



**What Determines Informal Hiring?  
Evidence from the Turkish Textile Sector**

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Working Paper No. 0604  
July 2006

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# What Determines Informal Hiring? Evidence from the Turkish Textile Sector\*

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**Abstract:**

Most studies about the shadow economy focus on the estimation of the aggregate size. However, this study aims to address the sectoral or micro aspects of this phenomenon using the data from the textile sector in Turkey. It uses discriminant analysis and ordered and logistic regression models to unveil the determinants of the informal hiring in Turkey. It concludes that high competition, the skill structure of the employees, perceived penalty scheme, and the size of the firms in the sector are important factors of the textile firms hiring informally.

JEL-class.: O17, O5, D78, H2, H11, H26.

Key-words: informal hiring in Turkish textile sector, discriminant analysis, logistic regression model, ordered regression

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\*A first version of this paper was presented at the “First International Conference on Business, Management and Economics”, Izmir, Turkey, June 16 – 19, 2005

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## 1. Introduction

Shadow or hidden economic activities have attracted attention of both researchers and politicians for more than quarter of a century. Most of the studies have dealt with the issue of estimating the aggregate size of shadow economies around the world. Although a large body of literature<sup>1</sup> on macro aspects of the hidden or shadow economy exists, the sectoral and micro characteristics of the shadow economy still remain unsearched. Turkey is certainly no exception for this. There have been quite a few studies<sup>2</sup> on the measurement of the size of the overall shadow economy in Turkey but the sectoral characteristics of the phenomenon still need attention. The goal of this paper is to provide a first but still preliminary insight into the determinants of the informal hiring using data gathered from the textile sector in Turkey.

Profit-maximizing firms base their decisions on a number of factors. These factors might be economical such as premiums the firms need to bear when they decide to employ formally or stem from legal environment in which the firms operate such as detection possibility and severity of penalty if detected when they decide to employ informally. There are some factors that can be considered as supply-side ones such as skill composition of the workers in the sector, the others as demand-side ones such as competitiveness in the sector. It is obvious that that these factors might contribute to informal hiring decisions of firms in different degrees depending on the sector the firms operate in. The textile sector in Turkey, as discussed in the paper in detail, is considered one of the most important sectors in creating employment and inducing export. The sector is also known to have a large informal part in it, it is labor-intensive, and the textile firms are mostly small and medium sized. Ownership structure of the firms is also likely to enhance their decisions on informal hiring: Many firms have relatives among owners so these tight relations might increase their ability to act contrary to the related laws without getting detected. These features make the sector an interesting and good field in a research of this kind aiming to unveil the determinants of informal hiring.

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<sup>1</sup> Literature on the subject of the “shadow,” “underground,” “informal,” “second,” “cash,” or “parallel,” economy has been increasing. Various topics—measurement, causes, effect on the official economy—are analyzed. See for example, survey publications: Frey and Pommerehne (1984); Thomas (1992); Loayza (1996); Pozo ed. (1996); Lippert and Walker eds. (1997); Schneider in Brandstatter and Güth eds. (1994a); Schneider (1994b); Schneider (1997); Schneider (1998); Johnson, Kaufmann, and Shleifer (1997); Johnson, Kaufmann, and Zoido-Lobaton (1998a); Johnson, Kaufmann, and Zoido-Lobaton (1998b); Belev (2003); Gerxhani (2003); Pedersen (2003). For an overall survey of the global evidence of the size of the shadow economy see Schneider and Enste (2000); Schneider and Enste, (2002); Schneider in Rowley and Schneider eds. (2003); Schneider (2005a, 2005b); Alm, Martinez-Vazquez, and Schneider (2004).

<sup>2</sup> See, for example, Kasnakoğlu (1993); Temel, Şimşek and Yazıcı (1994); Yayla (1995); Ögünç and Yılmaz (2000); Savasan (2003). The size of the overall (total) shadow economy of Turkey (calculated by Savasan and Schneider (2005)) is: 1999/2000: 32,1; 2001/2002: 33,2; 2002/2003: 34,3; 2003/2004: 34,8; 2004/2005: 35,2

The data used in this paper is likert type survey data whose questionnaire is exhibited in the appendix. Likert scaling targets to uncover the agreement levels of the respondents of the survey to some predetermined statements. For instance, respondents are asked whether they think that ‘in the textile sector, informality is high’. The respondents choose the best agreement level they think they fit in. In this paper, the five-point likert scaling from strongly disagree to strongly agree or one being neutral is used.

