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Investment Climate and Firm's Economic Performance: Econometric Methodology and Application to Turkey's Investment Climate Survey[1]

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Abstract

Government policies and behavior exert a strong influence on the investment climate through their impact on costs, risks and barriers to competition. Key factors affecting the investment climate through their impact on costs are: corruption, taxes, the regulatory burden and extent of red tape in general, factor markets (labor, intermediate materials and capital), the quality of infrastructure, technological and innovation support, and the availability and cost of finance. While the investment climate surveys are quite useful in identifying major issues and bottlenecks as perceived by firms, the data collected is also meant to provide the basic information for an econometric assessment of the impact or contribution of the investment climate (IC) variables on productivity. We believe that improving the investment climate (IC) is a key policy instrument to promote economic growth and to mitigate the institutional, legal, economic and social factors that are constraining the convergence of per capita income and labor productivity of Turkey relative to more developed countries. For that, we need to identify the main investment climate variables that affect economic performance measures like total factor productivity, employment, wages, exports and foreign direct investment and this is the main goal of this paper. In turn, that quantified impact is used in the advocacy for, and design of, investment-climate reforms.

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Keywords: Investment climate, firm level determinats of TFP, employment, wages, exports and FDI, mean contributions of investment climate.

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Contents

1. Introduction

As developing countries face the pressures and impacts of globalization, they are seeking ways to stimulate growth and employment within this context of increased openness. With most of these countries having secured a reasonable level of macroeconomic stability, they are now focusing on issues of competitiveness and productivity through microeconomic reform programs. Governments are reformulating their strategies and making increased competitiveness a key priority of government programs.

A significant component of country competitiveness is having a good investment climate or business environment. The investment climate, as defined in the WDR (2005), is "the set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs and expand." It is now well accepted and documented, conceptually and empirically, that the scope and nature of regulations on economic activity and factor markets - the so-called investment climate and business environment - can significantly and adversely impact productivity, growth and economic activity (see Bosworth and Collins, 2003; Rodrik and Subramanian, 2004; Loayza, Oviedo and Serven, 2004; McMillan, 1998 and 2004; OECD, 2001; Wilkinson, 2001; Alexander et al., 2004; Djankov et al., 2002; Haltiwanger, 2002; He et al., 2003; World Bank, 2003; and World Bank, 2004 a,b). Prescott (1998) argues that to understand large international income differences, it is necessary to explain differences in productivity (TFP). His main candidate to explain those gaps is the resistance to the adoption of new technologies and to the efficient use of current operating technologies, which in turn are conditioned by the institutional and policy arrangements a society employs (investment climate variables). Recently, Cole et al. (2004) also have argued that Latin America has not replicated Western economic success due to the productivity (TFP) gap. They point to competitive barriers (investment climate constraints) as the promising channels for understanding the low productivity observed in Latin American countries.

Government policies and behavior exert a strong influence on the investment climate through their impact on costs, risks and barriers to competition. Key factors affecting the investment climate through their impact on costs are: corruption, taxes, the regulatory burden and extent of red tape in general, factor markets (labor, intermediate materials and capital), the

quality of infrastructure, technological and innovation support, and the availability and cost of finance.

For example, Kasper (2002) shows that poorly understood "state paternalism" has usually created unjustified barriers to entrepreneurial activity, resulting in poor growth and a stifling environment. Kerr (2002) shows that a quagmire of regulation, which is all too common, is a massive deterrent to investment and economic growth. As a case in point, McMillan (1988) argues that obtrusive government regulation before 1984 was the key issue in New Zealand's slide in the world per-capita income rankings. Hernando de Soto (2002) describes one key adverse effect of significant business regulation and weak property rights: with costly firm regulations, fewer firms choose to register and more become informal. Also, if there are high transaction costs involved in registering property, assets are less likely to be officially recorded, and therefore cannot be used as collateral to obtain loans, thereby becoming "dead" capital.

Likewise, poor infrastructure and limited transport and trade services increase logistics costs, rendering otherwise competitive products uncompetitive, as well as limiting rural production and people's access to markets, which adversely affects poverty and economic activity (Guasch 2004).

The pursuit of greater competitiveness and a better investment climate is leading countries - often assisted by multilaterals such as the World Bank - to undertake their own studies to identify the principal bottlenecks in terms of competitiveness and the investment climate, and evaluate the impact these have, to set priorities for intervention and reform. The most common instrument used has been firm-level surveys, known as Investment Climate Assessments (ICAs), from which both subjective evaluations of obstacles and objective hard-data numbers with direct links to costs and productivity are elicited and imputed. Such surveys collect data at firm level on the following themes: a) infrastructure, b) red tape, corruption and crime, c) finance and corporate governance, d) quality, innovation and labor skills and d) other control variables like capacity utilization, age and size of the firm, etc.

While the Investment Climate Assessments are quite useful in identifying major issues and bottlenecks as perceived by firms, the data collected is also meant to provide the basic information for an econometric assessment of the impact or contribution of the investment

climate (IC) variables on productivity. In turn, that quantified impact is used in the advocacy for, and design of, investment-climate reform. Yet providing reliable and robust estimates of productivity estimates of the IC variables from the surveys is not a straightforward task since; first, the surveys do not provide panel-type data on IC variables; second, neither the production function parameters nor the functional form are observed; and third, there is an identification issue separating total factor productivity (TFP) component from the inputs of the production function.

When any of the production function inputs is influenced by common causes affecting productivity, like IC variables or other plant characteristics, there is a simultaneous equation problem. In general, one should expect the productivity to be correlated with the production function inputs (technological progress is not Hicks neutral) and, therefore, inputs should be treated as endogenous regressors when estimating production functions. This property has demanded special care with the econometric specification when estimating those productivity effects and in the choice of the most appropriate way of measuring productivity.

There is an extensive literature discussing the advantages and disadvantages of using different statistical estimation techniques and/or growth accounting (index number) techniques to estimate productivity or Total Factor Productivity (TFP). For overviews of different productivity concepts and aggregation alternatives see, for example, Solow (1957), Hall (1990), Foster, Haltiwanger and Krizan (1998), Batelsman and Doms (2000), Hulten (2001), Diewert and Nakamura (2002), Jorgenson (2003), Jorgenson, Gollop and Fraumeni (1987), Olley and Pakes (1996) and Barro and Sala-i-Martin (2004).

We believe that improving the investment climate (IC) is a key policy instrument to promote economic growth and to mitigate the institutional, legal, economic and social factors that are constraining the convergence of per capita income and labor productivity of Turkey relative to more developed countries. For that, we need to identify the main investment climate variables that affect economic performance measures like total factor productivity, employment, wages, exports and foreign direct investment and this is the main goal of this paper.

The recent trade literature has emphasized the importance of firm heterogeneity in understanding export behaviour. Traditional trade theory either has all firms or none of the

firms in a given sector export. However, micro-level evidence shows this picture to be seriously flawed. Even within so-called export sectors, a substantial fraction of firms exclusively sell in the domestic market. Bernard and Jensen (1995, 1999), Clerides, Lach and Tybout (1998), and Aw, Chung and Roberts (2000) all find that larger and more productive firms are more likely to export. This heterogeneity shows up both across and within sectors. Moreover, these stylized facts seem to be common to both developed and developing countries. The work of Bernard and Jensen (1995, 1999), for instance, focuses on the U.S., whereas Clerides, Lach and Tybout (1998) analyze Colombia, Mexico and Morocco. The results presented in this paper on Turkey confirm many of these stylized facts. In particular, productivity is shown to have an important impact on a firm's probability to export and larger firms are more productive. This result holds up even after controlling for a large variety of investment climate variables.

These stylized facts have given rise to a number of important theoretical contributions. Melitz (2003) proposes a monopolistic competition model with heterogeneous firms. Each firm draws its productivity from a distribution. To enter the export market, firms need to pay a fixed cost. As a result, only the larger or more productive firms will choose to export, while the smaller or less productive firms will decide to only serve the domestic market. Yeaple (2005) is able to obtain the same qualitative results, without assuming that firms are randomly assigned their productivity levels. Instead, ex ante homogeneous firms get to choose between competing technologies, and can hire workers of heterogeneous skill. Different workers have comparative advantage in different technologies. As in Melitz (2003), there is a fixed cost in accessing export markets. The model generates ex post heterogeneous firms, with the low productivity firms serving the domestic markets, and the high productivity firms exporting.

What keeps low productivity firms from exporting in both Melitz (2003) and Yeaple (2005) is the existence of a fixed cost to enter export markets. There is empirical evidence supporting this view. Das, Roberts and Tybout (2006), for instance, estimate that Colombian chemical plants need to pay a fixed cost of around $1 million to enter export markets. Other papers, such as Bernard and Jensen (2004) for the U.S. and Bernard and Wagner (2001) for Germany further substantiate the existence of fixed costs involved with exporting.

