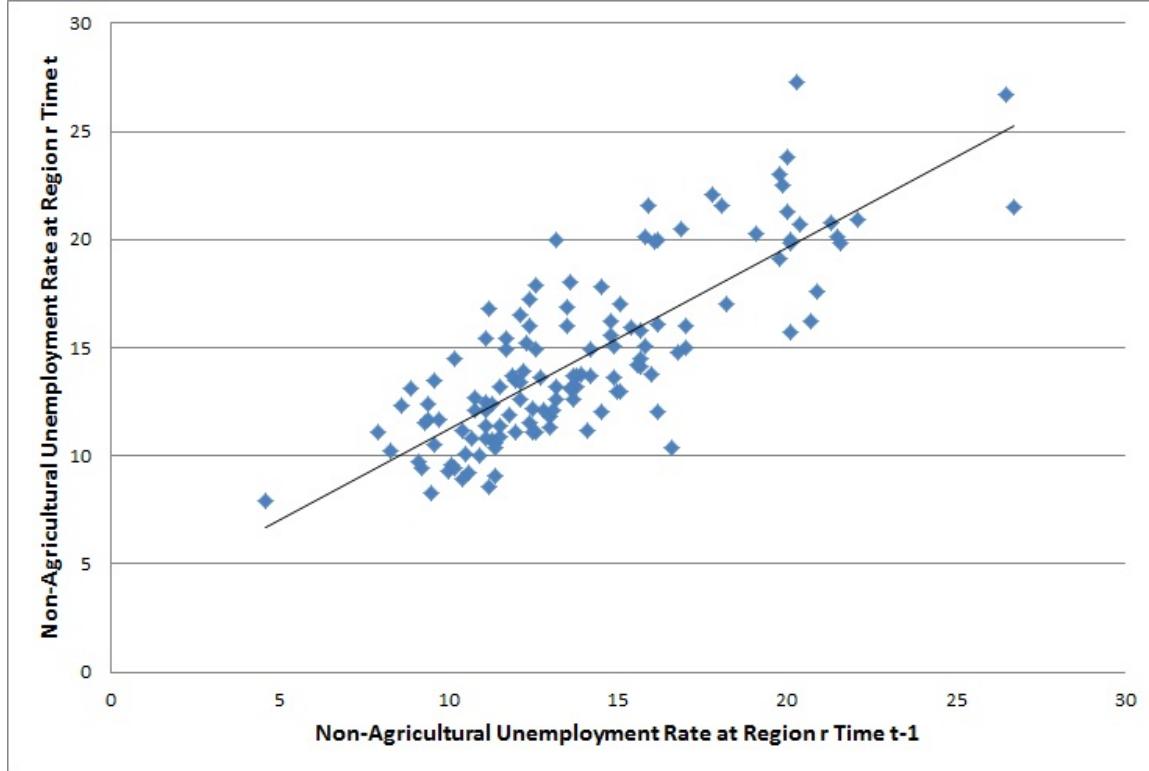
formal workers is lower than that for informal workers. This is -0.029 (formal) as compared to -0.049 (informal).

4.2 Accounting for Potential Endogeneity of Unemployment Rates

The preceding section does not consider the fact that the wages and unemployment rates are jointly determined. If the regional unemployment rate is endogenous, then the FE estimates yield biased and inconsistent estimates. Empirical evidence indicating the existence of such a bias in the FE estimator has been provided by Baltagi and Blien (1998) for Germany, Shilov and Möller (2009) for Russia and more recently by Baltagi et al. (2012) for Turkey. Following Baltagi and Blien (1998), we use the one year lagged value of the unemployment rate as an instrument for the unemployment rate at time t . Figure 1 shows that there is a strong correlation, approximately 0.77, between the regional unemployment rates at time t and $t - 1$, suggesting that lagged unemployment rates by region is not a weak instrument for the contemporaneous value of the regional unemployment rates. We also formally reject the hypothesis that the lagged unemployment rate is a weak instrument for the contemporaneous unemployment rate using the Kleibergen-Paap F-statistic, which are significantly above the Stock-Yogo critical values (see Panel B of Table 1).

The estimation results in Panel B of Table 1 are in line with the earlier findings in the literature, as they suggest much higher elasticities (in absolute value) when the unemployment rates are not treated as predetermined. The results for this specification, denoted by

Figure 1: Persistency in Regional Unemployment Rates



Notes: Data points reflect unemployment rates by region and time, which are available from Turkstat.

