INFORMALITY IN TURKEY:

EVIDENCE FROM A FIRM-LEVEL SURVEY

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Thesis Abstract

Muhammed Burak Sezgin, “Informality In Turkey: Evidence From A Firm-Level Survey”

In this thesis, we use the results of a novel survey of 500 firms from 13 different sectors in Turkish economy and a two-sector general equilibrium model to measure the extent of informality in these sectors through a sectoral analysis as well as in country level. Afterwards, we evaluate the effects of two different policy tools, namely the level of income taxes and the level of tax enforcement on informality. Our results show that both are effective policy tools in tackling informality, enforcement is a steadily effective tool and the effect of taxation, while positive, shifts around depending on the enforcement level.

Tez Özeti

Muhammed Burak Sezgin, Türkiye'de Kayıtdışılık: Bir Firma Bazlı Anketten Bulgular"

Bu tez çalışmasında, bir iki sektörlü genel denge modeli ve 13 farklı sektörden 500 firma ile yapılmış bir firma anketinin sonuçları kullanılarak bu sektörlerdeki ve Türkiye genelindeki kayıtdışılık seviyesi ölçülmeye çalışılmıştır. Ayrıca, iki farklı politika aracının, kurumlar vergisinin büyüklüğü ve kayıtdışılık üzerindeki vergi denetimleri, kayıtdışılık üzerindeki etkisi de incelenmiştir. Analiz sonuçları iki politika aracının da kayıtdışılıkla mücadele için etkili olduğunu göstermiştir, ancak vergi denetimi aracının kurumlar vergisine göre çok daha etkili bir araç olduğu görülmüştür. Kayıtdışılıkla mücadelede kurumlar vergisi özellikle düşük seviyelerde etkisiz kalmıştır.

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Finally, I want to thank Selvanur, my wife, who always runs to my help with her love when life gets difficult.

I dedicate this thesis to my family.

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CHAPTER 1

INTRODUCTION

In this study, using a survey conducted with a representative sample of 500 firms in Turkey, we measure the extent of informality in 13 different sectors of Turkish economy. Using information from the survey, we calibrate a two-sector general equilibrium model to back out the extent of informal activities in these sectors. In the model, firms choose to operate either in the formal sector or the informal sector after comparing potential maximized profits from each sector. Government applies a tax rate to profits to finance its spending, which is treated as exogenous and given and taxes do not apply to the firms in the informal sector. We also introduce a tax enforcement and tax evasion detection system to keep the informal sector firms in check. Finally, we use the survey data to calibrate the model and then to conduct a policy analysis.

The term informal economy or otherwise called as shadow, hidden, underground, black economy, holds an important place in the agendas of governments, bureaucrats and other policy makers. Although this is the case, there are different definitions provided for informal economy, which can range from all the economic activities outside the governmental watch (including criminal economic activities such as human trafficking, drug trade, etc.) to legal economic activities that do not comply with government regulations. However, mostly the definition of the informal economy includes what Schneider and Enste (2000) puts forward as "...all economic activities that contribute to the officially calculated (or observed) gross national product but are currently unregistered.". Examples of this are self-employment i.e. home based workers, or informal wage employment, i.e. firms that

evade paying taxes for their business activities and/or employ workers without (or partially) paying for their social security benefits. It's an ever-present problem especially in the developing countries where the average informal economy size is about 35 % of the official GDP (See Buehn and Schneider, 2012 or Elgin and Oztunali, 2012). As expected, informality poses serious economic, social and political problems for an economy. A large informal economy hinders governments' efforts to collect enough revenue, harming the provision of public goods and services, as well as reducing total productivity. It also prevents workers of the informal sector to utilize from social benefits, which further leads to other social and economic problems. For example, Angel-Urdinola et al. (2009) mentions (based on a World Bank report) that informality is ranked fourth in terms of obstacles faced when doing business in Turkey, ahead of tax rates and access to finance. Therefore, another effect of informality is the unfair competition it causes to the firms that choose to be formal.

Although informality is a ubiquitous phenomenon all around the world, its determinants are yet to be agreed upon by economists. Many ideas were thrown into focus including but not limited to, tax burden, tax enforcement, institutional quality and various other economic, political and social factors. Moreover, it is also well known that informal sector is generally based on less productive methods of production while the formal one tends to be more productive.[1]This mainly stems from the fact that larger firms have much higher operating costs compared to the smaller ones, and this entails higher productivity in larger firms' account[2].

[1] Dessy and Pallage, 2003.

[2] Barseghyan and DiCecio, 2007.

Consequently, the size of the firm is an important factor of the extent of informality within that firm. There is an extended literature on the relation between informality and firm size. Dabla-Norris et al. (2005) examines the determinants of informality over the legal system and also finds that size is negatively related with informal sector size. Using a world-wide survey, Schiffer and Weder (2001) reach to a conclusion that while smaller firms are generally disadvantageous compared to the large ones, they have certain advantages such as they can evade regulations easily and therefore become informal. Ulyssea (2014), using a general equilibrium model analyzes the firms' choices regarding their entries into the formal or informal sectors and claims that cost of informality rises with firm size. El-Diwany et al. (2000) claims that firms are pushed to stay small when the enforcement is size-sensitive and price competition can lock the firm into informality, and they show this using data comprising Egypt's micro and small enterprises. Prado (2011) builds a general equilibrium model with main determinants of informality such as taxation, enforcement, etc. He finds that sufficiently large firms choose to be formal as they find formality beneficial to their business. Also, he backs out enforcement levels needed country by country.