In our study on Turkey we find, for instance, that having *fixed costs* like web page, R&D activities, security costs etc., increase the probability to export. In contrast to Melitz (2003), the

theoretical work by Bernard, Eaton, Jensen and Kortum (2003) suggests that fixed export costs are not needed to match the heterogeneity in export performance. They propose a model with Bertrand competition, where the price a firm can charge is bound by potential rivals. In this setup it is easier for a firm to sell at home than abroad. To export, a firm needs to overcome the hurdle of transportation costs, whereas to sell in the domestic market, transportation costs reduce the threat of foreign rivals. Therefore, firms that export will be more productive.

Although much of the empirical evidence points to more productive firms becoming exporters and not the other way around (see, e.g., by Bernard and Jensen, 1999, and Clerides et al., 1998), the theory on the relation between productivity and exports is not exempt from reverse causality or the simultaneity found in Turkey. Whereas Melitz (2003) and Bernard et al. (2003) argue that high productivity firms self select to become exporters, it is also true that access to export markets may make firms more productive. In the work by Grossman and Helpman (1991), for instance, an increase in the market size allows for more varieties being produced, thus improving the productivity of final good producers. Holmes and Schmitz (2001) propose a quality ladder model, in which entrepreneurs can use their time to either block the innovation of their rivals or to innovate and move up the ladder. They show how trade shifts the relative returns from unproductive blocking towards productive innovation. Desmet and Parente (2006) emphasize yet another mechanism: they argue that access to larger markets increases the elasticity of demand, thus increasing the incentive for firms to adopt more productive technologies.

The conventional wisdom associates foreign direct investment with higher productivity. According to Markusen (1995), one important stylized fact is that multinationals are prevalent in firms and industries with high levels of R&D, a large share of professional and technical workers, and products that are new and/or technically complex. This is in line with Dunning (1993) who argues that to overcome local barriers, multinationals must have some intangible assets, such as superior technologies or more advanced management techniques and those arguments support our empirical findings in Turkey. Markusen (1995) refers to this as knowledge-based assets.

However, the statistical contemporaneous correlation (simultaneity) between foreign ownership and productivity does not settle the question of causality. Do foreign firms, through technology transfers, improve the productivity of the firms they acquire? Or do foreign

investors select more productive firms to acquire? To use the words of Evenett and Voicu (2002), are foreign investors picking winners or creating them? In order to answer this causality questions we need to have either a control group of firms or a dynamic panel of IC variables and therefore are out of the scope of this paper.

In the case of developing countries, inward FDI may increase productivity, simply because foreign investors, often based in more advanced economies, dispose of more productive technologies. In this case, domestically owned and foreign owned firms get their productivity from different exogenous distributions. However, the positive contemporaneous correlation between foreign ownership and productivity also holds up when one focuses on FDI between developed countries. The recent theoretical work of Helpman, Melitz and Yeaple (2004) proposes a mechanism, similar to the one in Melitz (2003) that rationalizes this fact. Because of the fixed costs involved in setting up an affiliate plant abroad, only the most productive firm are able to become multinationals. Even if home firms and foreign firms get their productivity assigned from the same exogenous distribution, only the more productive foreign firms will choose to set up affiliates in the home country. This self selection issue gives rise to an endogenous difference in the productivity distribution of domestically owned and foreign owned firms.

Although these theories suggest that foreign investors would tend to improve the productivity of the firms they acquire, recent work on FDI in developed countries suggests that selection bias may be a problem. This supports the view that foreign investors may be "picking winners". For instance, Harris and Robinson (2003) find that in the case of the UK foreign firms acquire better performing local firms, without further improving productivity after acquisition. Benfratello and Sembenelli (2006) come to a similar conclusion in the case of Italy. Other studies continue to find a positive effect from foreign ownership though. Conyon et al. (2002), for example, estimate that UK firms get a 14% productivity boost after being acquired by foreign firms.

Studies of foreign acquisitions in developing countries suggest self selection bias is less of an issue. In the case of the Czech Republic, Djankov and Hoekman (2000) and Evenett and Voicu (2002) both find evidence of technology transfers by foreign owners. Moreover, the positive impact is larger in foreign owned firms than in joint ventures. In a recent study of Indonesian manufacturing plants, Jens and Smarzynska (2005) use propensity score matching

to determine what would have happened to a domestic firm had it not been acquired? They find a strong positive effect of foreign ownership. The increase in plant productivity is estimated to reach 34% three years after acquisition.

In this work on Turkey we find that productivity is one of the main variables affecting foreign investors acquiring local firms but as in the work by Jens et al. (2005), other characteristics, such as infrastructures, innovation (technology licence, new product), exports size of the firm also matter. However, those firms that receive foreign direct investment are not more productive after controlling for R&D activities and human capital.

Productivity has also a positive and important effect on wages. These are good news since improvements in productivity (TFP) are transformed in increases in wages. The elasticity is 0.47 meaning that a one percent increases in TFP creates a 0.47 % increase in wages.

Finally, a negative elasticity (-0.072) of productivity (TFP) on employment, after controlling for other IC variables, implies that technical change is Hicks neutral. With the same amount of employment and capital services it is possible to produce more output. The detailed explanation of the individual IC effects will be given later on.

The structure of this paper is the following:

2. Data

The pursuit of greater competitiveness and a better investment climate is leading countries - often assisted by multilaterals such as the World Bank- to undertake their own studies, to set priorities for intervention and reform. The most common instrument used has been firm-level surveys, known as Investment Climate Surveys (ICs) from which both subjective evaluations of obstacles and objective hard-data numbers with direct links to costs and productivity are elicited and imputed.

The Investment Climate Surveys measure firms' experience in a range of areas related with the economic performance: financing, governance, corruption, crime, regulation, tax policy, labor relations, conflict resolution, infrastructures, supplies and marketing, quality, technology, and training among others; see Tables A.1 and A.2 of appendix III. For that purpose, we

classify investment climate factors in five categories to evaluate the impact of each group on the economic performance. In the first group, says infrastructures, we include all the variables related with customs clearance, power and water supply, telecommunications (including phone connection and information technologies) and transportation. In the second group, red tape, corruption and crime, are included all the IC factors regarding tax rates, conflicts resolution, crime, bureaucracy, informalities, corruption and regulations. The next group is finance and corporate governance which contains factors related with governance, investments, informalities in payments of sales and purchases, access and cost of finance and accountability (or auditing). The last group of IC variables is quality, innovation and labor skills; this group includes the quality certifications, technology usage, product and process innovation, research and development, quality of the labor, training and managers' experience and education. The last group –other control variables– is not properly a group of investment climate factors but a group of other firms' control characteristics, we classify into this group all the factors that we consider may have an important impact on the economic performance but not considered as IC factor: exports and imports, age, FDI, number of competitors, size of the firm, etc.

The ICs provides information on the productivity (or production function) variables, says, output (sales), employment, intermediate materials, capital stock and labor cost; see Table A.1 of appendix III. The ICs does not provide information on prices at the firm level, so the production function variables were deflated by using the World Bank's country specific Consumer Price Index, base 2000. An appendix with the definition of the variables used is included at the end of the paper.

The data are from a survey of 1323 manufacturing establishments conducted in the summer of 2005. The panel is short in the time dimension, since includes only 2 years of productivity data, and has 1 year of investment climate (IC) variables. The cleaned dataset leaves a panel with 836 observations for each of the two years; see appendix I for a summary of the treatment of missing observations and Tables B2a, B2b and B3 of appendix III for the percentage of missing values by industry, year and region and the response rate on IC variables. For a deeper analysis on the effects of missing values see Escribano and Pena (2008).

In this paper we focus on the manufacturing sector and by classifying the establishments by their ISIC code we end up with establishments from the next eight sectors: a) Food and beverages; b) Textiles and apparels; c) Chemicals; d) Non-metallic mineral products; e)

Metallic products f) Machinery and equipment; g) Electrical machinery; h) Transport equipment.

For more details see the last section on data transformations of the Appendix. As will become clear later on, this region-industry transformation helps us also reducing the degree of endogeneity of IC variables.

3. Evaluation of the impact of the investment climate on productivity

We consider that productivity (P), or multifactor productivity, refers to the effects of any variable different from the inputs --labor (L), intermediate materials (M) and capital services (K)--, affecting the production (Y) process. Since there is no single salient measure of productivity (or $\log P_i$), any empirical evaluation on the productivity impact of IC variables might critically depend on the particular way productivity is measured. Therefore, to get reliable empirical elasticities for policy analysis, Escribano and Guasch (2005, 2008) suggest searching for robust empirical results using several productivity measures. This is also the approach we follow in this paper. However, for cross-country comparisons and other economic performance measures, different than TFP, we will concentrate on the IC effects on Solow's residual.