FE-2SLS, indicate an elasticity of -0.105. This is consistent with what Blanchflower and Oswald (1994) regarded as an empirical regularity observed across different economies.

Panel B of Table 1 also finds that the estimated unemployment elasticity of hourly real wages for informal workers is more than 3 times larger than the estimated elasticity for formal workers. In fact, this elasticity is estimated at -0.069 for formal workers as compared to -0.264 for informal workers.

4.3 The Sensitivity of the Unemployment Elasticity of Real Wages for Formal and Informal Workers by Worker Types

Table 2 presents the sensitivity of the unemployment elasticity of real wages for formal and informal workers by worker types. We find that the real hourly wages of females are more sensitive to variations in the unemployment rates than males (-0.164 as compared with -0.088). This is also true for younger workers as compared with older workers (-0.127 as compared with -0.056), and workers having less years of tenure compared with those having more years of tenure (-0.180 as compared with -0.032). On the other hand, the difference between workers with low and high levels of education is not as dramatic (-0.098 compared with -0.089).

Table 2: The Unemployment Elasticity of Real Hourly Wages By Formality/Informality Status and Worker Types

| PANEL A: Gender | | | | | | |
|-----------------|------------|-----------|------------|------------|------------|------------|
| | Male | | | Female | | |
| FE-2SLS | All | Formal | Informal | All | Formal | Informal |
| | -0.088 | -0.058 | -0.177 | -0.164 | -0.119 | -0.525 |
| | (0.022)*** | (0.024)** | (0.046)*** | (0.042)*** | (0.039)*** | (0.143)*** |
| R^2 | 0.586 | 0.569 | 0.328 | 0.655 | 0.644 | 0.347 |
| K-P F stat. | 3.8e04 | 2.7e04 | 1.0e04 | 1.1e04 | 1.0e04 | 0.2e04 |
| Obs. | 286,034 | 212,916 | 73,118 | 81,061 | 61,579 | 19,482 |

| PANEL B: Age | | | | | | |
|--------------|-----------|---------|------------|------------|------------|------------|
| | Old | | | Young | | |
| FE-2SLS | All | Formal | Informal | All | Formal | Informal |
| | -0.056 | -0.020 | -0.283 | -0.127 | -0.115 | -0.199 |
| | (0.028)** | (0.029) | (0.075)*** | (0.027)*** | (0.029)*** | (0.056)*** |
| R^2 | 0.591 | 0.584 | 0.284 | 0.562 | 0.540 | 0.271 |
| K-P F stat. | 2.5e04 | 1.9e04 | 0.5e04 | 2.5e04 | 1.8e04 | 0.7e04 |
| Obs. | 167,645 | 130,656 | 36,989 | 199,450 | 143,839 | 55,611 |

| PANEL C: Tenure | | | | | | |
|-----------------|---------|---------|------------|------------|------------|------------|
| | High | | | Low | | |
| FE-2SLS | All | Formal | Informal | All | Formal | Informal |
| | -0.032 | -0.004 | -0.255 | -0.180 | -0.138 | -0.290 |
| | (0.027) | (0.028) | (0.081)*** | (0.027)*** | (0.030)*** | (0.053)*** |
| R^2 | 0.595 | 0.551 | 0.288 | 0.514 | 0.502 | 0.311 |
| K-P F stat. | 2.2e04 | 1.8e04 | 0.3e04 | 2.8e04 | 1.9e04 | 0.8e04 |
| Obs. | 137,393 | 119,617 | 17,776 | 229,702 | 154,878 | 74,824 |

| PANEL D: Education | | | | | | |
|--------------------|------------|------------|----------|------------|---------|------------|
| | High | | | Low | | |
| FE-2SLS | All | Formal | Informal | All | Formal | Informal |
| | -0.089 | -0.073 | -0.139 | -0.098 | -0.037 | -0.288 |
| | (0.026)*** | (0.026)*** | (0.094) | (0.030)*** | (0.034) | (0.051)*** |
| R^2 | 0.585 | 0.539 | 0.430 | 0.375 | 0.347 | 0.260 |
| K-P F stat. | 2.6e04 | 2.3e04 | 0.3e04 | 2.2e04 | 1.3e04 | 0.9e04 |
| Obs. | 178,755 | 158,767 | 19,988 | 188,340 | 115,728 | 72,612 |

Notes:

- a) Robust standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1%, respectively.
- b) Young (old) refers to individuals younger (older) than sample mean value for years of age, which is 34.1. Low (high) tenure refers to individuals with tenure less (more) than the sample mean value, which is 6.94 years. Low (high) education refers to individuals with less than or equal to 8 years of schooling (more than 8 years of schooling).
- c) In FE-2SLS specification, the logarithm of non-agricultural unemployment rate by region in the previous year is used as an instrument for the logarithm of non-agricultural unemployment rate by region at time t.
- d) The set of observed characteristics which are used to control for individual heterogeneity include age, gender, marital status, employment location, years of education, enrollment to a school, years of tenure at the firm, firm size, industry of employment according to the NACE Rev. 1.1 classification, occupational group according to the ISCO-88 classification, permanency of the job, part-time work, other activity to earn income and employment status in the same month of last year.
- e) Robust Kleibergen-Paap Wald rk F statistics suggest that the hypothesis that lagged value of regional unemployment rates is a weak instrument for contemporaneous value of regional unemployment rates is rejected, considering the Stock-Yogo "rule-of-thumb" critical value for weak instrument is 10.

Next, we analyze how informal and formal workers within different categories differ from each other with respect to the unemployment elasticity of real hourly wages. Panel A of Table 2 finds that there is a dramatic difference in the informal unemployment elasticity between males and females (-0.177 as compared to -0.525). Panel B of Table 2 finds that both formal and informal young workers are sensitive to variations in unemployment rates (-0.115 as compared to -0.199). In contrast, among older workers, only the informal workers display a significant wage curve relationship. Panel C of Table 2 finds that wages of informal workers are more sensitive than their formal counterparts both in low and high tenure subgroups. Formal workers with high tenure had an insignificant wage curve. Finally, Panel D of Table 2 finds that the highest unemployment elasticity of real hourly wages is attained by informal workers with low education. Whatever worker type we considered, it is clear that the informal elasticity estimates are higher in absolute value than their formal counterparts.

4.4 The Wage Curves for Informal and Formal Workers with Similar Observable Characteristics

The preceding sections find that the wage curves for informal workers are steeper than those for formal workers and may imply that informal employment is a key factor for labor market flexibility. However, if workers with formal and informal jobs have distinct observed and unobserved characteristics and are selected to formal and informal markets on the basis of these characteristics, then our results are subject to sample selection and one cannot conclude that informal labor markets play a key role for higher wage flexibility.

In this section, we attempt to deal with the selection issue subject to our data limitations. In particular, we use a two-step procedure for estimating wage curves for formal and informal workers who are similar in terms of the observed characteristics. In the first step, we estimate a probit model for predicting the probability of being a formal worker conditional on the individual's observed characteristics, such as age, education, gender, marital status, as well as job-related characteristics such as years of tenure, occupation, and industry. Using the predicted probabilities, the second estimation step entails dividing the sample into two subsamples, i.e., individuals below and above the median predicted probability of being a formal worker. We then estimate the wage curves for formal and informal workers for these two subsamples separately. In a sense, our estimation strategy can be regarded as using propensity scores on being a formal worker conditional on observed traits in order to compare the slope of wage curves across individuals with similar observed characteristics but different formality status.

Table 3 presents the probit marginal effects estimates relating the formality status and the individual's observed characteristics. Here the dependent variable takes the value of

Table 3: Determinants of Formality Status

| | |
|-------------------------|-----------------------|
| Age | 0.034 (0.001)*** |
| Age ² | -0.0004 (0.000)*** |
| Female | -0.055 (0.002)*** |
| Single | 0.026 (0.005)*** |
| Married | 0.067 (0.005)*** |
| Urban | -0.005 (0.002)*** |
| Enrolled | 0.048 (0.003)*** |
| Permanent | 0.294 (0.005)*** |
| Part-time | -0.213 (0.008)*** |
| More than one job | -0.033 (0.006)*** |
| Employed last year | 0.072 (0.003)*** |
| Experience | 0.015 (0.000)*** |
| Experience ² | -0.0003 (0.000)*** |
| Firm Size (10-24 Emp) | 0.108 (0.001)*** |
| Firm Size (25-49 Emp) | 0.146 (0.001)*** |
| Firm Size (50-249 Emp) | 0.200 (0.001)*** |
| Firm Size (250-499 Emp) | 0.146 (0.001)*** |
| Firm Size (Emp>500) | 0.161 (0.001)*** |
| Primary school grads | 0.088 (0.003)*** |
| Secondary school grads | 0.099 (0.002)*** |
| High school grads | 0.158 (0.003)*** |
| University grads | 0.176 (0.002)*** |
| Number of Observations | 367,095 |

Notes:

- a) Marginal effects; Estimated with probit to predict the propensity scores.
- b) Other control variables include occupation and industry dummies.
- c) Omitted categories for marital status, firm size and education are divorced or widowed, less than 10, and not completed any educational institution, respectively.
- d) The numbers in parentheses are robust standard errors clustered for within region correlations and *, ** and *** represent significance at 10%, 5% and 1%, respectively.