Also, in the literature, there is a line of studies trying to understand firm behavior with respect to informality that follow the size distribution idea of Lucas (1978) in which 'managerial talent' is the determinant of the size of a firm. This managerial talent manifests itself as productivity parameter, i.e. shows the unexplained part in converting factor inputs into output. This concept is widely used in many different areas in macroeconomics. In terms of informality related research, Rauch (1991) had the lead and in this study firms are allowed to pay lower wages if

they are small, in other words enforcement is only applied to firms bigger than a certain size, which in turn creates a dichotomy between formal and informal firms, namely small ones operate in the informal sector while large ones choose to be formal. Fortin et al. (1997) adds wage and evasion dualisms to the size dualism to check for the impact of taxation and wage controls. The result they reach is that in the equilibrium informal firms have the opportunity of paying smaller wages and evading taxes but there is a risk of getting caught and punished for operating informally. They test their theoretical findings using data from Cameroon. Moreover, Amaral and Quintin (2006) develop a competitive model of the labor market in which they use the Lucas framework of managerial talent. Being in the formal sector brings the benefit of capital availability and a tax burden. The equilibrium shows that large firms operate formally. Also the informal sector mainly employs low skilled workers and an employee gets the same wage in both formal and informal sectors, meaning that there is only one labor market. De Paula and Scheinkman (2009) use the Lucas method to investigate the determinants of informality in Brazil. They introduce lower interest rates and taxes on sales for the formal sector although the wages are the same for both formal and informal sectors. They similarly find that smaller firms operate informally and they, using a survey conducted in Brazil, empirically test this finding. Another related study is the one by Cerda and Saravia (2013), where the authors try to add informal sector to an optimal taxation environment. Finally, Galiani and Weinschelbaum (2011) develops a similar model in which they try to account for three facts: the size dualism, skill dualism (low-skilled workers work in the informal sector) and a new one which states that working family members other than the household head generally work in the informal sector.

The contribution of our study is two-fold: First, we introduce two difierent ideas to the model that are related to government tax enforcement, which are an enforcement parameter which discourages firms from participating in the informal sector; and a size parameter that shows that as size of a informal firm increases, it's more likely for it to get detected by the authorities. Second, we use the survey data to extract sector-level policy recommendations for the Turkish economy.

The rest of the thesis proceeds as follows. In the next chapter, we introduce the model and define an equilibrium. In Chapter 3 we present the model parameters, equations and dataset, and then we perform some numerical analysis and discuss the results. In Chapter 4, we conclude and provide some discussion.

CHAPTER 2

THE MODEL

Our model is mostly based on the two-sector model of Cerda and Saravia (2013). However, we extend this model by introducing a tax evasion detection and punishment system following Ihrig and Moe (2004).

Firms

There is a set I of mass one heterogenous firms indexed by i that produce a single good. Heterogeneity comes from the aforementioned Lucas (1978) framework in which the managerial ability (or the productivity parameter) A_{it} differs across firms.

There are two types of production technologies available to firms: the first type uses capital and labor as inputs and the other one employs only labor. The first type of technology is available for formal firms and the profit from this is taxed at the rate of τ, where ($\tau \in [0, 1]$), whereas the second type of technology is available to informal firms. When the informal technology is chosen, the firm faces a probability of detection by the government which depends on the government's level of tax enforcement as well as the number of workers the firm employs. Enforcement is represented by ρ, where ($\rho \in [0, 1]$).

We assume that the output of a firm in the formal sector is given by$A_{it}f(k_{it}, l_{it})$, whereas the output of a form in the informal sector is $A_{it}g(l_{it})$. Both production functions are of decreasing returns to scale[3], strictly increasing,

[3] This assumption is necessary so that the firms end up with positive maximized profits in both sectors.

strictly concave and satisfy Inada conditions. Firms rent capital from households at the rate of r_{it}, and pay w_{it} as wage to the workers of the formal sector and w_{it}^{inf} to the ones of the informal sector. Therefore the profit functions can be written as follows:

Formal:

$$V_i = \max(1-\tau)[A_{it}f(k_{it}, l_{it}) - r_{it}k_{it} - w_{it}l_{it}] \quad (1)$$

Informal:

$$V_i^{inf} = \max(1-\rho\tau)[A_{it}g\left(l_{it}^{inf}\right) - w_{it}^{inf}l_{it}^{inf}] \quad (2)$$

Each firm, depending on its productivity/managerial talent, chooses the sector in which it is going to operate by comparing the maximized profits that they would get from each sector. Then, the firm will solve the following dichotomy:

$$\max\{V_i, V_i^{inf}\} \quad (3)$$

Theorem: There exists a threshold productivity/managerial talent level A_i^* in which the firm shifts into the other sector such that:

$$\max(1-\tau)[A_i^* f(k_{it}, l_{it}) - r_{it}k_{it} - w_{it}l_{it}] =$$
$$\max(1-\rho\tau)[A_i^* g\left(l_{it}^{inf}\right) - w_{it}^{inf}l_{it}^{inf}] \quad (4)$$

A firm's capital or labor demand depends on which sector it is operating in. Therefore, we have:

$$k_{it} = 0 \quad if \quad A_{it} \leq A_t^* \tag{5}$$

If we assume that markets are competitive, then capital and labor will be paid at their marginal productivities, which are given by the following:

$$r_t = A_{it} f_k(k_{it}, l_{it}) \tag{6}$$

$$w_t = A_{it} f_l(k_{it}, l_{it}) \tag{7}$$

$$w_t^{inf} = A_{it} g_l\left(l_{it}^{inf}\right) \tag{8}$$

Moreover, the aggregate factor demands are the sum of individual demands. Hence:

$$K_t^D = \int_{A_t^*}^{\infty} k_{it}\, dG(A_{it}) \tag{9}$$

$$L_t^D = \int_{A_t^*}^{\infty} l_{it}\, dG(A_{it}) \tag{10}$$

$$L_t^{D,inf} = l_{it}^{inf}\, G(A_t^*) \tag{11}$$

Households

We have an infinitely lived representative household with consumption $\{c_t\}_{t=0}^{\infty}$ and leisure $\{h_t\}_{t=0}^{\infty}$ who maximizes:

$$\sum_{i=0}^{\infty} \beta \, U(c_t, h_t) \tag{12}$$

s.t.