In section 2, we discuss informal hiring with emphasis on the Turkish textile sector. In section 3, we provide an empirical/econometric analysis of the determinants of informal hiring with special emphasis to the country’s textile sector. The goal of this empirical analysis is to bring about some more insight into the labor and sectoral characteristics of the shadow economy in the textile sector in Turkey. For the empirical analysis we use ordered and logistic regressions and discriminant analyses. Finally in section 4, a summary and some conclusions are given.

## **2. The Informal (Shadow) Economy in the Turkish Textile Sector**

### **2.1 The Scope of the Informality in Turkey**

Under informality we understand the production of legal goods and services in the shadow economy avoiding to pay taxes and social security contributions and violating labor market laws. Informality is considered to be a large and growing part of the shadow economy in developing countries and, most of the time, is linked to the small and medium sized enterprises. The State Institute of Statistics in Turkey attempts to collect data on informal sector using censuses (first carried out in 1927) and labor force surveys (first carried out in 1966). But more technical and better defined data collection on the sector started in 1998 with the Household Labor Force Survey. Since then the survey has been repeated every two years. The State Institute uses some criteria to determine informality such as workplace and type of tax payment. It takes mobile workplaces (registered or not registered) and fixed workplaces employing less than five persons as informal sector participants. According to tax payment criteria, lump-sum tax payers, self-employed and employer hiring less than five workers, and unregistered people are considered as participants in the informal sector (Özel, 1996: 182-191). Another working definition is given by Tansel (2001): Wage earners not covered by any social security program are informal sector workers<sup>3</sup>.

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<sup>3</sup> This definition is followed in this study. The firms have been asked if they hire workers without social insurance; if the informality (number of employees uninsured) is high in the sector and what motivates the firms to hire informally. See the questionnaire in the appendix.

In Turkey, people are covered by three different social security organizations<sup>4</sup>: The Pension Fund (PF) providing coverage for civil servants, the Social Insurance Organization (SIO) providing coverage for employees of the state owned and private enterprises, and BAĞ-KUR providing coverage for self-employed. Using these three organizations, the PF creates no problem with respect to informality because it serves civil servants. But the other two include only part of the population they intend to cover. Their participants, especially those of the SIO have the opportunity to enter the system and get out easily. According to official statistics from the State Planning Organization of Turkey, the insured-labor force ratios range from 44 percent in 1994 to 51 percent in 2001. Needless to say these ratios are quite low and provide some clue for the extent of the informality in Turkey. These ratios are likely to go up when working age population is taken into account because some of the people at working age are not registered into labor force.

## **2.2 The Textile Sector in Turkey and the Determinants of Informal Hiring**

### ***2.2.1 The Textile Sector in Turkey and Its Relevance to the Shadow Economy***

In Turkey the textile sector plays an important role in employment, production and export. The sector's share in registered employment is about 11 percent (Varol, 2005: 1,12). The sector's share in GDP has been more than 10 percent for a long time. According to DPT, the Planning Institute of Turkey, textile sector has assumed a high share of the total export in the country ranging from 25% in 1982 to 42% in 1997 (Report by the Textile Commission, 2001: 12). Some other numbers also show the sector's role in export: Turkey's textile related export is about 7.5% of GDP in 2003 (IMF Country Report No 05/163, May 2005: 35).

In the literature, one can find many estimates of the shadow economies using different methods for almost every country.<sup>5</sup> We believe that specific inquiries into labor and sectoral characteristics of this phenomenon have the potential to provide some additional insight. From this perspective this paper focuses on the determinants of the informal hiring. To do so, it chooses the textile sector. This choice of the sector is driven by the following facts: *(i)* The textile sector in Turkey has a large informal part; *(ii)* ownership structure of this sector is family oriented (e.g., there are relatives among owners) and *(iii)* it contains mostly small and medium sized enterprises.

