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Polat, Sezgin

Galatasaray University, GIAM

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Industry Wage Differentials and Working Conditions in Turkey: A Brief Note

Sezgin Polat *

GIAM / Galatasaray University, Department of Economics

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Abstract

In this article, we test the compensating wage differentials hypothesis for the manufacturing industry using official industrial accident figures provided by the Ministry of Labor and Social Security and wage data for the 2009-2014 Household Labor Force Surveys. First, we estimate a standard hedonic wage equation for the fatal and injury risk at the industrial level. After controlling for industry effects, the positive injury risk compensation disappears and becomes insignificant while the fatal risk premium reverses its sign from positive to negative. For an alternative estimation, we also used a two-step procedure by regressing industry wage differentials on working conditions including accident risk and several industry-specific averages. The results show, contrary to the compensating wage differentials hypothesis, that poor working conditions (higher fatal risk, longer working hours and high turn-over rate) are associated with lower wage compensation at the industry level. Our findings reveal a segmented labor market where low pay sectors are characterized by poor working conditions.

Keywords: Hedonic Wages; Wage Differentials; Working Hours; Work Accident; Fatal Risk; Turkey

JEL Codes: J31; J81; J28

1 Introduction

The theory of equalizing differences suggests that, among other factors, wage differentials should reflect the work environment and working conditions Rosen (1986). Hard or poor

*Galatasaray University, Department of Economics. Ciragan Cad. No: 36, Ortakoy 34349, Istanbul. e-mail: sezginpolat@gmail.com. I would like to thank Mustafa Ulus for his invaluable comments and suggestions. The usual disclaimer applies.

conditions are generally associated with dangerous jobs, working environments where workers are more exposed to accident risks or jobs that require overtime and longer hours. In this study, we test the hypothesis of compensating wage differentials for the case of Turkey, using pooled cross-section data (2009-2014) from Household Labor Force Surveys (HLFS).

There are very few studies which directly deal with wage compensation and working conditions in Turkey. The higher incidence of fatal work accidents are documented in Toksöz (2008) and OECD (2006)¹, while Messenger (2011) reports that, among European countries, Turkey is an exceptional case in that low wages and longer hours are correlated. In developing countries, weak regulations and institutions worsen working conditions (e.g poorer work safety and more accidents), particularly in rapidly growing sectors facing global competition Hämäläinen (2009), although poor working conditions also undermine productivity. ² Finally, Turkey scores the highest level of subjective work intensity among European countries, (Eurofound, 2012).

The structure of the paper is as follows. We briefly present the data before introducing the basic hedonic OLS model using industry-wide injury and fatality risk in the second section. Because the OLS estimates with and without industry controls show inconsistent results, we limit the framework to identifying the interaction effects of other factors. Using a two-step strategy which allows for multi-level estimation, we next regress industry wage differentials on working conditions proxies, including accident risks and factors like longer work hours. Our results suggest that wage differentials do not reflect wage compensation for industry-specific characteristics, which include long hours, poor work safety and high job-turnover rates. These findings support the labor market segmentation thesis, which is more relevant than the compensating wage differential theory in the context of developing countries.

2 Data and Estimation Strategy

For wage regressions, Turkey's Household Labor Force Surveys (HLFS) provide detailed information on wages and work characteristics. In order to estimate the wage premium related to unsafe work, we obtained accident rates from the official industrial accident figures provided by Turkey's Ministry of Labor and Social Security (MLSS). The MLSS's

¹Turkey ranks highest among OECD countries in terms of fatality and injury incidence.

²Messenger et al. (2007, p.123) argue that, in developing countries, *"the relationship between working time and productivity is weak and increases in output are often fueled by overtime work"*

industry classification, which is compatible with HLFSS, has broad coverage including 24 sub-sectors of manufacturing industry (Nace, rev. 2). The accident figures include only formally employed wage-earning workers who are subject to social security coverage (under Article 4-1/a of Act 5510).³ The total number of workers corresponding to each sector were obtained from the MLSS while we calculated per worker figures according to the number of registered workers in each industry.⁴ Pooled cross-sectional wage data for 2009-2014 are restricted to formal workers with social security coverage (Article 4-1/a).