$$c_t + i_t + \frac{b_{t+1}^d}{R_t} = r_t K_t + w_t L_t + w_t^{inf} L_t^{inf} + b_t^d + \int_{A_t^*}^{\infty} V_{it} \, dG(A_{it}) + V_{it}^{inf} G(A_t^*) \tag{13}$$

$$K_{t+1} = i_t + (1 - \delta) K_t \tag{14}$$

and

$$h_t + L_t + L_t^{inf} = \bar{H} \tag{15}$$

where $\bar{H}$ is the total time available.

We assume that the utility function $U(.)$ is strictly increasing and strictly concave. At period 0, the household has a capital stock of $K_0 > 0$ and a government bond stock of b_0. Each period, the household chooses his consumption, leisure, investment and bond holdings. δ is the assumed depreciation rate. The household rents his capital K_t for a rental rate of r_t and his labor for a wage of w_t if he works in the formal sector and w_t^{inf} if he works in the informal sector. The last two arguments in equation (14) are the (after-tax) profits received by the household from the formal sector firm and the informal sector firm respectively. R_t is the interest rate for the stock of bonds b_t.

Government

The government in this model has an exogenous stream of expenditures which we define as $\{e_t\}_{t=0}^{\infty}$. The government only applies tax to profits. However, we assume that its only revenue source is not the profits received from the formal firms but also the income received through punishments applied to the detected informal firms. Here, we assume that the government commits to the policies it builds. The government's budget constraint is therefore given by the following:

$$\frac{b_{t+1}^{S}}{R_t} - b_t^S + \tau \int_{A_t^*}^{\infty} V_{it}\, dG(A_{it}) + \rho\tau\, V_{it}^{inf} G(A_t^*) \geq e_t \qquad (16)$$

Equilibrium

We can define the competitive equilibrium for this economy as follows:

Definition: Given an enforcement level ρ, a competitive equilibrium is sequences of allocations $\{c_t, k_{it}, l_{it}, l_{it}^{inf}, b_t\}_{t=0}^{\infty}$, prices $\{r_t, w_t, w_t^{inf}, R_t\}_{t=0}^{\infty}$,a government policy$\{e_t, \tau_t\}_{t=0}^{\infty}$and a threshold productivity/managerial talent$\{A_t^*\}_{t=0}^{\infty}$ such that:

1. Sequences $\{c_t, k_{it}, l_{it}, l_{it}^{inf}, b_t\}_{t=0}^{\infty}$ solve the household's problem given by the equations (12)-(15).
2. Each firm solves firm's problem (equation (4)), given A_{it}.
3. $\{A_t^*\}_{t=0}^{\infty}$ is determined through the previously stated theorem.
4. The sequences $\{e_t, \tau_t\}_{t=0}^{\infty}$ make the government budget constraint (equation 16) hold every period.
5. Capital, labor, bond and goods markets clear

$$K_t = \int_{A_t^*}^{\infty} k_{it}\, dG(A_{it}) \tag{17}$$

$$L_t = \int_{A_t^*}^{\infty} l_{it}\, dG(A_{it}) \tag{18}$$

$$L_t^{inf} = l_{it}^{inf}\, G(A_t^*) \tag{19}$$

$$h_t + L_t + L_t^{inf} = \overline{H} \tag{20}$$

$$b_t^s = b_t^d \tag{21}$$

$$c_t + e_t + K_{t+1} = \int_{A_t^*}^{\infty} A_{it} f(k_{it}, l_{it})\, dG(A_{it}) + A_{it} g\left(l_{it}^{inf}\right) G(A_t^*) + (1-\delta)K_t \tag{22}$$

CHAPTER 3

EMPIRICAL ANALYSIS

Parameters and Data

The utility function and production functions that we use are the following:

$$U = \frac{\left[c^{\phi_2}(\bar{H}-l)^{1-\phi_2}\right]^{\phi_1}}{\phi_1} \tag{23}$$

The production technology for a formal sector firm is given by:

$$Y_{it} = A_{it}\left({k_{it}}^{\alpha},\ {l_{it}}^{1-\alpha}\right)^{\theta} \tag{24}$$

Next, the technology available to informal firms is:

$$Y_{it}^{inf} = A_{it}\left({l_{it}^{inf}}^{1-\gamma}\right) \tag{25}$$

The Survey

The survey data that we use in this study contains 500 representative firms from 16 different sectors and is conducted in April-May 2013 with the support of Scientific and Technological Research Council of Turkey (TUBITAK). Table 1 shows these sectors, along with their NACE codes[4].

[4] Nomenclature statistique des Activities economiques dans la Communauté Européenne (In English: Statistical Classification of Economic Activities in the European Community). It is an industry standard classification system used in Europe.