Anecdotal evidence and some discussions indicate that the informal employment is high in the sector. For instance, Varol (2005; 1-12) discusses that when informal employment

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<sup>4</sup> These three organizations were merged in April, 2006 in an effort to reform the social security in Turkey, the results of which are yet to be seen.

<sup>5</sup> Compare e.g. Schneider and Enste (2000) and Schneider (2005).

is taken into account the sector's share in employment goes up to 20 percent from 11 percent. If these estimates have some scientific validity (considering the difficulties involved in estimating) informal employment is somewhere around 50 percent of the total employment in the sector.

As in many developing countries in Turkey the textile sector is shaped mostly by small and medium sized enterprises (SME's); as well as family owned and operated enterprises which are also very common. These features become apparent in the results of the survey conducted in 2005 displayed in tables 1 and 2. The ratio of the firms that have relatives among owners is about 67 percent. This feature might affect informal hiring positively or negatively: On the one hand, owners might get around the laws and regulations because they have tight relationships to their relatives; thus, these firms might hire more informal workers. On the other hand, this type of relationship may result in more "official" hiring from relatives, because employers might be more willing to pay insurance premiums for their relatives than to other foreign employed workers..

**Table 1: Ownership Structure of the Firms in the Textile Sector**

<b>"Any relatives among owners"</b>	<b>Frequency</b>	<b>Percent</b>
<b>Yes</b>	371	67.3
<b>No</b>	180	32.7
<b>Total</b>	551	100,0

Source: The frequencies are calculated from the responses for question 1 of the questionnaire displayed in appendix I.

Table 2 displays the firms' size in the sector, following EU classification (Çolakoğlu, 2002: 3-8): Of the firms in the textile sector interviewed, 30 percent is considered 'micro' (in table 2 micro I and II), 44.2 percent 'small' (in table 2 small I), 19.1 percent 'medium' (in table 2 small II and medium). Only 6.7 percent of the firms are in the categories of 'high medium' and 'big'.

**Table 2: The Sizes of the Firms in the Textile Sector**

<b>Number of Employee</b>	<b>Classification</b>	<b>Frequency</b>	<b>%</b>	<b>Cumulative %</b>
<b>0-4</b>	<b>Micro I</b>	100	15.2	15.2
<b>5-9</b>	<b>Micro II</b>	98	14.8	30.0
<b>10-49</b>	<b>Small I</b>	292	44.2	74.2
<b>50-99</b>	<b>Small II</b>	57	8.6	82.9
<b>100-250</b>	<b>Medium</b>	69	10.5	93.3
<b>250 +</b>	<b>High- medium and big</b>	44	6.7	100.0
<b>Total</b>		660	100.0	

Source: The frequencies are calculated from the responses for question 2 of the questionnaire displayed in appendix I.

To sum up, the three most distinct features of the textile sector in Turkey are the following:

- (1) The informality in the sector is high;
- (2) more than two third of the firms are family-owned and
- (3) the firms in the sector are mostly SME's.

These three features motivated us to apply the questionnaire in the appendix to the textile sector to unveil the determinants of informal hiring.

### ***2.2.2 The Determinants of Informal Hiring***

From our theoretical reasoning and the institutional knowledge about the Turkish textile sector we can distinguish the following six hypotheses why informal hiring work takes place:

- (1) It is widely agreed that informal hiring is more common in the small and medium sized enterprises, and in firms where the owners are not relatives of the employees, *ceteris paribus*.
- (2) The higher the competition in the textile sector is, the more likely is the hiring of informal labour, *ceteris paribus*.
- (3) If the supply of labor exceeds the demand for labor, employers hire labor with lower wages hence pay no taxes and social security contributions, *ceteris paribus*.
- (4) The textile sector uses labor-intensive technologies, where not much skill from the worker is required. Hence, as low skilled workers are easily available in Turkey, informal hiring easily will take place, *ceteris paribus*. Also, the rather high labor cost of the “official” textile sector is an important element which provides a strong incentive for the firms in the textile sector to hire informally. The “official” labor cost of the textile sector in Turkey is \$2.14 per hour, which is high, when compared with other countries: the cost of labor per hour is \$1.89 in Tunisia, 1.92 in Morocco, \$0.6 in India and \$0.61 in China; it is \$2.52 in Poland and \$16.65 in Italy (Report by the Textile Commission, 2001: 13), just to quote two developed countries.
- (5) High insurance premiums (pensions on health care) paid by the firms increase the labor cost of the firm motivating them to hire informally, *ceteris paribus*. In Turkey, the social security premiums/payments are found higher than many OECD countries as seen on table 3. The ratio of social security contributions to average employee wage cost was about 17 percent in 1999 and rose to 31 percent in 2000. The employer share also went up from 10 to 18 percent. The figures for Turkey seem higher than most of the OECD countries.