3.1 Two steps estimation of IC elasticities and semi-elasticities

The first productivity analysis considered in this paper is to use the nonparametric or index number approach based on cost-shares from Hall (1990) to obtain the Solow´s residual (Solow, 1957) in levels (logs) with restricted cost shares

$$\log Y_{j,it} = \overline{s}_L \log L_{j,it} + \overline{s}_M \log M_{j,it} + \overline{s}_K \log K_{j,it} + \log P_{j,it} \tag{3.1}$$

where $\overline{s}_r$ is the aggregate *average cost shares* from the last two years[2]. We also allow the cost-shares to vary industry by industry ($\overline{s}_{j,L}, \overline{s}_{j,M}, \overline{s}_{j,K}$), yielding the *unrestricted* by industry Solow residuals.

Once we have estimated (first step) productivity from equation (3.1) we estimate from equation (3.2) the investment climate (IC) elasticities and semi-elasticities by OLS (with robust standard errors) and by random effects obtaining *two steps estimators*,

$$\log P_{j,it} = \alpha'_{IC} IC_i + \alpha'_C C_i + \alpha'_{Ds} D_j + \alpha'_{DT} D_t + \alpha_P + u_{j,it} \tag{3.2}$$

[2] When there is only firm information about a single year we take the average cost share of the firms of that year.

where IC_i, C_i, D_j and D_t are (Q x 1), (M x 1), (J x 1) and (T x 1) column vectors, of investment climate (IC) variables, control (C) variables, country and industry dummies (D_j) and year dummies (D_t), respectively. The composite random-effect error term equal to $u_{it} = \varepsilon_i + v_{it}$ and should satisfy *standard assumptions* of random effects (RE) conditional models. That is,

$$E\left[v_{it} / \log L_{it}, \log M_{it}, \log K_{it}, IC_{P,i}, C_{P,i}, D_j, D_t, \varepsilon_i \right] = 0$$

$$E\left[\varepsilon_i / \log L_{it}, \log M_{it}, \log K_{it}, IC_{P,i}, C_{P,i}, D_j, D_t \right] = 0$$

$$and \quad Var\left[\varepsilon_i / \log L_{it}, \log M_{it}, \log K_{it}, IC_{P,i}, C_{P,i}, D_j, D_t \right] = \sigma_\varepsilon^{\,2}.$$

Notice that we need to condition on the observable fixed effects (IC) to get the orthogonally condition of the inputs L, M and K.

3.2 Single step estimation of IC elasticities and semi-elasticities

In the second estimation strategy and to address the endogeneity problem of the inputs, we follow the approach proposed by Escribano and Guasch (2005, 2008). That is, we proxy the usually unobserved firm specific fixed effects, which is the main source of endogeneity of the inputs, by a long list (say 83 variables in this case) of firm specific *observable time-fixed effects* coming from the investment climate surveys (ICs).

In particular, we form the *extended Cobb-Douglas production function* with restricted input-output elasticities estimated in one step as;

$$\log Y_{j,it} = \alpha_L \log L_{j,it} + \alpha_M \log M_{j,it} + \alpha_K \log K_{j,it} + \alpha'_{IC} IC_i + \alpha'_C C_i + \alpha'_{Ds} D_j + \alpha'_{DT} D_t + \alpha_P + u_{j,it} \qquad (3.3)$$

and similarly with the unrestricted by industry input-output elasticities of the production function. We also consider alternative parametric models based on the *Translog functional* form of the production function since our aim, is not to find the true model but to estimate *elasticities, and semi-elasticities* of IC variables on productivity that are *robust* (with equal signs and of similar magnitudes) to all the alternative productivity measures considered.

Table 1 summarizes the list of productivity measures used for the IC evaluation.[3] The *two steps* estimation starts from the non-parametric approach based on cost-shares from Hall (1990) to obtain the Solow's residuals in logs under two different assumptions: first, the cost shares are constant for all the establishments located in the same region (*restricted Solow residual*), and second the cost shares varies among industries in the same region (*unrestricted by industry Solow residual*). Once we have estimated the two productivity measures ($\log P_i$) in the first step, see equation (3.1), in the second step we can estimate the IC elasticities and semi-elasticities

[3] The details of the econometric methodology are described in Escribano and Guasch (2005, 2008).

from equation (3.2). The advantage of the Solow residual is that it does not require neither the inputs (L, M, K) to be exogenous nor the input-output elasticities to be constant or homogeneous, see Escribano and Guasch (2005) for a further discussion. The drawback is that it requires having constant returns to scale (CRS) and at least competitive input markets.

Table 1. Summary of Productivity Measures and Estimated Investment Climate (IC) Elasticities

1. Solow´s Residual	Two Step Estimation	1.1 Restricted Coef. 1.2 Unrestricted Coef.	1.1.a OLS 1.1.b RE 1.2.a OLS 1.2.b RE	2 (P_{it}) measures 4 (IC) elasticities
2. Cobb-Douglas	**Single Step Estimation**	**2.1 Restricted Coef.** **2.2 Unrestricted Coef.**	**2.1.a OLS** **2.1.b RE** **2.2.a OLS** **2.2.b RE**	**4 (P_{it}) measures** **4 (IC) elasticities**
3. Translog	**Single Step Estimation**	**3.1 Restricted Coef.** **3.2 Unrestricted Coef.**	**3.1.a OLS** **3.1.b RE** **3.2.a OLS** **3.2.b RE**	**4 (P_{it}) measures** **4 (IC) elasticities**
Total				**10 (P_{it}) measures** **12 (IC) elasticities**

Restricted Coef.ficints= Equal input-output elasticities in all industries. Unrestricted Coefficients.= Different input output elasticities by industry. OLS = Pooling Ordinary Least Squares estimation (with robust standard errors). RE = Random Effects estimation.

In the *single step* estimation approach we estimate by ordinary least squares (OLS), with robust standard errors, the extended production function. To address the well-known endogeneity problems of the inputs (L,M, and K) we follow the approach proposed by Escribano and Guasch (2005). That is, we proxy the usually unobserved firm specific fixed effects (which are the main cause of the endogeneity of the inputs) by a long list of firm specific observed fixed effects coming from the investment climate information. Controlling for this largest set of investment climate (IC) variables and plant control (C) characteristics we can get, under standard regularity conditions, *consistent and unbiased* least squares estimators of the parameters of the production function. In particular we use two different functional forms of the production function, Cobb-Douglas and *Translog*, under two different input-output elasticities: equal input-output elasticities in each industry (restricted case) and different input-output elasticities by industries (unrestricted case).

Table B.5 of the Appendix shows the correlation matrix among the alternative productivity measures estimated by pooling the samples (ICs) from the four countries. Clearly the correlation can be very high (say 0.99) or very low (say 0.083). Therefore, it seems challenging to be able to find robust IC-productivity elasticities estimates, based on productivity measures with low correlation coefficient.

Another econometric problem that we have to face when estimating IC elasticities on TFP, is the *endogeneity of some IC and C variables*. In these productivity equations, the traditional dynamic instrumental variable (IV or GMM) approach is difficult to implement, given that we only have IC information for one year and therefore we cannot use the natural instruments for the inputs, like those provided by their own lags, etc. Therefore, as an alternative correction for the endogeneity of the IC variables, we use the region-industry-size average of the plant level investment climate variables ($\overline{IC}$) instead of the crude IC variables, which is a common solution in panel data studies at the firm level[4].

The endogeneity of the IC variables is a topic that has been dealt with in the recent literature on investment climate. Veeramani and Goldar (2004) estimate the impact of several IC indicators on TFP variable by variable using the industry-location averages as instruments to avoid the endogeneity problem. In the same line, Hallward et al (2003) to avoid multicollinearity problems due to the correlation among the IC indicators proposes to use the industry-region averages in models with a reduced number of explanatory variables. While this approach avoids problems of multicollinearity, it introduces and important *omitted* variables bias. The long list of investment climate factors works as a proxy of the idiosyncratic differences among firms, and therefore the omission of a group of variables may introduce biases and inconsistencies in the estimation of the rest of the parameters of the model. As we have discussed before, taking *industry-region-size* averages is also useful to mitigate the effect of missing individual IC observations at the plant level, as mentioned in section 2.