1 for workers registered with the social security system and zero otherwise. The potential determinants of the formality status involves age, gender, job tenure, marital status, size of the firm where individuals are working, education level, occupation and industry of employment. These results are mostly in line with our expectations. To summarize, we find that the probability of being a formal worker increases monotonically with education level, the years of job tenure and age, where the difference in the propensities due to an extra year of job tenure and age decreases with the level of job tenure and ages. Males are more likely to be formal workers than females, conditional on other observed characteristics. We also find that married individuals are more likely to be formal workers.

The results presented in Table 4 show that informal and formal workers with predicted probability of being formal either below or above the median probability have different wage curves.¹⁶ In particular, the unemployment elasticities of real wages for informal and formal workers in the subsample of predicted probabilities below the median are -0.247 and -0.151 respectively. Similarly, the elasticities for the informal and formal workers with a predicted probability of being a formal worker in the upper half of the distribution is -0.312 and -0.054. The fact that informal workers have steeper wage curves than formal workers with similar predicted probabilities of being a formal worker provide support for the explanation that the informality of the employment status is a factor contributing to the higher sensitivity of wages to the unemployment variations. These results should be tempered by the fact that any unobserved difference among individuals that would matter for the formality status would affect the propensity scores and in turn the role of informal employment in labor market flexibility.

These higher elasticities and the stronger wage curve relationship for the informal workers contribute to our understanding of how the labor markets in developing countries operate. While the share of the informal labor markets is generally not negligible in less developed countries, the number of studies focusing on how the wage curve relationship differs for informal and formal workers are quite limited.

Also, our results suggest that the existence of informal labor markets contributes to the flexibility of real wages in the Turkish economy. Reducing the size of informal labor markets could potentially be an important source of tax revenues as well as social security contributions. In addition, these policies can also help in closing the wage gap between formal and informal workers in Turkey, which has recently been documented by Baskaya and Hulagu (2011). From a macroeconomic perspective, this also suggests that workers with less protected jobs play a key role in the adjustment of labor markets to shocks that change the unemployment rates. As a consequence, reforms aiming at reducing the size of informal labor markets may reduce the degree of overall wage flexibility in the economy,

¹⁶We also reach similar results when we define the subsamples with respect to deciles, quintiles or quartiles of the distribution of the predicted formality probabilities.

Table 4: The Unemployment Elasticity of Real Hourly Wages By Formality/Informality Status and Propensity Scores

| | Formal | Informal |
|--------------|----------------------|----------------------|
| Above median | -0.054 (0.023)** | -0.312 (0.191)* |
| Below median | -0.151 (0.039)*** | -0.247 (0.044)*** |

Notes:

- a) Results of FE-2SLS specification are given. The logarithm of non-agricultural unemployment rate by region in the previous year is used as an instrument for the logarithm of non-agricultural unemployment rate by region at time t.
- b) Robust standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1%, respectively.
- c) The set of observed characteristics which are used to control for individual heterogeneity include age, gender, marital status, employment location, years of education, enrollment to a school, years of tenure at the firm, firm size, industry of employment according to the NACE Rev. 1.1 classification, occupational group according to the ISCO-88 classification, permanency of the job, part-time work, other activity to earn income and employment status in the same month of last year.

which is one of the key elements of the labor market adjustment mechanisms over the business cycles. Therefore, our results may suggest that the policies aiming at reducing the size of informal labor market should be conducted in tandem with other policy measures that would compensate for the potential loss in the labor market's flexibility.

5 Conclusion

Using a rich individual level data set for Turkey observed over the period 2005-2009, this paper estimated wage curve relationships with a particular focus on whether informal and formal workers differ from each other with respect to the sensitivity of real hourly wages to unemployment rates. We find that the unemployment elasticity of real hourly wages for informal workers is around -0.25. It is remarkable that this figure is 2.5 times the estimated elasticity obtained for all workers and 3.5 times the estimate for formal workers. This is even more dramatic by worker type, such as male versus female. No matter what worker type is used, the informal elasticity estimates are higher in absolute value than their formal counterparts. We also show that steeper wage curves for informal workers hold even within the sample of individuals who have similar observable characteristics as implied by the predicted probabilities of being a formal worker.