- (6) The probability of detection and the extent of the punishment after detection will affect the decision of the firms planning to hire informally, *ceteris paribus*.

**Table 3: The Ratios of Social Security Contributions to Average Employee Wage Cost, Selected OECD Countries, 1999 (%)**

Country	Employee	Employer	Total
Australia	2	0	2
Canada	5	6	11
Denmark	11	1	12
Japan	9	9	18
Luxembourg	12	12	24
Netherlands	25	14	39
New Zealand	0	0	0
Poland	21	17	38
South Korea	6	8	14
Switzerland	10	10	20
Turkey (1999)	7	10	17
Turkey (2000)	13	18	31
United Kingdom	7	8	15
United States	7	7	14

Source: OECD; Taxing Wages, 2000 Edition

### 3. Empirical Results

#### 3.1. Data and Survey Design

The survey (i.e. the questionnaire) is displayed in the appendix and uses Likert scaling to collect data. The responses are scaled from 1 to 5, 1 being ‘strongly disagree’ with the statement and 5 being ‘strongly agree’. The responses show whether the participants are favorable or not to the statements and to what degree. However, it is impossible to determine the difference between the responses since the choice and the number of the response categories are chosen arbitrarily. That is, we cannot treat the difference between a 3 and a 2 the same as that between a 2 and a 1. They represent only a ranking.

The participants of the survey indicated their agreement with each of the nine item using the 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Table 4 shows the marginal percentages of the statements that ask the owners of textile firms about their own and the sector’s behaviors in informal hiring.



**Table 4: The Marginal Percentages of the Response Categories for the Statements about Informal Hiring in the Textile Sector (2005)**

Question/Answer		Count	Percentage
"In the sector, informality is high"	Strongly disagree	52	10.6
	Disagree	98	19.9
	Neutral	61	12.4
	Agree	163	33.1
	Strongly agree	118	24.0
Total		492	100.0
"The firm never employs informally"	Strongly disagree	25	5.2
	Disagree	53	11.0
	Neutral	35	7.3
	Agree	133	27.7
	Strongly agree	235	48.9
Total		481	100.0

Source: The marginal percentages are from the survey conducted in 2005, whose questionnaire is displayed in the appendix.

The percentages of the different possibilities to answer of the two statements in the table 4 display a distinct feature: It shows that only 78 firms out of 481 firms interviewed disagreed to some extent (cumulative frequencies in percentages of ‘disagree’ and ‘strongly disagree’ responses) with the statement ‘the firm never hires informally’. That is, only 16.2 percent of the firms state that they do hire informally. This percentage is much lower than expected, especially when compared with the percentages for the statement “In the sector, informality is high”. There, agreement with the statement goes up to 57 percent, a percentage which is in line with some previous findings (e.g. Varol, 2005). Hence, it seems obvious that people, if directly shed to their own situation, answer quite differently compared to a more general question on stigmatized topics such as tax evasion and informal hiring.

### 3.2. Estimation Models and Empirical Findings

Now we proceed with the empirical analyses of our survey data and the underlying theory using three techniques: ordered and logistic regressions and discriminant analyses. Before discussing the results a few words on the independent variables are useful: Informal hiring in the sector (‘SECINFOR’) depends on a number of independent factors:

- (1) the ownership structure of the firm labeled as ‘RELATIVE’ (whether owners are relatives),
- (2) the size of the firms (‘SIZE’),
- (3) degree of the competition in the sector (‘COMPETITION’),
- (4) social security payments ‘PREMIUMS’,

- (5) detection probability (DETECTION) when a firm hires informally and is detected a penalty is the consequence ('PENALTY'), and
- (6) the skill composition of the labor in the sector ('UNSKILLED').