Table 1: Sectors Included in the Survey

NACE Code	Sector
B	Mining and Quarrying
C	Manufacturing
D	Electricity, Gas, Steam and Air Conditioning Supply
E	Water Supply, Sewerage, Waste Management and Remediation Activities
F	Construction
G	Wholesale and Retail Trade, Repair of Vehicles and Motorcycles
H	Transporting and Storage
I	Accommodation and Food Services
J	Information and Communication
K	Financial and Insurance Activities
L	Real Estate Activities
M	Professional, Scientific and Technical Activities
N	Administrative and Support Service Activities
O	Education
P	Human Health and Social Service Activities
R	Arts, Entertainment and Recreation

The survey contains more than fifty questions, however, in this study we use only a few of them. Most of the variables that we use here will serve the purpose of extracting the necessary parameters for the numerical analysis. These parameters include a productivity/managerial talent level, which will be used to compare the firms threshold productivity/managerial talent level in order to see whether the firm

operates in the formal or informal sector; capital and labor that the firm possesses; factor shares, namely α, θ and γ; and wages.

One of the questions the survey asks to the interviewees (owners or managers of the firms) is how many workers their firms employ. Multiplying these with the average number of hours a worker works in a year in Turkey (1877 in 2012) gives us the firms' labor sizes. Using the firms' incomes, their purchases of raw material and products, rental spendings[5] and the interest rate, we calculate the capital stock of each firm.

In order to calculate the factor shares α, we make use of the survey questions that inquire firms' spendings on rent and raw materials, and on wages and social benefits.[6] Spendings on rent and raw materials, as it's mentioned in the previous paragraph, represents the investment for physical capital stock; and the last two represents the labor. This allows us to calculate the capital shares, α, at the firm level, at the sector level as well as at the economy level[7]. Since our primary aim here is to obtain sector wide and economy wide measures of informality, we restrict ourselves to sector and economy levels, respectively. Also firms that contain incomplete answers and sectors with less than 5 firms are removed for healthier

[5] The survey specifically asks: "In year 2012, what percentage of your income is spent on raw material and product purchases?" and "In year 2012, what percentage of your income is spent on rent (building, land and/or machinery)?"

[6] The survey specifically asks: "In year 2012, what percentage of your income is spent on wages, including social benefit spending?" and "In year 2012, what percentage of your income is spent on social benefits for the workers?"

[7] $\alpha = \frac{Spending\ on\ Capital}{Spending\ on\ Capital + Spending\ on\ Labor}$

results. At the end, we end up with 13 difierent sectors and 358 firms. Table 2 presents the number of firms, αs for the each sector and the economy as a whole.

Table 2. Number of firms considered and sectoral and economy-wide factor shares

Sector	Number of Firms	α
C	72	0.715
D	5	0.801
E	5	0.815
F	28	0.716
G	112	0.762
H	17	0.588
I	47	0.708
J	12	0.689
K	5	0.508
L	6	0.653
M	10	0.761
N	24	0.681
O	15	0.461
Whole Economy	358	0.711

In order to make a comparison with the threshold productivity/managerial talent level, we need the maximum productivity level a firm can reach in the formal sector. To do that we use the values of income, capital and labor, factor shares and the equations (24-25) and extract A_{it}. If this level is higher than the threshold, then the firm will choose to operate in the formal sector since its productivity/managerial

talent will result in higher profits in the formal sector than in the informal one.

Parameters

The various parameters that are required for the numerical analysis are chosen based on several previous studies. For the parameters in the utility function, we will use the same values as they did in Schmitt-Grohe and Uribe (2006), which are $\phi_1 = 1$ and $\phi_2 = 0.75$. β, the discount factor, is chosen through King and Rebelo's (2000) method in which they match the interest rate. The equation they use is a variation of the one below:

$$r = \frac{1}{\beta} - 1 \tag{27}$$

Here, we match an interest rate of 10%. The depreciation rate, δ, is 0.025 following many previous studies. And the total amount of time available for leisure and work, $\bar{H}$, is equal to 1. Informal sector factor share of labor, γ, and the decreasing to return scale parameter, θ, are calibrated to match the size of the informal sector in Turkey (~30 %). The baseline tax rate, τ, is the current income tax in Turkey, which is 20 %. Enforcement is taken as zero in the baseline. Table 3 summarizes the parameters.

Table 3. Parameter Values

Parameter	Values
ϕ_1	1
ϕ_2	0.75
r	0.1
δ	0.025
$\bar{H}$	1
Informal Sector Size	0.3
τ	0.2
ρ	0

Results

Benchmark

After calibration with the previously mentioned baseline parameters, we get the results that are shown in Table 4. As we can observe in Table 4, the size of the informal economy varies greatly across sectors. While sectors like Transporting and Storage (H), Financial and Insurance Activities (K) and Real Estate Activities (L) have low informalities, some others are almost or completely informal. These results seems to verify that each sector has its disparate features. This suggests that every sector should be investigated separately and it justifies our idea of a sectoral analysis.

Table 4: Sectoral Informal Sizes

Sector	% of Informal
C	26
D	100
E	100
F	46
G	34
H	4
I	71
J	94
K	10
L	4
M	100
N	68
O	56
Total	30

In our study, sectors that have a higher tendency for informality almost consist of small and medium enterprises with low averages of income. As they are mainly small firms, the costs of being formal is greater for them and this naturally results in them being in the informal sector. On the other hand, in the sectors that are highly formal, the ones mentioned in the previous paragraph, larger firms are in presence. This again confirms our initial proposal that larger firms tend to be formal. Moreover, although the sectors whose level of informality is close to 100 is high in number (such as sectors D, E, J, M), they contain smaller number or smaller sized firms, therefore they are not dominant enough to pull informality up above a certain

point. Besides, the limited sample sizes for these sectors may be the cause why these are highly informal.

Firm Size

The impact of firm size to informality is another interest of this study and we expect that smaller firms to be more likely to operate in the informal sector. To this end, with the results that we extract from the model, we performed correlation and statistical analyses to see the relationship between firm size and informality. The histograms in Figure 1 and 2 show the frequency of firms (informal and formal, respectively) with respect to their incomes, and Figure 3 and 4 with respect to their number of employees.