The standard hedonic wage model Eq. (1) estimated in this study combines the usual wage equation with a compensation factor (taste) for the risk to wage earners associated with each specific industry.

$$\ln(w_{ijt}) = \alpha + \beta_1 X_{ijt} + \beta_2 H_{jt} + \gamma p_{jt} + \varepsilon_{ijt} \quad (1)$$

In Eq. (1), w_{ijt} denotes the log real hourly wage expressed in 2014 prices of individual i in sub-sector j in year t . X is a set of individual covariates including gender, education (4 categories), age, age squared, tenure and its square, marital status, born local, state employee, firm size (3 categories), occupation (9 categories), year and region (12, NUTS1) dummies. H indicates the industry effects (24 manufacturing sectors, Nace rev.2) γ_1 denotes the compensation associated with the industry specific fatality or injury risk for a given year, p_{jt} . ε is the error term. Table 1 gives a brief description of data that will be used in regressions.

Table 2 presents the results from the hedonic wage model. The basic coefficients of the wage regression have the expected signs. Hourly wages increase with completed education level, age and tenure. Female and single workers earn less than other categories. Controlling for industry effects modifies the previously significant positive coefficients of remuneration for fatality and injury risks in model specifications (Table 2, columns 1 and 3), becoming insignificant for injury risk while the sign for fatal risk reverses to negative (Table 2, columns 2 and 4). However, the coefficients for the other variables do not change sign or lose their statistical significance.⁵ We therefore need to address these inconsistent results for risk compensation since they indicate a multicollinearity problem reported by

³It is a legal obligation in Turkey for firms to report work accidents.

⁴For developing economies, ignoring the amount of informal employment and the importance self-employment biases the true accident cases in each sector. Hämäläinen et al. (2009) argue that the global figures provided by the ILO underestimate the true level of accidents.

⁵Returns to education decrease slightly after controlling for industry effects, which show some selection bias.

Table 1: Brief Descriptive Statistics

Variables	Mean	Std. Dev.
Fata Risk (%)	0.01	0.01
Injury Risk (%)	1.76	1.59
Female	0.19	0.39
Age	33.64	8.89
Job Tenure	5.45	5.96
Born Local	0.57	0.50
State Employee	0.02	0.14
Regular Working Hours	51.66	9.17
Married	1.77	0.49
No Schooling	0.03	0.16
Primary of less	0.57	0.49
Secondary	0.28	0.45
Tertiary	0.12	0.33
Firm Size (less 10)	0.13	0.34
Firm Size (11-49)	0.27	0.44
Firm Size (+50)	0.60	0.49
<i>Manufacturing Sectors</i>		
Food Products	0.14	0.35
Beverages	0.01	0.07
Tobacco Products	0.01	0.05
Textiles	0.12	0.33
Wearing Apparel	0.13	0.33
Leather and Related Products	0.02	0.13
Products of Wood and Cork	0.02	0.14
Paper and Paper Products	0.02	0.13
Printing and Media	0.02	0.12
Coke and Refined Petroleum Products	0.01	0.07
Chemical Products	0.03	0.16
Pharmaceutical Products	0.01	0.09
Rubber and Plastic Products	0.04	0.21
Other Non-Metallic Mineral Products	0.08	0.27
Basic Metals	0.06	0.23
Fabricated Metal Products	0.06	0.23
Computer, Electronic and Optical Products	0.01	0.10
Electrical Equipment	0.04	0.20
Machinery and Equipment	0.05	0.21
Motor Vehicles and Trailers	0.06	0.24
Other Transport Equipment	0.01	0.10
Furniture	0.05	0.22
Other Manufacturing	0.01	0.12
Repair of Machinery and Equipment	0.02	0.12
<i>Years</i>		
2009	0.14	0.34
2010	0.16	0.36
2011	0.17	0.37
2012	0.17	0.38
2013	0.18	0.39
2014	0.19	0.39
No. Obs.	103,734	

Accidents cases and number of insured workers are provided from Ministry of Labor and Social Security numbers conform the criteria under the article 4-1/a of Act 5510.