The econometric methodology applied for the selection of the variables (IC and C) goes from the *general to the specific*. The otherwise *omitted variables* problem that we encounter, starting from a too simple model, generates biased and inconsistent parameter estimates. We start the selection of variables with a wide set compounded by up to 97 variables, we avoid using at the same time variables providing the same information and likely to be correlated among them, mitigating the problem of multicollinearity mentioned above. We then start removing the less significant variables, one by one, until we obtain the final set of explanatory variables that are significant in at least one of the productivity measures. The main result is that those IC elasticity-productivity estimates vary within a reasonable range of values and with equal signs. Tables C.1a and C.1b of appendix III include the set of IC variables that were significant in at least one of the 10 productivity measure used. Notice that we always get the expected signs for each individual IC variable, that their signs are robust to alternative TFP measures and that the range of values of the estimated elasticities and semi-elasticities is reasonable.

[4] This two step estimation approach has an instrumental variables (2SLS) interpretation.

For each significant IC variable, we represent the average values of the pooling OLS elasticity estimates given in Tables C.1a and C.1b of Appendix III.

3.4 IC-Evaluation on the Average (log) Productivity.

Equation (3.2), estimated by pooling OLS with a constant term, implies that the mean of the residuals is zero and therefore that we can evaluate the estimated regression (3.2) at their sample mean without including an error term. Therefore, the corresponding expression for the first term of the Olley and Pakes (1996) decompositions of productivity in logs becomes,

$$\log \overline{P}_{jt} = \hat{\alpha}_P + \hat{\alpha}'_{\mathrm{IC}} \overline{\mathrm{IC}} + \hat{\alpha}'_C \overline{C} + \hat{\alpha}'_{Ds} \overline{D}_j + \hat{\alpha}'_{DT} \overline{D}_t \tag{3.4}$$

where the variables with bars indicate sample averages of each variable. Therefore, we can evaluate the impact of each $\overline{IC}$ variable on average log productivity, dividing the whole expression by the dependent variable $\log \overline{P}_{j,t}$ and multiplying by 100 we get, following Escribano and Guasch (2005, 2008), the direct contribution of each variable. That is,

$$100 = \frac{\hat{\alpha}_P}{\log \overline{P}_{jt}} 100 + \frac{\hat{\alpha}'_{\mathrm{IC}} \overline{\mathrm{IC}}}{\log \overline{P}_{jt}} 100 + \frac{\hat{\alpha}'_C \overline{C}}{\log \overline{P}_{jt}} 100 + \frac{\hat{\alpha}'_{Ds} \overline{D}_j}{\log \overline{P}_{jt}} 100 + \frac{\hat{\alpha}'_{DT} \overline{D}_t}{\log \overline{P}_{jt}} 100 \tag{3.5}$$

represents the sum of the percentage productivity gains (or losses) from all the explanatory variables of the regression, relative to the average (log) productivity of industry j at time t. In particular the contribution of r component of the vector of IC variables, relative to average (log) productivity, is given by the term $\left(\frac{\hat{\alpha}_{IC,r} \overline{IC}_r}{\log \overline{P}_{jt}} 100 \right)$.

If the average log productivity is not calculated across all the firms of the country, but it is calculated industry by industry, sector by sector, by size, by age of the firm, etc., then the sample mean of those residuals, $\hat{u}_{r,it} = (\hat{v}_{ri} + \hat{\varepsilon}_{r,it})$ from (3.2), is not exactly zero and the decomposition is not exact. In that case, the residual mean would also have a contribution (although small) to the average log productivity.

3.5 Empirical Results.

Numbers in Figure 1 are relative percentages computed with the absolute values of percentage contributions of equation (3.5); that is, Figure 1 shows in its first column the relative weight of each group of IC variables (with respect to the whole absolute contribution of all IC variables) on average log-productivity. The main group explaining average log-productivity is red tape, corruption and crime with a relative weight of 65%; thus, more than half log-productivity may be explained with this group of IC variables. Next group is Infrastructures with 15.5%, followed by finance and corporate governance with 10%.

To disentangle the impact of each group of Figure 1 variable by variable we can use Figure 2.1, which directly reports the results obtained by applying equation (3.5) to Turkey. Simulations experiments to evaluate the impact of IC on TFP (and not on log TFP) can be done with qualitatively similar results; see Escribano et al (2008).

The variables with the largest percentage contributions are *Losses due to criminal activity* (26.9%) and *Sales declared to taxes* (22.4%) in the red tape, corruption and crime group. Within infrastructures group, the largest contribution comes from *Days to clear customs to import* 99.3%); *External auditory* (9.8%) is the only significant variable in finance and corporate governance group; the percentages contributions to average log-productivity in quality and innovation and labor skills group are lower than in other groups, only *Weeks of training of skilled workers* is over 4%; finally, in other control variables group the contributions are insignificant.

Figure 3.1 reports the results obtained from applying equation (3.5) by sizes instead of at the aggregate level. There is not a significant difference among sizes.

4. IC assessments on economic performance: employment, real wages, exports and FDI

Since in the previous section on productivity we found robust results for all the ten productivity measures used, in what follows, we will concentrate on the analysis of only one productivity (TFP) measure[5]; the restricted Solow´s residuals.

[5] It is interesting to use always the same measure of TFP, to allow for cross-country TFP comparisons; see Escribano et al. (2008).

In order to estimate the impact of IC and C variables on several measures of economic performance, controlling for TFP, we use the following simultaneous equations system;

$$\log P_{j,it} = \alpha_P + \alpha'_{\mathrm{IC}}\mathrm{IC_i} + \alpha'_C C_i + \alpha'_{Ds} D_j + \alpha'_{DT} D_t + (\mathrm{v_{P,i}} + \varepsilon_{P,j,it}) \quad (4.1)$$

$$y^{Exp}{}_{j,it} = \delta_{Exp} + \delta_P \log P_{j,it} + \delta'_{\mathrm{IC}}\mathrm{IC_i} + \delta'_C C_i + \delta'_{Ds} D_j + \delta'_{DT} D_t + (\mathrm{v_{Exp,i}} + \varepsilon_{Exp,j,it}) \quad (4.2)$$

$$y^{FDI}{}_{j,it} = \rho_{FDI} + \rho_P \log P_{j,it} + \rho'_{\mathrm{IC}}\ \mathrm{IC_i} + \rho'_C C_i + \rho'_{Ds} D_j + \rho'_{DT} D_t + (\mathrm{v_{FDI,i}} + \varepsilon_{FDI,j,it}) \quad (4.3)$$

$$\mathrm{LogL_{j,it}} = \gamma_{\mathrm{L}} + \gamma_{\mathrm{P}}\mathrm{logP_{j,it}} + \gamma_{\mathrm{w}}\mathrm{logW_{j,it}} + \gamma'_{\mathrm{L}}\mathrm{IC_i} + \gamma'_{\mathrm{C}}\mathrm{C_i} + \gamma'_{Ds} D_j + \gamma'_{DT} D_t + (\mathrm{v_{L,i}} + \varepsilon_{\mathrm{L,j,it}}) \quad (4.4)$$

$$\mathrm{LogW_{j,it}} = \beta_{\mathrm{W}} + \beta_{\mathrm{P}}\mathrm{logP_{j,it}} + \beta'_{\mathrm{IC}}\mathrm{IC_i} + \beta'_{\mathrm{C}}\mathrm{C_i} + \beta'_{Ds} D_j + \beta'_{DT} D_t + (\mathrm{v_{W,i}} + \varepsilon_{\mathrm{W,j,it}}) \quad (4.5)$$

Notice that since the variable $\mathrm{y^r_{j,it}}$, with r = Exp or FDI, is a *binary random variable* taking only 0 and 1 values, then $P(y^r{}_{j,it} = 1/x) = E(y^r{}_{j,it}/x)$, the conditional probability is equal to the conditional expectation which is usually assumed to follow a PROBIT or a LOGIT model, and the conditional variance (heteroskedasticity) is equal to the product of the conditional probabilities of the two events. In general, the linear probability models (LPM) approximate well the PROBIT and LOGIT nonlinear models when the variables are evaluated at their sample means. The treatment of PROBIT and LOGIT models with endogenous explanatory variables has no well established solution. However, since we are interested in the mean IC contribution relative to the mean values of the dependent variables, we will concentrate on linear probability specifications, like (4.2) and (4.3). The main advantage of the LPM is that the endogeneity of the regressors can be addressed by standard instrumental variables (IV) approaches like 2SLS or GMM.