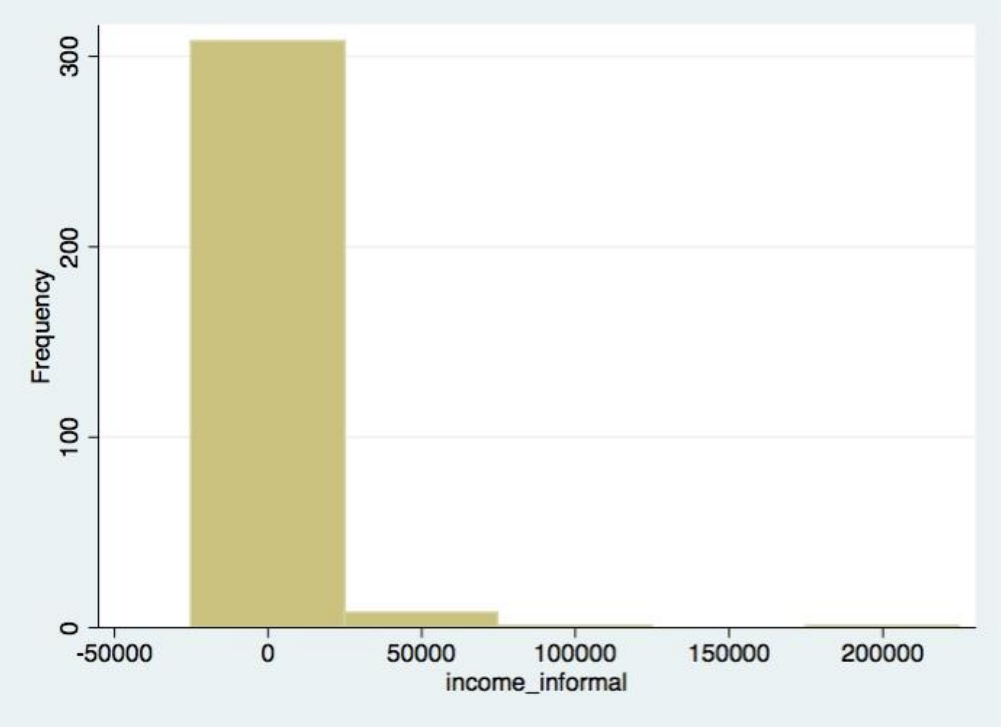

Figure 1: Income distribution of informal firms

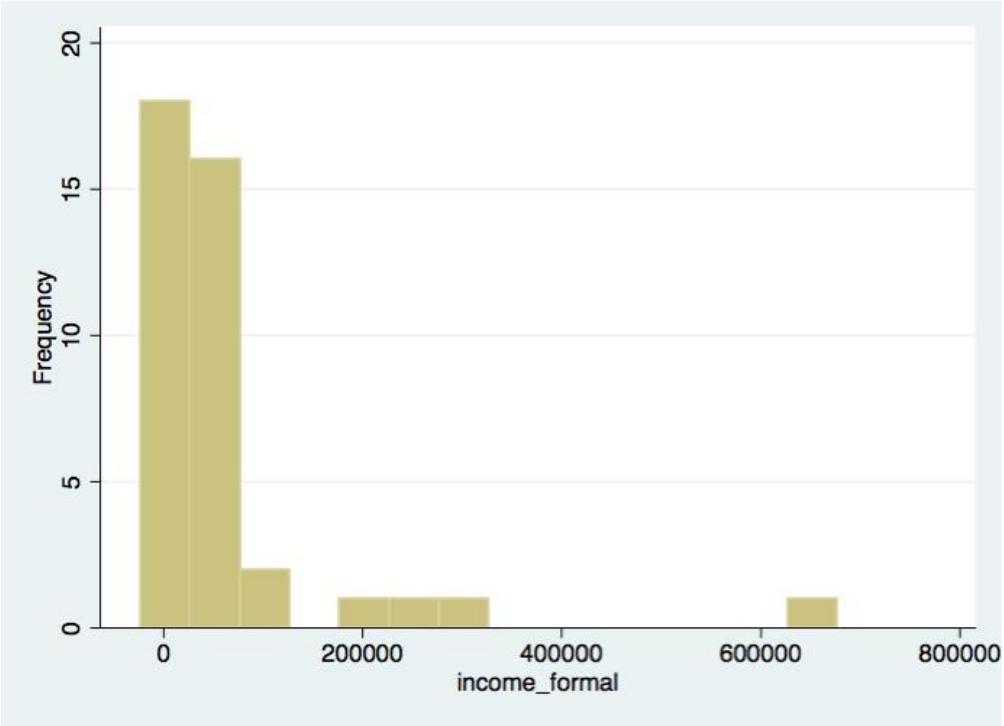

Figure 2: Income distribution of formal firms

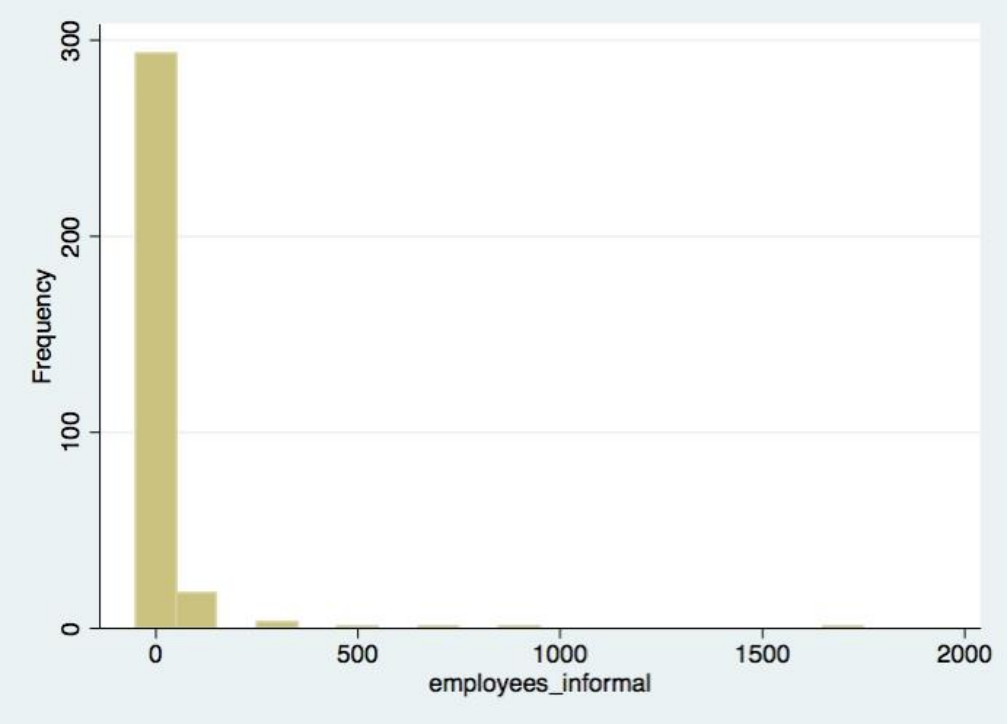

Figure 3: Employee distribution of informal firms

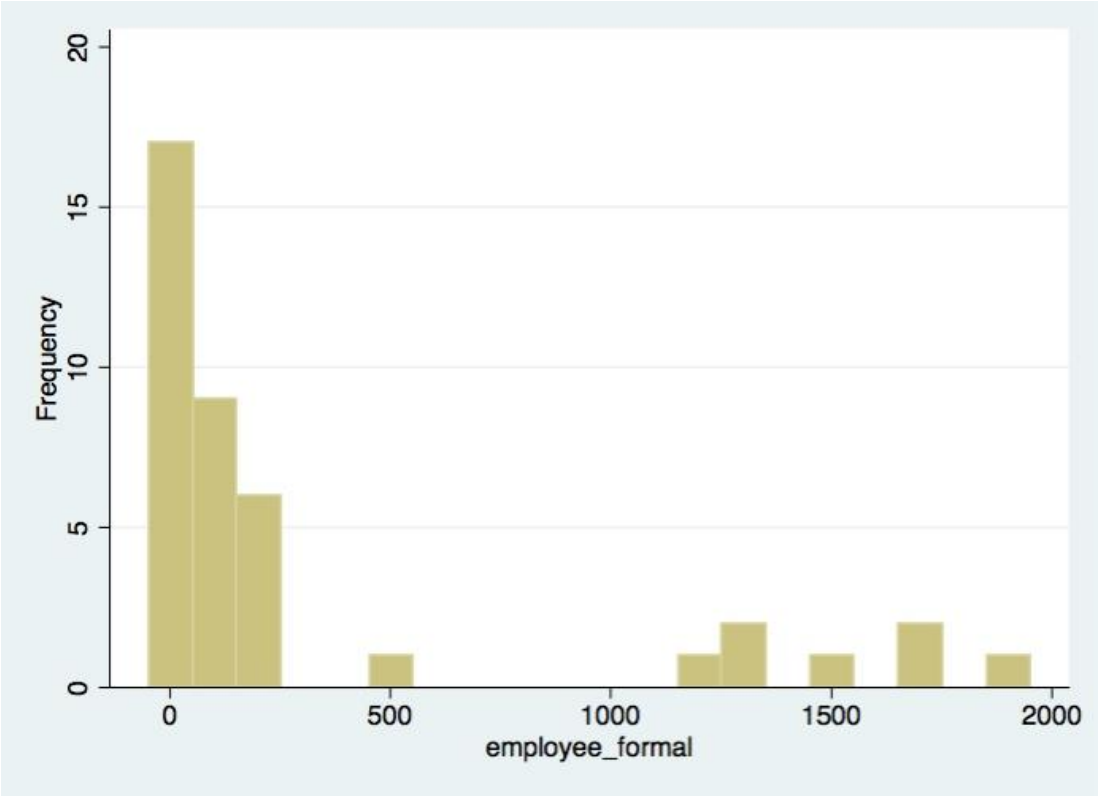

Figure 4: Employee distribution of formal firms

These histograms clearly show that while informal firms tend to concentrate on the left side of the income axis, formal firms are mostly located in the higher income region.

Policy Evaluation

After finding the level of informality in each sector, we now turn to comparative statics, that is we will try to see what impact do enforcement and tax have on the size of the informal sector. To this end, we will toggle with first the level of enforcement and then the level of income taxation. The initial values were $\rho = 0$ and $\tau = 0.2$. First, we will try different values of enforcement while keeping the initial tax rate intact and the results for which is presented at Table 5.

Table 5. Size of Informality at Different Values of Enforcement, $\tau = 0.2$.