Region and occupation dummies are included in the regressions but not reported for lack of space (12 regions - 9 occupations)

earlier studies like Hintermann et al. (2010) and Viscusi and Aldy (2003). It is hard to distinguish the premium associated with a specific industry and the risk compensation related to a particular job. By using few industry dummies, Leigh (1995) finds that risk variables and inter-industry differentials are correlated. He concludes that the data is insufficient to produce accurate estimates of risk compensation. One possible solution to this problem, proposed by Kochi (2011), is to use more detailed risk data, which would help isolate specific accident rates by including comprehensive occupation-industry pairs. However, it is not always possible to obtain a breakdown matching specific industry-occupation pairs for every country. In Turkey's case, Polat (2014) argues that gender-specific industry controls do not undermine the results for 2010 and 2011. While injury risk is not positively compensated, fatality risk has a negative compensation for the manufacturing industry. Thus, it seems that OLS estimates are not conclusive enough to explain why inter-industry wage differentials fail to reflect unsafe working conditions and omitted variable bias can not be addressed within this framework.

Eq. 1 estimates a labor supply model that, because it treats accident risks as uniform within each industry, suffers from endogeneity bias (Hwang et al., 1992) and lacks indicators to measure poor working conditions and production technology (Brown, 1980). The first bias is unavoidable and can not be eliminated without an indicator capable of measuring workers' abilities or preferences. The second bias is primarily due to industry specific effects that could be controlled using various indicators.⁶ However, besides these two biases, the institutional and regulatory constraints that are crucial for safer technology are supposed to be neutral in this setting. A number of studies help highlight the role of the institutional setting in determining the safety of working conditions. For instance, reduced unionization (Kim and Fishback, 1999) and changes in liability rules (Kim and Fishback, 1999) both affect the size of compensating differentials. Morantz (2011) finds that, for the mining industry, unionization leads to more frequent inspections and potential fines for safety violations.

From the firms' perspective, when costly safety measures are adopted, the risk premium is reduced by the preventive technology. Assuming that accident risks can be eliminated by investing in safer technology, the trade-off between capital and risk would imply that less productive firms would hire workers willing to accept the associated risks. In this case, however, the cost of introducing safer technology and the premium associated with the risk undertaken by the workers should be equal. The equilibrium price would reinforce that

⁶While using employer-employee matched data is the best option, such data are very rare.

Table 2: Hedonic Wage Regressions for Pooled Cross-Sections (2009-14)

	(1)	(2)	(3)	(4)
Fatal Risk (%)	1.446*** (0.172)	-0.686** (0.277)		
Injury Risk (%)			0.014*** (0.001)	-0.001 (0.002)
Gender	-0.146*** (0.003)	-0.130*** (0.003)	-0.141*** (0.003)	-0.130*** (0.003)
Age	0.036*** (0.001)	0.036*** (0.001)	0.037*** (0.001)	0.036*** (0.001)
Age Squared	-0.044*** (0.001)	-0.044*** (0.001)	-0.044*** (0.001)	-0.044*** (0.001)
Job Tenure Years	0.014*** (0.001)	0.014*** (0.001)	0.014*** (0.001)	0.014*** (0.001)
Job Tenure squared	0.000 (0.003)	-0.001 (0.003)	0.000 (0.003)	-0.001 (0.003)
Born local	-0.036*** (0.002)	-0.036*** (0.002)	-0.036*** (0.002)	-0.036*** (0.002)
State Employee	0.379*** (0.008)	0.356*** (0.009)	0.387*** (0.008)	0.356*** (0.009)
Regular Working Hours	-0.016*** (0.000)	-0.016*** (0.000)	-0.016*** (0.000)	-0.016*** (0.000)
Married	0.041*** (0.003)	0.041*** (0.002)	0.040*** (0.003)	0.041*** (0.002)
<i>Education Level</i>				
Primary or less	0.008 (0.005)	0.007 (0.005)	0.006 (0.005)	0.007 (0.005)
Secondary	0.137*** (0.005)	0.124*** (0.005)	0.133*** (0.005)	0.124*** (0.005)
Tertiary	0.329*** (0.007)	0.305*** (0.007)	0.325*** (0.007)	0.305*** (0.007)
<i>Firm Size</i>				
Firm Size (11-49)	0.031*** (0.003)	0.030*** (0.003)	0.030*** (0.003)	0.030*** (0.003)
Firm Size (+50)	0.092*** (0.003)	0.086*** (0.003)	0.090*** (0.003)	0.086*** (0.003)
<i>Year Effects</i>				
Year 2010	-0.021*** (0.004)	-0.009** (0.004)	-0.026*** (0.004)	-0.012*** (0.004)
Year 2011	0.001 (0.004)	0.015*** (0.004)	-0.003 (0.004)	0.011*** (0.004)
Year 2012	0.020*** (0.004)	0.021*** (0.003)	0.007** (0.004)	0.022*** (0.004)
Year 2013	0.050*** (0.004)	0.062*** (0.004)	0.020*** (0.004)	0.060*** (0.005)
Year 2014	0.095*** (0.004)	0.105*** (0.004)	0.059*** (0.004)	0.105*** (0.005)
Constant	2.221*** (0.022)	2.213*** (0.022)	2.225*** (0.022)	2.210*** (0.022)
Industry Effects	no	yes	no	yes
Occupation Effects	yes	yes	yes	yes
Regions Effects	yes	yes	yes	yes
Observations	103,734	103,734	103,734	103,734
R-squared	0.577	0.588	0.578	0.588