The expected sign of the independent variable 'relative' is ambiguous. It can be argued that tight relationship between owners and employees owners might provide opportunity to act contrary to the laws and regulations, resulting in more informal hiring. On the other hand, this ownership structure might result in more official employment of their relatives providing them with better working conditions (e.g. health coverage, retirement benefits). The size of the firms in the textile sector can be considered as an important determinant of informal hiring. In the literature, informal employment has been taken one of the most important characteristics of the small and medium sized enterprises, hence the expected sign for coefficient 'SIZE' is negative, i.e. if the firms get larger (smaller) informal hiring gets lower (higher). The textile sector is a sector in which high competition is observed both in Turkey and in the world. Heavy competition might force the firms to hire informally if they find the opportunity; hence the expected sign for the coefficient COMPETITION is positive. High insurance premiums for social security will also increase informal hiring. The expected signs for the coefficients of the variables DETECTION and PENALTY are negative, implying that, if firms are intensely audited and severely punished when detected, informal hiring will be reduced. Skill structure of the employees in the textile sector might affect the employees' bargaining power with employers. As employees get more (less) skilled they have better (less) chance to fight for insurance. So the expected sign for 'UNSKILLED' is positive.

### **3.2.1 Results of Ordered and Logistic Regressions**

The ordered regression model is based on the notion that there is some latent continuous outcome variable, and that the ordinal outcome variable arises from discretizing the underlying continuum into ordered groups. The basic form of the model is laid out in the following equation;

$$\text{link}(\gamma_{ij}) = \theta_j - [\beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_p X_{ip}] \quad (1)$$

where  $\text{link}(\cdot)$  is the link function<sup>6</sup>;  $(\gamma_{ij})$  is the cumulative probability of the  $j^{\text{th}}$  category for the  $i^{\text{th}}$  case;  $\theta_j$  is the threshold (cutoff value) for the  $j^{\text{th}}$  category;  $X_{i1} \dots X_{ip}$  are the values of the predictors for the  $i^{\text{th}}$  case and  $\beta_1 \dots \beta_p$  are regression coefficients.

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<sup>6</sup> We employed different link functions readily provided by SPSS package in search of better model. As discussed in SPSS, there is no theoretical background as to which function to be used. The ordered regression model predicts a function of the actual cumulative probabilities. More discussion on the ordered regression

The models use the predictor variables to calculate predicted probabilities of membership in the categories for each case. The main focus of the model is on the parameter estimates of the independent variables. Table 5 shows the parameter estimates, their significance and fit statistics from two ordered regressions. Model I exhibits the results when all five response categories are used. Model II exhibits results when the responses showing disagreement and agreement to some extent (the sums of ‘strongly disagree’ and ‘disagree’ and of ‘agree’ and ‘strongly agree’) are collapsed into two large categories. The dependent variable labeled as ‘SECINFOR’ is response categories to the statement ‘in the sector, informality is high’.

As far as the signs and significances of the parameters are concerned we can identify three common findings of the models:

1) In model I the firm’s size and intensity of penalty for informal hiring are quantitatively important as well as the variables COMPETITION and UNSKILLED. The first two variables both have negative signs (as expected) and are statistically significant at 5 percent significance level. These results tell us that as firm size (labeled as ‘size’) and perceived penalty get larger probability of informal hiring gets lower.

2) In all models competition in the sector “forces” the firms to find ways to reduce the costs. The sign of that predictor’s coefficient is positive as expected and statistically significant at five percent.

3) In all models the coefficient for the predictor labeled as ‘unskilled’ is positive and statistically significant. It basically tells us that in this sector unskilled labour is hired informally because they do not have bargaining power over employers to get social security insurance.

**Table 5: The Ordered and Logistic Regression Results**

Variables		Models		
		Ordered Regression		Logistic
		Model I	Model II	
Threshold	[SECINFOR=1]	-0.414 (0.328)	1.404*** (0.410)	
	[SECINFOR=2]	0.329 (0.330)	1.807*** (0.413)	
	[SECINFOR=3]	0.713** (0.331)		
	[SECINFOR=4]	1.971*** (0.108)		
Constant				-2.248*** (0.779)
Relative		-0.127	-0.202	0.048

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models can be found in SPSS, Daykin and Moffatt (2002) and Greene (1997).