We would like to assume that the error terms of each equation ($\mathrm{v_{r,i}}+\varepsilon_{\mathrm{r,j,it}}$) are uncorrelated with all the explanatory variables of each equation r, where r=P, Exp, FDI, W and L. However, for certain explanatory variables of the system this exogeneity[6] conditions are not satisfied. The endogeneity of certain IC variables induces a correlation between those IC variables and the errors ($\mathrm{v_{r,i}}+\varepsilon_{\mathrm{r,j,it}}$) of the system of equations (4.1) to (4.5) and creates simultaneous equation biases and inconsistencies in least squares estimators, like pooling OLS or in random effects (RE) estimators. This correlation is in general mitigated by replacing those plant-level IC variables by their region-industry averages ($\overline{IC}_j$), as we have seen before. However, for some other explanatory variables like productivity, wages, exports and FDI, the endogeneity is

[6] See the orthogonality conditions discussed after equation (3.2).

intrinsic due to the simultaneous structure of the system of equations. Therefore, when necessary, we will estimate each equation by instrumental variables (IV) techniques based on two stages least squares (2SLS) procedures using heteroskedasticity-robust standard errors. We could have used 3SLS, which is more efficient than 2SLS under correct specification of each equation of the system. However, since with system of equations estimation techniques the misspecification of one equation affects the whole system, the results obtained from 2SLS are more robust.

To discuss the identification issues underlying the system of equations proposed it is useful to apply matrix notation. The structural form of the system (4.1) - (4.5) is given by

$$\mathbf{A}\mathbf{y}_t + \mathbf{B}\mathbf{x}_t = \mathbf{u}_t \tag{4.6}$$

where $\mathbf{y}_t$ is the 5×1 vector of observations of *dependent* variables (log-productivity, y_{it}^{Exp} and y_{it}^{FDI}, log-employment and log-wages); $\mathbf{x}_t$ is the 97×1 vector of observations on the *exogenous/endogenous* variables (IC_i, C_i, D_j and D_t); $\mathbf{u}_t$ is the 5×1 vector of errors; $\mathbf{A}$ is a 5×5 matrix of coefficients of simultaneous *dependent* variables; $\mathbf{B}$ is a 5×97 matrix of coefficients of the exogenous/endogenous variables.

In the system (4.1) - (4.5), we are imposing certain structure; for example that employment has no direct effect in any other equation of the system and that real wages only affects employment demand, after controlling for all IC and C variables. Therefore, we can explicitly write the first term of (4.6) as;

$$\mathbf{A}\mathbf{y}_t \equiv \begin{pmatrix} 1 & -a_{P,Exp} & -a_{P,FDI} & 0 & 0 \\ -a_{Exp,P} & 1 & -a_{Exp,FDI} & 0 & 0 \\ -a_{FDI,P} & -a_{FDI,Exp} & 1 & 0 & 0 \\ -a_{L,P} & -a_{L,Exp} & -a_{L,FDI} & 1 & -a_{L,W} \\ -a_{W,P} & -a_{W,Exp} & -a_{W,FDI} & 0 & 1 \end{pmatrix} \begin{pmatrix} \log P_{it} \\ y_{it}^{Exp} \\ y_{it}^{FDI} \\ \log L_{it} \\ \log W_{it} \end{pmatrix} \equiv \begin{pmatrix} \log P_{it} - a_{P,Exp} y_{it}^{Exp} - a_{P,FDI} y_{it}^{FDI} \\ y_{it}^{Exp} - a_{Exp,P} \log P_{it} - a_{Exp,FDI} y_{it}^{FDI} \\ y_{it}^{FDI} - a_{FDI,P} \log P_{it} - a_{FDI,Exp} y_{it}^{Exp} \\ \log L_{it} - a_{L,P} \log P_{it} - a_{L,W} \log W_{it} - a_{L,Exp} y_{it}^{Exp} - a_{L,FDI} y_{it}^{FDI} \\ \log W_{it} - a_{W,P} \log P_{it} - a_{W,Exp} y_{it}^{Exp} - a_{W,FDI} y_{it}^{FDI} \end{pmatrix}.$$

The rank condition is a necessary and sufficient condition for the system (4.6) to be identified. To discuss whether the rank condition is satisfied, say, in the first equation, let $\boldsymbol{\alpha}'$ be the first row of $\mathbf{A}$ and $\boldsymbol{\beta}'$ the first row of $\mathbf{B}$. We may now partition these vectors into two components corresponding to the included ($\boldsymbol{\alpha}_1'$ and $\boldsymbol{\beta}_1'$) variables and excluded ($\boldsymbol{\alpha}_2'$ and $\boldsymbol{\beta}_2'$) variables in the productivity equation such that $\mathbf{A} = \begin{bmatrix} \boldsymbol{\alpha}_1' & \mathbf{0} \\ \mathbf{A}_1 & \mathbf{A}_2 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} \boldsymbol{\beta}_1' & \mathbf{0} \\ \mathbf{B}_1 & \mathbf{B}_2 \end{bmatrix}$, which allow us

to construct the next matrix $\mathbf{D}=\begin{bmatrix}\mathbf{0} & \mathbf{0}\\ \mathbf{A_2} & \mathbf{B_2}\end{bmatrix}$. By the rank condition, productivity equation is identified if $rank(\mathbf{D}) = 5-1$. The same holds for the rest of equations of the system. Thus, even if we have several exclusion restrictions in matrix $\mathbf{A}$ (in the productivity, wages and employment equations), nevertheless these restrictions are not enough to ensure the rank condition to be satisfied, for more details on the particular extra identification conditions imposed see Appendix II.

The empirical results based on 2SLS pooling the ICs from turkey are included in Tables D.1 to D.4 of the Appendix III. In all the cases we found that TFP has a significant impact on employment demand (negative), real wages (positive), and on the probabilities of exporting (positive) or receiving FDI (positive), even after controlling for IC variables.

5. IC-Evaluation on the Average Value of Each Dependent Variable

The objective now is to measure the *partial direct effect* of each IC variable on each dependent variable at different aggregation levels (aggregate level, sector by sector, region by region, by size of the firm, by age of the firm, etc.). For that purpose, we evaluate the impact of the average IC variable on the sample average values of the dependent variables (employment, wages, exports, FDI,). In what follows, we substitute all the unknown parameters from the system (4.1) to (4.5) by their corresponding 2SLS estimated values.

Labor demand equation;

$$\log \overline{L}_{j,it} = \hat{\gamma}_L + \hat{\gamma}_P \log \overline{P}_{j,it} + \hat{\gamma}_W \log \overline{W}_{j,it} + \hat{\gamma}'_{\text{IC}} \overline{IC} + \hat{\gamma}'_C \overline{C} + \hat{\gamma}'_{Ds} \overline{D}_j + \hat{\gamma}'_{DT} \overline{D}_t \qquad (5.1a)$$

where $\log \overline{L}_{j,it} = \dfrac{1}{N_{jt}} \sum_{i=1}^{N_{jt}} \log L_{j,it}$.

$$100 = \frac{\hat{\gamma}_L}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}_P \log \overline{P}_{j,it}}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}_W \log \overline{W}_{j,it}}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}'_{\text{IC}} \overline{IC}}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}'_C \overline{C}}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}'_{Ds} \overline{D}_j}{\log \overline{L}_{j,it}} 100 + \frac{\hat{\gamma}'_{DT} \overline{D}_t}{\log \overline{L}_{j,it}} 100 \qquad (5.1b)$$

Wage equation;

$$\log \overline{W}_{j,it} = \hat{\beta}_W + \hat{\beta}_P \log \overline{P}_{j,it} + \hat{\beta}'_{\text{IC}} \overline{IC} + \hat{\beta}'_C \overline{C} + \hat{\beta}'_{Ds} \overline{D}_j + \hat{\beta}'_{DT} \overline{D}_t \qquad (5.2a)$$

where $\log\overline{W}_{j,it} = \frac{1}{N_{jt}}\sum_{i=1}^{N_{jt}} \log W_{j,it}$.

$$100 = \frac{\hat{\beta}_W}{\log\overline{W}_{j,it}}100 + \frac{\hat{\beta}_P \log\overline{P}_{j,it}}{\log\overline{W}_{j,it}}100 + \frac{\hat{\beta}'_{\mathrm{IC}}\overline{IC}}{\log\overline{W}_{j,it}}100 + \frac{\hat{\beta}'_C\overline{C}}{\log\overline{W}_{j,it}}100 + \frac{\hat{\beta}'_{Ds}\overline{D}_j}{\log\overline{W}_{j,it}}100 + \frac{\hat{\beta}'_{DT}\overline{D}_t}{\log\overline{W}_{j,it}}100 \qquad (5.2b)$$