The omitted category for dummies; having no schooling for education, less than 10 workers for firms size, the year 2009 for year effect, food sector for industry, executive managers for occupations, Istanbul province for regions. We control region (12), year (6), occupation (9) and industry (24) fixed effects.

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

risk premium should be paid according to the trade-off. In short, if productivity dispersion (wage differentials) reflects the level of firm-specific technology then more productive (with higher capital) firms should pay less to their workers for risky tasks than firms with less safe technology.

However, industry wage differentials may not only reflect risk compensation but also industry-specific technology differences that are hard to identify with limited (pooled cross-sectional) data, although multi-leveilling could offer one improvement. In this study, we propose a solution involving a two-step procedure used to model hierarchical structures (Hanushek, 1974), (Saxonhouse, 1976). Bryan and Jenkins (2016) have recently discussed the effectiveness of a two-step procedure to isolate the source of variation by multi-leveilling the estimation. The proposed solution is to regress the raw industry differentials (q_{jt}) obtained in the first step (Eq.2) on the proxy variables that we think measure working conditions and environment (second stage). In the second step (Eq.2), the estimated industrial wage differentials (\hat{q}_{jt}) are regressed on accident risks and indicators such as industry averages (factor-weighted) proxying for unobserved productivity. The second stage also controls for the fixed effects for year and industry (24 sub-sectors). We argue that, in the presence of multi-collinearity correlation bias, the standard hedonic wage regression may be unable to differentiate industry wage differentials from the compensating premiums related to working conditions.

$$\ln(w_{ijt}) = \alpha + \beta X_{ijt} + q_{jt} + \epsilon_{ijt} \quad (2)$$

$$\hat{q}_{jt} = \gamma I_{jt} + \eta_{jt} \quad (3)$$

In Eq.3, I stands for all industry specific variables which include working hours, value added, tenure years, share of workers with less than secondary education level (8 years), fatality or injury risk. η is the error term.

Table 3: Second Stage Results (Industrial Wage Differentials and Industry Specific Indicators)

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
Fatal Risk (%)	-0.924* (0.526)							-0.746* (0.445)	-1.117** (0.535)			-1.033* (0.557)		-0.293 (0.491)	
Injury Risk (%)		-0.002 (0.004)								-0.001 (0.004)	0.005* (0.003)		0.007** (0.003)		-0.000 (0.004)
Ave. Job Tenure Years			0.018** (0.008)									0.016*** (0.005)	0.017*** (0.006)	0.012* (0.007)	0.012 (0.007)
Ave. Working Hours				-0.011* (0.006)				-0.010* (0.006)	-0.015*** (0.003)	-0.011* (0.006)	-0.016*** (0.003)	-0.013*** (0.003)	-0.013*** (0.003)	-0.005 (0.005)	-0.005 (0.005)
Unqualified Workers					-0.257*** (0.082)							-0.061 (0.074)	-0.109 (0.071)	-0.251*** (0.084)	-0.272*** (0.078)
Value-Added per worker						-0.037 (0.035)		-0.001 (0.033)	0.074*** (0.015)	-0.009 (0.034)	0.065*** (0.013)	0.060*** (0.016)	0.048*** (0.013)	-0.018 (0.031)	-0.022 (0.031)
Administrative Workers							0.078 (0.177)		0.253 (0.263)		0.226 (0.299)	0.115 (0.287)	0.028 (0.306)	-0.315 (0.212)	-0.339 (0.207)
Constant	0.005 (0.007)	0.004 (0.006)	-0.113** (0.051)	0.628* (0.349)	0.169*** (0.053)	0.402 (0.381)	-0.002 (0.013)	0.570 (0.447)	0.003 (0.295)	0.685 (0.466)	0.159 (0.251)	0.016 (0.266)	0.141 (0.222)	0.597* (0.337)	0.662* (0.340)
Year Effects	+	+	+	+	+	+	+	+	-	+	-	-	-	+	+
Industry Effects	+	+	+	+	+	+	+	+	-	+	-	-	-	+	+
Observations	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
R-squared	0.909	0.904	0.914	0.911	0.917	0.906	0.904	0.915	0.647	0.912	0.640	0.670	0.669	0.929	0.929