	(0.108)	(0.124)	(0.265)
Size	-0.072** (0.032)	-0.037 (0.037)	-0.057 (0.079)
Competition	0.248*** (0.053)	0.457*** (0.089)	0.579*** (0.123)
Premium	0.047 (0.055)	0.144 (0.094)	0.097 (0.130)
Detection	-0.060 (0.04)	-0.069 (0.064)	-0.024 (0.095)
Penalty	-0.097** (0.041)	-0.095 (0.068)	-0.137 (0.101)
Unskilled	0.13*** (0.041)	0.295*** (0.071)	0.354*** (0.094)
Model Fitting Information	110.635***	114.948***	100.9***
Pseudo R <sup>2</sup> (Cox and Snell)	0.201	0.208	0.225

In ordered regressions, the cutoff values, produced by the model, define the categories and are estimated by the thresholds (constants). They depend only on which category's probability is being predicted and are not affected by the values of the predictor variables. The SPSS program uses the Wald Statistic to test the null hypothesis that a coefficient value is zero in the population.

Model fitting information provides the log likelihood values for the intercept only (baseline) model and the final model with the predictors. The difference of log-likelihoods can be interpreted as chi-square distributed statistics. The significant chi-square statistics indicates a significant improvement over the baseline model. The model here, as suggested by the significant chi-square statistics, shows significant improvements. That is, the model gives better predictions than guesses based on the marginal probabilities for the outcome categories. How much better is the model really? The pseudo R-squares are not very high, implying that the model is only partially successful in predicting the outcome categories. Another way to discuss the success of the model is to compare the predicted outcome with the actual data. Table 6 shows the cross table for the response categories. The ordered regression model seems somewhat successful in predicting the actual responses correctly ranging from about 40 percent to 72 percent.

**Table 6: The Cross Table for Response Categories from Ordered Regression**

"In the sector, informality is high"		Predicted Group Membership (%)			
		Strongly disagree	Disagree	Agree	Strongly agree
Observed (%)	Strongly disagree	46.2	17.3	30.8	5.8
	Disagree	2.0	39.8	52.0	6.1
	Agree	2.5	7.4	71.8	18.4
	Strongly agree	1.7	5.9	52.5	39.8

Using an ordinal dependent variable, the important matter is the ordering of categories which can be quite arbitrary. Thus, two similar categories can be collapsed into one (larger) category. To do so, 'agree' and 'strongly agree' responses are collapsed to make a common

category for the responses which reveal that the firms agree with the statements in different degrees. The same is done for the responses revealing disagreement with the statements in different degrees. The model II in table 5 exhibits the results of the ordered regression after collapsing the four into two categories. The empirical results are quite similar as the results from model I. However, the coefficients for SIZE and PENALTY become insignificant while those for competition and unskilled remain significant. There is little but some improvement of the explanatory power of the regressors.

We also uses a logistic regression model to identify the important determinants of the informal hiring in the Turkish textile sector, the findings are presented in table 5. The logistic model is suitable when the dependent variable consists of categories. We recoded the data into two large categories: 0 when the response showed disagreement to some extent with the informal hiring statement, 1 when the response showed agreement to some extent with the statement. The signs of the coefficients of the independent variables are the same as those from the ordered regression models except for that of the independent variable ‘RELATIVE’, but the estimated coefficients are statistically insignificant from all three models. The coefficients of the variables COMPETITION and UNSKILLED from logistic regressions are positive and significant at 1 percent level. Since these estimated coefficients are on a log scale their interpretation is somewhat different from those from ordinary regressions: The coefficients mean that being one unit higher in agreement level with the related statements increases the log odds of being in informal hirer category by 0.579 and 0.354, respectively.