We believe that our analysis contributes to the literature focusing on the workings of labor markets in developing countries, where the size of informal employment is considerable. In fact, our results based on the samples of informal and formal workers with observationally similar characteristics corroborate the view that informal employment may be an important source of labor market flexibility in developing countries. This suggests that workers with less protected jobs play a key role in the adjustment of labor markets to shocks that change the unemployment rates. However, our results should be tempered by the fact that

unobserved differences among individuals that would matter for the formality status would affect the propensity scores and in turn the role of informal employment in labor market flexibility.

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A Data Appendix

In this appendix, we provide details about our dataset. First, we summarize our data with respect to informality for different subgroups. Particularly, Table A.1 lists percentages of formal and informal workers for four individual characteristic categorizations and three different samples. In Table A.2, we present means and standard deviations of wage levels, age, education levels, experience, the rate of permanent and part-time jobs for both formal and informal workers.

We also give details about the individual specific control variables that we use. These are listed below:

- Age. The survey provides eleven age categories in 5-year intervals.
- Gender. Female=1 and Male=0.
- Marital status. Married=1, and zero otherwise.
- Employment location. Urban=1 and Rural=0.
- Education. The variable *educ* is years of completed education, while the variable *enrolled* is a binary variable which takes the value 1 for individuals enrolled to a school, and zero otherwise. Variable *req_att* equals to 1 for individuals who are enrolled in a school that requires regular attendance, 0 otherwise.
- Social security registration: Binary variable which takes the value 1 if the individual is registered in the social security administration, and zero otherwise.
- The individual's years of tenure at the firm. This is calculated as the starting year at the current job subtracted from the survey year.
- Industry classification. This is a set of seven binary variables categorized according to the NACE Rev. 1.1 classification pertaining to the non-agricultural industries, which include mining, manufacturing, electricity, construction, transportation, trade, finance, and community, social and personal services.
- Occupational group. This is a set of seven binary variables defined in line with non-agricultural occupations categorization according to the ISCO-88 classification, which include legislators, senior officials and managers; professionals; technicians and associate professionals; fishery workers; clerks; service workers and shop and market sales workers; craft and related trades workers; plant and machine operators and assemblers; and elementary occupations.

- Permanency of the job. This is a set of three mutually exclusive binary variables describing whether the job is *permanent*, *temporary* or *seasonal*.
- Employment type. Full-time=0 and part-time=1.
- Other activity to earn income. Yes=1 and no=0.
- Firm size. This is measured by the number of persons employed in the firm and summarized by six binary variables corresponding to the following categories: less than 10 employees, 10-24, 25-49, 50-249, 250-499, and 500 and more.
- Employment status in the same month of last year. Binary variable which takes the value 1 if the individual was working in the same month of last year, and zero otherwise.

Table A.1: The Formality Percentages of Workers by Types

| | Formal | Informal |
|-----------|--------|----------|
| Gender | | |
| Male | 74.44% | 25.56% |
| Female | 75.97% | 24.03% |
| Age | | |
| Old | 77.94% | 22.06% |
| Young | 72.12% | 27.88% |
| Tenure | | |
| High | 87.06% | 12.94% |
| Low | 67.43% | 32.57% |
| Education | | |
| High | 88.82% | 11.18% |
| Low | 61.45% | 38.55% |

Source: Authors' Calculations Using THLFS. Workers in the agricultural sector are excluded.

Table A.2: Summary Statistics for Some Characteristics by Formality Status

| | Formal | Informal | Total |
|----------------|-----------------|------------------|------------------|
| Real wage | 5.14 (5.45) | 2.31 (3.19) | 4.37 (5.10) |
| Age | 34.67 (9.32) | 32.82 (12.64) | 34.16 (10.36) |
| Education | 9.91 (3.89) | 6.75 (2.95) | 9.05 (3.92) |
| Experience | 7.84 (7.65) | 4.24 (6.80) | 6.86 (7.60) |
| Permanency | 97.41% | 68.31% | 89.49% |
| Part-time rate | 1.50% | 5.91% | 2.70% |

Source: Authors' Calculations Using THLFS. Workers in the agricultural sector are excluded. Means of characteristics are reported while standard errors are given in parentheses.

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