$\tau = 0.2$	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**
C	26%	26%	26%	26%	25%	23%	23%
D	100%	100%	100%	100%	10%	10%	10%
E	100%	100%	100%	100%	100%	100%	48%
F	46%	24%	20%	19%	19%	3%	2%
G	34%	34%	29%	16%	16%	10%	9%
H	4%	3%	3%	2%	2%	1%	1%
I	71%	61%	61%	55%	49%	30%	16%
J	94%	94%	94%	84%	36%	36%	34%
K	10%	10%	10%	10%	0%	0%	0%
L	4%	4%	4%	4%	3%	3%	1%
M	100%	100%	100%	100%	90%	34%	20%
N	68%	68%	62%	62%	59%	48%	43%
O	56%	51%	49%	44%	41%	18%	6%
TOTAL	**30%**	**28%**	**26%**	**23%**	**18%**	**15%**	**14%**

As expected, in all sectors and in the whole economy, as enforcement increased, level of informality decreased. At the economy level, an increase in enforcement from 0 to 10%, 10 to 20 and 20 to 30% lowers informality about 2, 2 and 3% respectively. Although this is the case, impact of enforcement is varying across sectors. Some sectors such as F and I respond to enforcement immediately. On the other hand, sector E does not get affected by it until the enforcement level is quite high. Apparently, they benefit from informality so much that only higher risk of getting caught do change their behavior. Moreover, some of them respond greatly after a certain point. To sum up, increased inspection to firms in the sectors that are

highly sensitive to enforcement may result in more success for dealing with informality.

Secondly, we keep the enforcement level constant and play with the rate of income tax. A common result in many papers that approach to the relationship between taxes and informality is that higher taxes lead to more informality since costs of staying formal increases and revenues may not be able to compensate these costs, pushing the firm into the informal sector. Therefore, we expect that increasing the tax rate will increase the level of informality. After toggling with the magnitude of income tax, the results are shown in Table 6.

Table 6. Size of Informality at Different Values of Profit Tax, $\rho = 0$.

ρ = 0	**τ = 0.1**	**τ = 0.2**	**τ = 0.3**	**τ = 0.4**	**τ = 0.5**
C	26%	26%	27%	32%	46%
D	100%	100%	100%	100%	100%
E	100%	100%	100%	100%	100%
F	23%	46%	51%	51%	60%
G	34%	34%	59%	61%	68%
H	3%	4%	4%	4%	4%
I	61%	71%	100%	100%	100%
J	94%	94%	100%	100%	100%
K	10%	10%	10%	10%	10%
L	4%	4%	4%	4%	4%
M	100%	100%	100%	100%	100%
N	68%	68%	68%	100%	100%
O	51%	56%	56%	100%	100%
TOTAL	**28%**	**30%**	**38%**	**42%**	**51%**

At the first look, it seems that tax have a more striking impact on informality than enforcement, although the effect of enforcement is higher after an enforcement level of 0.3. At the economy level, a 10% tax decrease from the baseline reduces informality about 3%. This comes from noticeable decreases in sectors F and I. More strikingly, a similar increase have a much bigger effect to the other way (about 7%). The high effect of a tax increase on the level of informality continues as tax gets higher. The result that emerges from this table is that while increases in the income tax causes large increases in informality, a decrease is less effective comparatively.

In addition, sectors that are already completely informal initially did notrespond to changes at all in both directions. Moreover, a 10% increase of the

income tax causes the sectors I and J and doubling the tax rate results in sectors N and O to go completely informal. Finally, already low level of informality in sectors H, K and L stay at the same levels regardless of the tax rate, showing that they are inelastic to the changes in the income tax.

Now, we change the level of enforcement and tax rate at the same time to get a better hold on their effects, since most probably the government will use both of these policy parameters to tackle informality in the economy. To this end, we repeat trials of different taxes while changing the enforcement to 0.25 and 0.5. Results for these trials are shown at Tables 7 and 8.

Table 7. Size of Informality at Different Values of Income Tax, $\rho = 0.25$.

ρ = 0.25	**τ = 0.1**	**τ = 0.2**	**τ = 0.3**	**τ = 0.4**	**τ = 0.5**
C	26%	26%	26%	26%	27%
D	10%	100%	100%	100%	100%
E	100%	100%	100%	100%	100%
F	19%	20%	23%	46%	51%
G	14%	21%	34%	34%	60%
H	2%	3%	3%	4%	4%
I	54%	61%	61%	71%	100%
J	84%	85%	94%	94%	100%
K	0%	10%	10%	10%	10%
L	4%	4%	4%	4%	4%
M	100%	100%	100%	100%	100%
N	62%	62%	62%	68%	68%
O	43%	49%	51%	56%	56%
TOTAL	**20%**	**24%**	**28%**	**31%**	**39%**

Table 8. Size of Informality at Different Values of Income Tax, $\rho = 0.5$.

ρ = 0.5	**τ = 0.1**	**τ = 0.2**	**τ = 0.3**	**τ = 0.4**	**τ = 0.5**
C	23%	23%	25%	26%	26%
D	10%	10%	10%	10%	100%
E	71%	100%	100%	100%	100%
F	2%	3%	3%	19%	20%
G	10%	10%	11%	14%	29%
H	1%	1%	2%	2%	3%
I	24%	30%	47%	54%	61%
J	34%	36%	36%	84%	94%
K	0%	0%	0%	0%	10%
L	1%	3%	3%	4%	4%
M	20%	34%	90%	100%	100%
N	45%	48%	53%	62%	62%
O	6%	18%	26%	43%	49%
TOTAL	**14%**	**15%**	**16%**	**20%**	**26%**

The first thing that catches our attention is the fact that whenever at a very high level of enforcement (when $\rho = 0.5$), tax rate seems to decrease in its effectiveness as a policy tool. For example, when $\rho = 0$ (Table 6) the range of impact that the income tax have on informality is 23 percentage points (from 28% to 51%) , 19 percentage points when $\rho = 0.25$ but this value drops to 12 percentage points when $\rho = 0.5$. This is probably because when enforcement is at a quite high level, it captures the firms that are on the margin, therefore leaving less space for new movements.