Since y_{it}^{Exp} is a binary variable, evaluating the impact at the sample mean implies the evaluation on the *probability (frequency) of exporting*. In particular the equation (4.4) evaluated at the sample mean becomes

$$\hat{P}(Exp_{j,t} \succ 0) = \hat{\delta}_{Exp} + \hat{\delta}_P \log\overline{P}_{jt} + \hat{\delta}'_{\mathrm{IC}}\overline{\mathrm{IC}} + \hat{\delta}'_C\overline{C} + \hat{\delta}'_{Ds}\overline{D}_j + \hat{\delta}'_{DT}\overline{D}_t \qquad (5.3a)$$

where $\hat{P}(Exp_{j,t} \succ 0) = \frac{1}{N_{jt}}\sum_{i=1}^{N_{jt}} y^{Exp}{}_{j,it}$. From equation (5.3a) we can, as we did previously, evaluate the impact of the average IC variables on the probability of exporting,

$$100 = \frac{\hat{\delta}_{Exp}}{\hat{P}(Exp_{j,t} \succ 0)}100 + \frac{\hat{\delta}_P \log\overline{P}_{jt}}{\hat{P}(Exp_{j,t} \succ 0)}100 + \frac{\hat{\delta}'_{\mathrm{IC}}\overline{\mathrm{IC}}}{\hat{P}(Exp_{j,t} \succ 0)}100 + \frac{\hat{\delta}'_C\overline{C}}{\hat{P}(Exp_{j,t} \succ 0)}100 + \frac{\hat{\delta}'_{Ds}\overline{D}_j}{\hat{P}(Exp_{j,t} \succ 0)} + \frac{\hat{\delta}'_{DT}\overline{D}_t}{\hat{P}(Exp_{j,t} \succ 0)}100. \qquad (5.3b)$$

Similarly, y_{it}^{FDI} is also a binary variable, therefore evaluating the impact at their sample mean implies evaluating the impact on the *probability (frequency) of receiving foreign direct investment.* In particular the equation (4.5) evaluated at the sample mean becomes (5.4a).

$$\hat{P}(FDI_{j,t} \succ 0) = \hat{\rho}_{FDI} + \hat{\rho}_P \log\overline{P}_{jt} + \hat{\rho}'_{\mathrm{IC}}\overline{\mathrm{IC}} + \hat{\rho}'_{\mathrm{C}}\overline{C} + \hat{\rho}'_{\mathrm{Ds}}\overline{D}_j + \hat{\rho}'_{\mathrm{DT}}\overline{D}_t \qquad (5.4a)$$

and $\hat{P}(FDI_{j,t} \succ 0) = \frac{1}{N_{jt}}\sum_{i=1}^{N_{jt}} y^{FDI}{}_{j,it}$. From equation (5.4a) we can, as we did previously, evaluate the impact of the average IC variables on the probability of receiving foreign direct investment.

$$100 = \frac{\hat{\rho}_{FDI}}{\hat{P}(FDI_{j,t} \succ 0)}100 + \frac{\hat{\rho}_P \log\overline{P}_{jt}}{\hat{P}(FDI_{j,t} \succ 0)}100 + \frac{\hat{\rho}'_{\mathrm{IC}}\overline{\mathrm{IC}}}{\hat{P}(FDI_{j,t} \succ 0)}100 + \frac{\hat{\rho}'_{\mathrm{C}}\overline{C}}{\hat{P}(FDI_{j,t} \succ 0)}100 + \frac{\hat{\rho}'_{\mathrm{Ds}}\overline{D}_j}{\hat{P}(FDI_{j,t} \succ 0)} + \frac{\hat{\rho}'_{\mathrm{DT}}\overline{D}_t}{\hat{P}(FDI_{j,t} \succ 0)}100. \qquad (5.4b)$$

5.1 Empirical Results in the Employment Equation

Second column of Figure 1 summarizes results obtained from applying equation (5.1b) to Turkey. As in log-productivity section, red tape, corruption and crime (45.%) is dominating the average log-employment decomposition. Finance and corporate governance (17.5%), quality, innovation and labor skills (14.8%) and real wages (13.53%) are the next groups in order of relative importance.

Figure 2.2 shows the result obtained for each term of equation (5.1b). *Labor costs declared* has the highest contribution with 20.7, in the same group *Sales declared to taxes* and *Transaction fees to obtain a land or a building* have also considerable contributions to average log-employment. *Dummy for rent land* has the largest contributions among finance and corporate governance variables with 5.6%. There are six variables in the quality, innovation and labor skills group, having *Education of the manager* the largest contribution, concretely 4.8%. In what refers to other control variables the largest contributions come from *Dummy for exporter* with 2.6%. Finally, real wages matters enormously when explaining average productivity, explaining by itself 13.3% of average log-employment.

Decomposition by size is in Figures 5.2. Main issues are: the demand for labor in large firms is more likely to be affected by quality innovation and labor skills variables and less by red tape, corruption and crime variables.

5.2 Empirical Results in the Real Wage Equation

From Figure 1, third column, it is clear that Red tape, corruption and crime is the more important group when explaining real wages (37.5%). Infrastructures, other control variables and productivity have also considerable contributions with 16.8%, 16.4% and 14.3% respectively.

Figure 2.3 breaks down the results for real wages of Figure 1 variable by variable. *Productivity* is the second most important variable with 14.3% contribution to average log-wage. Within Infrastructure variables *Internet page* has the largest contribution with 7.8%. Red tape, corruption and crime is the key group explaining log-wage with four variables characterized by large contributions: *Security expenses* with 15.3%, *Manager's time spent in bureaucratic issues* with 12.5%, *Labor cost declared* with 7.9% and *Absenteeism* with 1.8%.

Contributions of Finance and corporate governance variables are low; the only significant contribution within this group comes from *Dummy for rent buildings* being 6.6%. The same occurs with quality, innovation and labor skills group, only *Training unskilled workers* has a contribution equal to 5%. Four IC variables are in the group other control variables, *Competitors* is the key variable of this group contributing with 12.5% to average log-wage.

Regarding the decomposition by size (Figure 3.3) the results are almost homogeneous.

5.3 Empirical Results in the Exports Equation

Red tape, corruption and crime is again the key group of variables affecting the probability of exporting in Turkey as Figure 1 in its fourth column shows, being its relative percentage contribution among all IC variables 36.2%. Nevertheless, other control variables (21.9%), infrastructures (19.4) and productivity (13.4%) have an important relative contribution too. Quality, innovation and labor skills (7.1%) and finance and corporate governance (2.1%) relative importance is lower.

Figure 2.4 breaks down groups of fourth column of Figure 1 in key components. Within infrastructures group the more prominent contribution to the probability of exporting comes from *Number of power outages* (10.3%). *Security expenses* variable has the largest impact within Red tape, corruption and crime variables (27.7%) and *Number of competitors* within other control variables (11.8%). Productivity has a clear positive impact on the probability of exporting, being its percentage contribution 19.4%. In what refers to labor relations, quality and innovation and finance and corporate governance, only the contribution of *Education of the manager* exceeds 3%.

The decomposition of the probability of exporting performed by size highlights some differences among groups. The probability of exporting in large firms is more likely to be affected by finance and corporate governance and quality innovation and labor skills variables. However, these firms are less affected by red tape, corruption and crime variables.

5.4 Empirical Results in the FDI Equation

Quality, innovation and labor skills is the key group of variables affecting the probability of receiving FDI in Turkey, which relative importance is 38.9%, as Figure 1 shows. The second

group of variables is productivity followed by infrastructures; the gap between these two groups and quality, innovation and labor skills is considerable, being their contributions. The role of red tape, corruption and crime and other control variables is in this case lower than in previous equations.

To decompose the groups of fifth column of Figure 1 in key variables we include Figure 2.5. The impact of IC factors on the probability of receiving FDI can be summarized in six key variables. The largest positive impact comes from *Dummy for internal training* (18.2%), whereas the main variable affecting negatively FDI is *Days to clear custom to import* (17%). Productivity has a key role being its effect on FDI large and positive (17.8%). *Education of the manager* and *Dummy for new product variables* within the quality, innovation and labor skills group, have important impacts, 17.6% and 12.7% respectively. Although red tape, corruption and crime group has a minor importance when compared with other groups, the only significant variable of this group contributes by itself with 9.7% of the probability of receiving FDI.

When the decomposition is performed by sizes we do not obtain significant differences among groups.

6. Conclusions

We believe that improving the investment climate (IC) is a key policy instrument to promote economic growth and to mitigate the institutional, legal, economic and social factors that are constraining the convergence of per capita income and labor productivity of Turkey relative to more developed countries.

In this paper, we identify the main investment climate variables that affect economic performance measures like total factor productivity, employment, wages, exports and foreign direct investment. We extend the productivity methodology of Escribano and Guasch (2005, 2008) and Escribano et al. (2008), based on the analysis of how the investment climate affect productivity, to other economic performance measures. We have proposed a system of five

simultaneous equations to analyze the interactions between TFP and other economic performance measures.

We found that TFP is a key variable explaining other important economic decisions for the firm, like employment demand, wages, exports and FDI, even after controlling for the investment climate environment.

From the analysis of Firm's perceptions, we identify the block of red tape, corruption and crime as the main IC block creating severe obstacles for firm economic performance. The main individual IC bottlenecks are taxes and tax administration. The second and third IC blocks are finance and the block of quality innovation and labor skills. Within the infrastructure block firms' perceive that the main elements are customs, trade regulations and electricity.