**Table 7: The Cross Table for Response Categories from Logistic Regression**

"In the sector, informality is high"		Predicted		Percentage Correct
		Disagree	Agree	
Observed	Disagree	79	64	55,2
	Agree	28	225	88,9
Overall Percentage				76,8

Table 7 shows overall “hit rate” of about 77 percent which is a considerable improvement over the rate one could get by a pure random assignment which is 50 percent. The correct prediction for the statement showing agreement with the informal hiring is about 89 percent.

### **3.2.2 Discriminant Analysis**

Discriminant analysis is used to classify cases into the values of a categorical dependent variable. Given a set of independent variables, discriminant analysis attempts to find linear combinations of those variables that best separate the groups of cases. The procedure supplied in SPSS automatically chooses a first function that separates the groups as

much as possible. It then chooses other functions that are both uncorrelated with each other and provide as much further separations as possible. A discriminant analysis can be formulated as follows:

$$d_{ik} = b_{0k} + b_{1k}X_{i1} + \dots + b_{pk}X_{ip} \quad (2)$$

where  $d_{ik}$  is the value of the  $k^{\text{th}}$  discriminant function for the  $i^{\text{th}}$  case,  $p$  is the number of predictors (or discriminating variables),  $b_{jk}$  is the value of the  $j^{\text{th}}$  predictor,  $X_{ij}$  is the value of the  $i^{\text{th}}$  case of the  $k^{\text{th}}$  predictors. The number of functions separating the groups equals  $\min(\# \text{of groups} - 1, \# \text{of predictors})$ . If the discriminant function analysis is effective for a set of data, the classification table of correct and incorrect estimates will yield a high percentage of correct estimates.

In this paper we provide two discriminant analyses, one with all five response categories from strongly disagree to strongly agree, the other with only two categories, disagree and agree. In the analysis utilizing all response categories, there are four functions “estimated”, and the results are shown in tables 8 and 9. As indicated in table 8, the eigenvalue for the first function is 0.325, 10 times larger than that for the second function. We get smaller eigenvalues toward the fourth function. Since the size of the eigenvalue is related to the discriminating power of that function we demonstrate that among the four, the first function has the highest discriminating power and especially the third and the fourth functions are very weak indeed. This result is better seen when we check the functions’ contributions in explaining the variance of the dependent variable. Functions 1 and 2 together account for 96.5% of the explained variance. Checking the canonical correlations summarizing the degrees of associations between the groups and the discriminating functions, we see, that it is the largest for the first function (0.495).

**Table 8: Canonical Correlations and Test of Significance**

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	0.325	87.9	87.9	0.495
2	0.032	8.6	96.5	0.176
3	0.010	2.7	99.2	0.099
4	0.003	0.8	100.0	0.055
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 4	0.722	157.801	28	0.000
2 through 4	0.957	21.485	18	0.256
3 through 4	0.987	6.237	10	0.795
4	0.997	1.489	4	0.829

All four functions have a joint  $\chi^2$  157.8. with an associated p value of less than 1 percent. This demonstrates an overall level of discriminatory power that is unlikely to be random. The Wilks's lambda of 0.722 indicates that the functions account for 27.8% (1-0.722) of the variance of the intensity of the agreement with informal hiring statement. The other tests of functions show no statistical significance. All of this suggests that only one function is required rather than the four that are available in principle.

Table 9 shows the standardized canonical discriminant function coefficients. All the signs are as expected and in line with the findings from ordered and logistics regressions. Ignoring the signs, COMPETITION makes the greatest contribution in determining the dependent variable on function 1. UNSKILLED, PREMIUM, and PENALTY are next in the rank. The structure coefficients for each discriminator tells us how closely variables and functions are related. A very large absolute magnitude of a coefficient (closer to 1) indicates that the function is carrying nearly the same information as the variable. The values for COMPETITION and PREMIUM are 0.877 and 0.669, respectively.

**Table 9: Standardized Discriminant and Structure Coefficients<sup>1</sup>**

Variables	Standardized Canonical Discriminant Function Coefficients				Structure Coefficients	
	Model I	Rank	Model II	Rank	Model I	Model II
RELATIVE	-0.026	7	0.024	7	0.024	0.055
SIZE	-0.126	5	-0.059	6	-0.297	-0.261
COMPETITION	0.651	1	0.669	1	0.877	0.865
PREMIUM	0.178	3	0.168	3	0.669	0.641
DETECTION	-0.100	6	-0.061	5	-0.097	-0.106
PENALTY	-0.144	4	-0.116	4	-0.050	0.009
UNSKILLED	0.408	2	0.448	2	0.628	0.652

<sup>1</sup> Model I and II refer to discriminant analyses with all response categories and with only two categories, respectively.