Furthermore, it is obvious that the combination of strong enforcement and low taxes seems to be the optimal policy to reduce informality. However, as can be most strikingly seen in Table 6, and because of the aforementioned reason in the previous paragraph, when for example the level of enforcement is kept high the effect of taxation becomes fairly small. This suggests that increased enforcement allows the government to charge the participants in the economy at higher levels of income tax without big ramifications on the account of informality. Of course, this may cause some unseen problems that are not directly related to informality such as increased unemployment or social unrest.

As a final check, we change the level of enforcement to 0.95. Through this, we provide a system of punishment in which if the the particular informal firm get caught by the authorities, almost all the profits are surrendered as a fine. Another way of looking at this is that the probability of getting caught is almost 1, or it's almost impossible to evade from paying taxes. The results for this level of enforcement is presented in Table 9.

Table 9. Size of Informality at Different Values of Income Tax, $\rho = 0.95$.

ρ = 0.95	**τ = 0.1**	**τ = 0.2**	**τ = 0.3**	**τ = 0.4**	**τ = 0.5**
C	17%	17%	20%	20%	20%
D	9%	9%	9%	9%	9%
E	24%	24%	24%	24%	24%
F	2%	2%	2%	2%	2%
G	1%	2%	2%	2%	2%
H	0%	0%	0%	0%	0%
I	1%	1%	1%	1%	1%
J	16%	16%	16%	16%	16%
K	0%	0%	0%	0%	0%
L	1%	1%	1%	1%	1%
M	0%	0%	0%	0%	0%
N	30%	30%	30%	30%	30%
O	2%	2%	2%	2%	2%
TOTAL	**8%**	**8%**	**10%**	**10%**	**10%**

As can be seen in Table 9, there are still some firms that operate informally, although getting busted is almost certain. The reason for this is probably that for these firms either making profits in the formal sector is extremely difficult, if not impossible or that their profits in the informal sector is so high, the benefit suppresses the high risk. This result is similar to the one found in Sarte (2000), in which he proposes that informal firms can still exist even when the cost of informality is extreme.

A Further Analysis

Since the data used in this thesis comes from a survey, it can be interesting to see whether the results match with the participants answers. In the survey, there are a few questions that can be used as proxies for informality. These are:

1. Answers to the direct question in which the participants are asked "In your opinion, what proportion of the value added created in your sector comes from informal activities?"
2. Answers to the survey question: "What do you think is the percentage of employees in your sector working without social security?"
3. Answers to the survey question: "What do you think is percentage of the firms that you receive service from do not provide bills to you or their other customers?"
4. In Turkey, the average social security spending for a firm in 34.5% of its total salary spending. The percentage of firms that stay below this line.

The results received from these questions are proxies can be plausible substitutes for the informal economy, and reported in Table 10.

The results extracted from the answers gives a picture that there are discrepancies with the results found in this thesis as well as with each other. By taking a look at the results in Table 10, we can easily say that the correlations are weak, if not negative, between the supposedly similar indicators. There may be certain causes why this is the case. The most obvious one is that since the first three questions are based on the perceptions of the survey participants and not on facts, the answers may be different depending on the question. The other problem is that the

limited sample size. Some sectors have only five firms in the survey. Moreover, the firms in some these small sample-sized sectors are not diverse enough, for example having one big and 4 small firms, which negatively affect the robustness of the analysis and somewhat prevents us from proposing strict claims about those sectors.

Table 10. A Comparison: Answers to Some Survey Questions

	model	**1.**	**2.**	**3.**	**4.**
C	26%	30%	34%	19%	65%
D	100%	32%	35%	5%	100%
E	100%	24%	40%	25%	100%
F	46%	25%	35%	19%	39%
G	34%	28%	32%	17%	67%
H	4%	22%	37%	18%	59%
I	71%	19%	26%	11%	66%
J	94%	23%	30%	16%	25%
K	10%	19%	53%	45%	60%
L	4%	47%	63%	32%	83%
M	100%	14%	38%	14%	50%
N	68%	20%	21%	20%	71%
O	56%	27%	22%	18%	33%
TOTAL	**30%**	**26%**	**32%**	**17%**	**62%**

However, in dealing with surveys these problems are ever-present. Therefore, when faced with an analysis that is based on a survey, one must caution himself and look for other analyses to support the claims made in the former. A further study for us might be conducting another survey includes much more firms that are selected to represent the size and value-added of their sectors. This way the results of this study might get stronger or weaker, which helps us, governments, bureaucrats, and the

academia to make better judgments, policies about the extent of, and dealing with informality.

CHAPTER 4

CONCLUSION

In this study, we used findings from a firm-level survey of the Turkish economy to measure informality in different sectors of the economy as well as evaluated difierent policy tools to alleviate it. To this end, we built a two-sector dynamic general equilibrium model and used it along with the firm-level survey to back out sectoral informality size.

The first thing that the results indicate is that since sectors have their idiosyncratic properties, they all have different informalities, which show that treating each sector individually is important. While some sectors are completely informal, and they are composed of mostly SMEs. Our comparative statics show that at the economy level, enforcement is quite effective in dealing with informality. However, certain sectors are immune to changes in enforcement, which suggests that a government focus on the sectors that are sensitive to enforcement could be a beneficial and efficient way to address informality. Income tax, on the other hand, is also effective but at higher levels of enforcement, its effect lessens. Also, it's impact increases with high and implausible levels of taxation.

Moreover, this study should be reinforced with further studies since it is based on a survey that is limited in size. Also, the problems brought by survey method may be another reason why we should further look into other studies in the literature as well as additional analyses.

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