The Doing Business report (2007), DBR, identifies three main problems; dealing with licenses and closing a business, employing workers, paying taxes and trading across borders.

From our econometric analysis we observe similar results since red tape, corruptions and crime is the main issue in terms of productivity, employment wages and exports. The main IC variables form this group are the manager's time spent in bureaucratic issues and taxes. The employment effects are stronger for small firms. This is also consistent with the DBR. The main econometric effect on productivity from the IC block on infrastructures is also the number of days to clear customs for imports.

TFP in Turkey´s manufacturing firms is very important to enhance international trade. Not only it affects the capacity of firms to export but also affects the probability of the firms to attract foreign direct investment (FDI). In fact, for FDI the most important IC block is quality, innovation and labor skills. The two main individual elements are the education of the manager and the internal training done t the firm level. The quality of infrastructure in Turkey also affects the probability of exporting with the number of power outages being the main individual determinant followed by the days to clear customs for exports and the fact that firm uses e-mail. Finally, from the econometric analysis, we also find that for attracting FDI the main bottleneck in infrastructures has to do with the time to clear customs for imports.

We conclude that for policy analysis it is very useful to combine different sources of information; firm perceptions on bottlenecks, ease of doing business conclusions form DBR and the econometric performance analysis based in investment climate surveys.

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Appendix I: Data Transformations

The IC survey of Turkey has a large amount of zeros and missing values, especially in the production function variables (see Table B.1). Therefore, in order to keep as many observations as possible, to benefit us of the law of the large numbers, we decided to replace the certain missing values- for a deeper analysis on missing values in ICs see Escribano and Pena (2008). The data transforming process is the following:

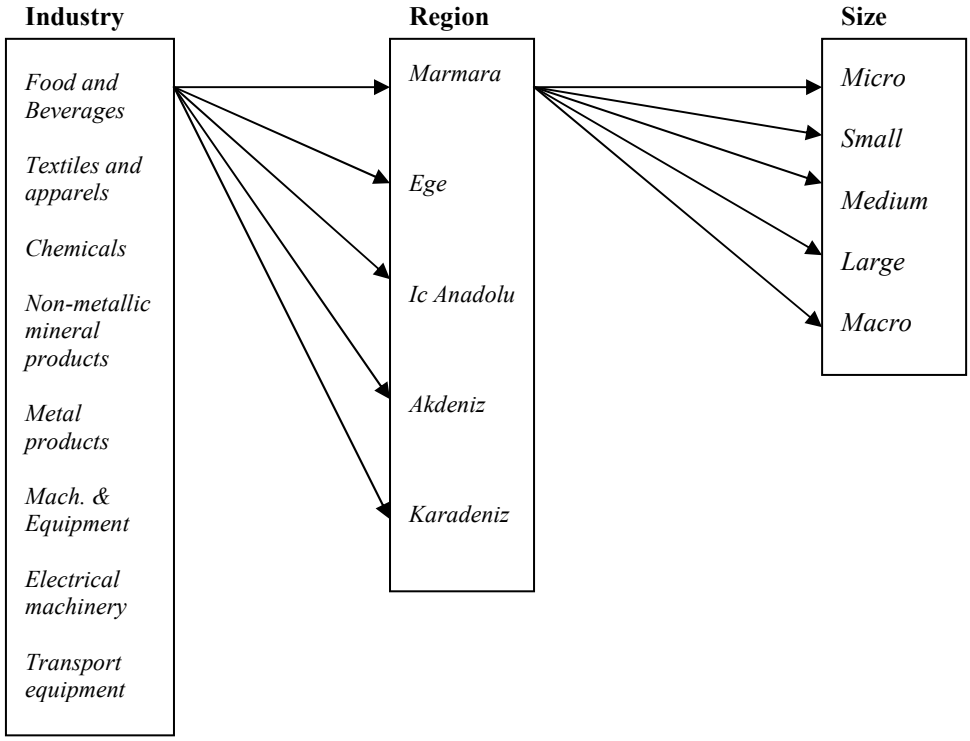
Step 1: *Previous transformations*. We dropped those plants with either zeros or missing values in all of the production function variables. In addition, we also dropped all plants with either zeros or missing values in sales, materials and capital stock. For the remaining missing values we followed steps 2 and 3.

Step 2: *Data transformation.* We began by stratifying original sample into sub-groups in order to compute the median of production function variables for each group, the remaining missing values would be then replaced by these medians. Notice that the smaller the sub-groups we create, the more variability will be in the sample for each IC variable. There is a trade-off between the representativity of the sample used and number of observations available in each group (cell). For some sub-groups, we could not compute the median because there were no observations in that cell and we had considered larger groups. If the problem persists, we proceed to create a larger sub-group. We repeat this stratification process three times:

A. *By Industry, region and size of the firms*: eight industries, five regions and five sizes, 200 sub-groups.
B. *By industry and region*: forty sub-groups.
C. *By industry*: eight sub-groups.

Step 3: *Final transformations*. Final step simply consists of excluding the outliers, defined as those observations with ratios of materials to sales or labor cost to sales greater than one.

Stratification Process:



Appendix II: Identification Restrictions

The restricted variables and the equations in which their coefficients are restricted to take value 0 are listed in what follows, in brackets are the substitutive variables:

a) *Productivity equation*: Transaction fees to obtain a land or a building ($b_{TrsFees}$) (Payments to government or private parties to obtain a land or a building, Delay to obtain a land or a building), Average duration of water outages ($b_{AvDurWatOut}$) (Water outages), Internet page ($b_{IntPage}$) (E-mail), Criminal attempts (b_{CrAtt}) (Losses due to criminal activity), Payments to obtain a contract with the government ($b_{PayContrGov}$) (Payments to deal with bureaucratic issues and Manager's time spent in bureaucratic issues). With the restrictions applied on productivity equation matrix D becomes (see sub-section 4.)

$$\mathbf{D}=\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & a_{L,W} & b_{L,TrsFees} & b_{L,AvDurWatOut} & 0 \\ 0 & 1 & 0 & b_{W,AvDurWatOut} & b_{W,IntPage} \\ 0 & 0 & b_{Exp,TrsFees} & b_{Exp,AvDurWatOut} & 0 \\ 0 & 0 & 0 & 0 & b_{FDI,IntPage} \end{bmatrix}$$

b) *Employment demand equation*: Days to clear customs to import ($b_{DsCstm\,\mathrm{Im}\,p}$) (Days to clear customs to export), Water outages (b_{WatOut}) (Average duration of water outages), Internet page ($b_{IntPage}$) (E-mail), Illegal payments for protection ($b_{IllPay\,\mathrm{Pr}\,ot}$) (Losses due to criminal activity and Criminal attempts), Licensed technology ($b_{LicTech}$) (New technology purchased), Training unskilled workers ($b_{TrUskWrks}$) (Weeks of training unskilled workers) and Power outages (b_{PowOut}) (Average duration of Power outages). Matrix D for employment demand equation is

$$\mathbf{D}=\begin{bmatrix} b_{P,DsCstm\,\mathrm{Im}\,p} & b_{P,WatOut} & 0 & b_{P,IllPay\,\mathrm{Pr}\,ot} & b_{P,LicTech} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & b_{W,WatOut} & b_{W,IntPage} & 0 & b_{W,LicTech} \\ b_{Exp,DsCstm\,\mathrm{Im}\,p} & 0 & 0 & b_{Exp,IllPay\,\mathrm{Pr}\,ot} & b_{Exp,LicTech} \\ b_{FDI,DsCstm\,\mathrm{Im}\,p} & b_{FDI,WatOut} & b_{FDI,IntPage} & b_{FDI,IllPay\,\mathrm{Pr}\,ot} & b_{FDI,LicTech} \end{bmatrix}$$

c) *Real Wages equation*: Days to clear customs to import ($b_{DsCstm\,\mathrm{Im}\,p}$) (Days to clear customs to export), Power outages (b_{PowOut}) (Average duration of Power outages), E-mail (b_{Email}) (Internet page), Illegal payments for protection ($b_{IllPay\,\mathrm{Pr}ot}$) (Losses due to criminal activity and Criminal attempts), Loan (b_{Loan}) (Loan outstanding) and Transaction fees to obtain a land or a building ($b_{TrsFees}$) (Payments to government or private parties to obtain a land or a building, Delay to obtain a land or a building). Matrix D is in this case