As seen in table 10, the percentage of the 'known' cases which are correctly classified is about 46. This hit rate is a considerable improvement over the correct prediction rate one could get by pure random assignment. However, the correct prediction rates for every category are not the same; i.e. the overall success in correct prediction is not achieved throughout the categories.

**Table 10: The Cross Table for Response Categories from Discriminant Analysis. Model I**

"In the sector. informality is high"		Predicted Group Membership %				
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Observed (%)	Strongly disagree	31.0	26.2	1.2	25.0	16.7
	Disagree	7.7	35.9	0.9	45.3	10.3
	Neutral	10.3	16.7	2.6	60.3	10.3
	Agree	3.3	9.9	0.5	76.5	9.9
	Strongly agree	2.7	4.0	0.7	53.0	39.6

45.9% of original grouped cases correctly classified. 43.2% of cross-validated grouped cases correctly classified. In cross validation, each case is classified by the functions derived from all cases other than that case.

Model II refers to the discriminant analysis in which the categories of the levels of the agreement are collapsed into two large categories, the case, where only one function is available. The function is found to be significant at 1 percent level with the chi<sup>2</sup> value of 127.6. Canonical correlation is found to be 0.51. The Wilks's lambda of 0.741 indicates that the function accounts for 26% of the variance of the level of the agreement with informal hiring statement. As seen in table 8, the contributions and the signs for the discriminators under model II seem to follow those under model I, in which all of the response categories are used together. An overall hit rate of about 78 percent is achieved with model II as shown in table 11. This rate seems reasonably higher when compared with 50 percent one could get with pure random assignment.

**Table 11: The Cross Table for Response Categories from Discriminant Analysis. Model II**

"In the sector. informality is high"		Predicted Group Membership %	
		Disagree	Agree
Observed %	Disagree	58.7	41.3
	Agree	12.1	87.9

77.7% of original grouped cases correctly classified. 76.6% of cross-validated grouped cases correctly classified. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

To conclude: the methods employed in this paper to analyze the survey data seem to reach similar results. The ordered and logistic regressions and the discriminant analyses all produce the expected signs and achieve quite an improvement in predicting observed outcomes over pure random assignment.

#### **4. Summary and Conclusions**

Informal work might stem from the supply and/or demand conditions in the “official” labor market. In this paper, the determinants that motivate the firms to hire informally have been analyzed. The textile sector has been chosen because this sector is relatively labor intensive and shadow economy activities are higher. The firms hiring informally (e.g., hiring without insurance) base their decision on a number of factors which are related to either supply-side or demand-side conditions.

The conclusions to be drawn from the ordered regressions are as follows: Among the determinants of informal hiring, the size of the firms, the severity of penalty after detection, competition and skill composition of the labor are found statistically significant. The



estimated coefficients of the first two independent variables are negative, implying that possibility of hiring informally decreases as the size of the firm gets larger and the amount of the perceived penalty gets higher. The coefficients of the latter two are positive, implying that competition within the textile sector and the characteristics of unskilled labor increase informal hiring in the sector. All coefficients resulted from the logistic regression have expected signs and competition and skill level of employees in the textile sector are found to affect informal hiring positively and significantly. Discriminant analysis demonstrates that competition, skill level of employees, high premiums, and penalty rate make the greatest contributions in determining the informal hiring in Turkish textile sector.

## 5. Appendix: The Questionnaire

- 1) Any relatives among owners?
- 2) Number of employees in the firm?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
"In the sector. hiring is easy"					
"My firm never employs informally"					
"In the sector. informality is high"					
"Competition in the sector forces to employ informally"					
"High premiums force the firm to hire informally"					
"It is easy to find workers ready to work without insurance"					
"Workers in the sector without insurance are unskilled"					
"In the sector. firms are scanned frequently for uninsured workers"					
"High penalties for hiring without insurance make informal work difficult"					

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