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

3 Discussion

We do not present the estimation results from the first-step regression since they did not differ significantly from the expected dummy variables for industry-by-year pairs. Table 3 displays the results of the second stage with various specifications. It is striking that, on average, industries with higher fatality accident risk pay are correlated with lower wage premiums while injury risk is positively compensated in some specifications. It is possible that more risk-exposed sectors may be associated with various factors other than accident risk that affect wage differentials. The inclusion of industry-specific averages might help isolate these omitted factors. Krueger and Summers (1988) find that, in OLS estimations, controlling for working conditions does not change pay differentials across industries. For example, they integrated value added per worker⁷ to reflect differences in production technology and profit sharing. This has a positive and significant impact on wage differentials. For the share of unqualified workers, the negative impact significantly captures unobserved productivity or the limited level of human capital, even after including other variables. Average years of tenure is included to proxy for workforce turnover and firm-specific knowledge accumulation. Given its positive impact, we can interpret tenure as a proxy for turnover. Note that firm-specific experience may also reflect that sector-specific skill building is important in Turkey's case, in addition to the other standard human capital proxy of education level. However, the share of administrative workers has no significant effect on sector pay differences.

As already mentioned, the role of longer working hours also needs further discussion. Low pay (less productive) sectors are associated with longer working hours. The legal framework in Turkey allows firms to determine the working hours of each worker during a working week. According to the World Bank's Doing Business Index(2010)⁸, the standard number of working hours in a day (Article 63, Labor Law, 2003) is restricted to eleven hours in Turkey, which is not common in most OECD countries, as the usual upper limit in practice is eight hours per day. In the Turkish labor market, working hours commonly exceed the standard 45 hours per month⁹ (without compensation) in both the formal and informal sectors (Toksöz, 2008);(Messenger, 2011). Finally, although multi-leveling

⁷Aggregated data for industry-level value added per worker are derived from the Annual Firm Census (TurkStat).

⁸<http://www.doingbusiness.org/data/exploretopics/employing-workers>

⁹The minimum wage is paid on a monthly basis. Polat and Ulus (2014) argue that monthly wage dispersion provides evidence that minimum wage setting is binding in the formal sector whereas hourly wage dispersion is less bound by minimum wage legislation.

improves the estimation compared to the standard hedonic regression, these results should be interpreted cautiously as further research is needed to address the shortcomings of this study. In particular, greater than two-digit disaggregation of sectors may refine the relationship between low pay and poor working conditions more clearly.

4 Conclusion

This study tested the compensating wage differentials hypothesis for the case of Turkey, using official industrial accident figures provided by Turkey's Ministry of Labor and Social Security and wage data from the 2009 and 2014 Household Labor Force Surveys. The standard hedonic wage equation for fatal and injury risk at the industrial level gave inconsistent results. In particular, positive risk compensation disappeared after controlling for industry effects. To provide an alternative estimation, this study followed a two-step procedure of regressing accident risk and several industry-specific averages like working hours on the industry wage differentials. The results of this estimation show that, contrary to the compensating wage differentials hypothesis, higher fatal risk and longer working hours in Turkey are associated with lower wage compensation at the industry level. We therefore argued that compensation for risk does not help explain wage differentials, even when sector-specific factors are included to control for productivity differences. The negative effects of longer working hours and accident risk on wage differentials indicate that industries with lower productivity provide poorer working conditions and environments for their workers. These findings reinforce the labor segmentation theory for Turkey, which is more relevant, considering that Turkey's labor market institutions perform poorly and that its informal sector has a larger share than other OECD countries.

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