$$\mathbf{D}=\begin{bmatrix} 0 & b_{P,DsCstm\,\mathrm{Im}\,p} & b_{P,PowOut} & b_{P,Email} & b_{P,IllPay\,\mathrm{Pr}ot} \\ 1 & 0 & 0 & b_{L,Email} & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & b_{Exp,DsCstm\,\mathrm{Im}\,p} & b_{Exp,PowOut} & b_{Exp,Email} & b_{Exp,IllPay\,\mathrm{Pr}ot} \\ 0 & b_{FDI,DsCstm\,\mathrm{Im}\,p} & b_{FDI,PowOut} & 0 & b_{FDI,IllPay\,\mathrm{Pr}ot} \end{bmatrix}$$

d) *Probability of exporting equation*: Internet page ($b_{IntPage}$) (E-mail), Water outages (b_{WatOut}) (Average duration of water outages), Payments to obtain a contract with the government ($b_{PayContrGov}$) (Payments to deal with bureaucratic issues and Manager's time spent in bureaucratic issues), Illegal payments for protection ($b_{IllPay\,\mathrm{Pr}ot}$) (Criminal attempts, Losses due to criminal activity) and New technology ($b_{NewTech}$) (New licensed technology). Matrix D becomes now

$$\mathbf{D}=\begin{bmatrix} 0 & 0 & 0 & b_{P,WatOut} & 0 \\ 1 & a_{L,W} & 0 & 0 & b_{L,CrAtt} \\ 0 & 1 & b_{W,IntPage} & b_{W,WatOut} & b_{W,CrAtt} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{FDI,IntPage} & b_{FDI,WatOut} & b_{FDI,CrAtt} \end{bmatrix}$$

e) *Probability of receiving FDI equation*: Average duration of water outages ($b_{AvDurWatOut}$) (Water outages), E-mail (b_{Email}) (Internet page), Transaction fees to obtain a land or a building ($b_{TrsFees}$) (Payments to government or private parties to obtain a land or a building, Delay to obtain a land or a building), Manager's time spent in bureaucratic issues ($b_{MngTmBur}$) (Payments to deal with bureaucratic issues and Payments to obtain a contract with the government) and

Losses due to criminal activity ($b_{LossCrAct}$) (Illegal payments for protection and Criminal attempts). Matrix D for this case becomes

$$\mathbf{D} = \begin{bmatrix} 0 & 0 & 0 & b_{P,Email} & 0 \\ 1 & a_{L,W} & b_{L,AvDurWatOut} & b_{L,Email} & b_{L,TrsFees} \\ 0 & 1 & b_{W,AvDurWatOut} & 0 & 0 \\ 0 & 0 & b_{Exp,AvDurWatOut} & b_{Exp,Email} & b_{Exp,TrsFees} \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Appendix III: Tables and Figures

Table A.1: General Information at Plant Level and Production Function Variables.[1]

General Information at Plant Level	Industrial classification	a) food and beverages; b) textiles and wearing apparel; c) chemical products, petroleum, coal, rubber and plastics; d) non-metallic metal products; e) fabricated metal products, excluding machinery and equipment; f) machinery and equipment, excluding electrical; g) electrical machinery apparatus, appliances and supplies; h) transport equipment.
	Regional classification	a) Marmara; b) Ege; c) Ic Anadolu; d) Akdeniz; e) Karadeniz (Dogu Anadolu).
Production Function Variables	Sales	Used as the measure of output for the production function estimation. Sales are defined as total annual sales. The series are deflated by using the Producer Price Indexes (PPI), base 2000.
	Employment	Total number of permanent and temporal workers.
	Total hours worked per year	Total number of employees multiplied by the average hours worked per year.
	Materials	Total costs of intermediate and raw materials used in production (excluding fuel). The series are deflated by using the Producer Price Indexes (PPI), base 2000.
	Capital stock	Net book value of machinery and equipment. The series are deflated by using the Producer Price Indexes (PPI), base 2000.
	User cost of capital	The user cost of capital is defined in terms of the opportunity cost of using capital; it is defined as a 15% of the net book value of machinery and equipment.
	Labor cost	Total expenditures on personnel. The series are deflated by using the Producer Price Indexes (PPI), base 2000.
Dependent Variables in Equation Regressions and Linear Probability Models	Exports	Dummy variable that takes value 1 if exports are greater than 10%.
	Foreign Direct Investment	Dummy variable that takes value 1 if any part of the capital of the firm is foreign.
	Wages	Real wage is defined as the total expenditures on personnel (deflated by using the Producer Price Indexes (PPI), base 2000.) divided by the total number of permanent and temporal workers.
	Employment	Total number of permanent and temporal workers.

[1] All series were translated to US dollars by using the official exchange rate. Data obtained from the World Bank data base.

Table A.2 (I): Investment climate (IC) and control (C) variables

Blocks of ICAs	Name of the variable	Description of the variable
Infrastructures	Days to clear customs for exports	Average number of days to clear customs to export (log).
	Days to clear customs for imports	Average number of days to clear customs to imports (log).
	Average duration of power outages	Average duration of power outages suffered by the plant in hours (log).
	Losses due to power outages	Value of the losses due to the power outages as a percentage of sales (conditional on the plant reporting power outages).
	Number of power outages	Number of power outages suffered by the plant in 2003 (log).
	Average duration of water outages	Average duration of water outages suffered by the plant in hours (log).
	Number of water outages	Number of water outages suffered by the plant in 2003 (log).
	Losses due to water outages	Value of the losses due to the water outages as a percentage of sales (conditional on the plant reporting water outages).
	Wait for phone	Actual delay to obtain a phone connection in days (log).
	Wait for electricity connection	Actual delay to obtain a electricity connection in days (log).
	Wait for water connection	Actual delay to obtain a water connection in days (log).
	Wait for health certification	Actual delay to obtain a health certification in days (log).
	Shipment losses	Fraction of the value of the plant's average cargo consignment that was lost in transit due to breakage, theft, spoilage or other deficiencies of the transport means used.
	Dummy for email	Dummy variable that takes value 1 if the plant uses email.
	Dummy for internet page	Dummy variable that takes value 1 if the plant has a website.
	Dummy for electronic invoice system	Dummy variable that takes value 1 if the plant uses an electronic invoice system.

Table A.2 (II): Investment climate (IC) and control (C) variables

Blocks of ICAs	Name of the variable	Description of the variable
Red Tape, Corruption and Crime	Dummy for criminal activity	Dummy variable that takes value 1 if the plant suffered any criminal attempt during 2003.
	Losses due to criminal activity	Value of losses due to criminal activity (log).
	Security expenses	Cost in security (equipment, staff, etc) (log).
	Illegal payments for protection	Cost due to protection payments e. g. to organized crime to prevent violence (bribery) (log).
	Dummy for consulting	Dummy variable that takes value 1if the firm uses consultants or employments to help deal with bureaucratic issues.
	Dummy for payments to deal with bureaucratic issues	Dummy that takes value 1 if firms in the main sector occasionally need to give gifts or make informal payments to public officers in order to "get things done" with regard to customs, taxes, licenses, legislations, services, etc.
	Manager's time spent in bureaucratic issues	Percentage of managers' time spent in dealing with bureaucratic issues.
	Dummy for informal competition	Dummy variable that takes value 1 if the firm competes with informal (no registered) firms.
	Sales declared to taxes	Percentage of total sales declared to taxes.
	Labor costs declared	Percentage of workforce declared to taxes.
	Number of inspections	In the last year, total number of inspections (log).
	Dummy for payments to obtain a contract with the government	Dummy variable that takes value 1 if in plant's sector it is common to pay an extra amount of money in order to obtain a contract with the government.
	Conflicts with clients	Percentage of conflicts with clients solved in the courts in the last two years.
	Average duration of conflicts	Average weeks that take to resolve a conflict from the moment the case was brought to court until the moment the court decided the case.
	Absenteeism	Days of production lost due to absenteeism (log).
	Wait for a construction related permit	Actual delay to obtain a construction related in days (log).
	Wait for a main operating license	Actual delay to obtain a main operating license in days (log).
	Dummy for new land or building	Dummy variable that takes value 1 if the firm acquired or attempted to acquire new land or buildings to expand operations in the previous 3 years.
	Delay to obtain a land or a building	Total time that took from the moment the firm decided to buy a new land or building to the moment the firm finally got it (Including all the time required for official registration, negotiations with the seller and obtaining all licenses and necessary development permits and excluding the time needed for the construction permits).
	Transaction fees to obtain a land or a building	Total cost related with transaction fees (including registration fees, payments to lawyers, brokers, etc) to obtain a land or a building.
	Payment to government or private parties to obtain a land or a building	Total cost in informal payments to government officials or private parties to obtain a new land or buildings
	Dummy for contract enforcement	Dummy variable that takes value 1 if the conflict of the firm with clients solved in courts were generally enforced.
	Dummy for alternative resolution of conflicts	Dummy variable that takes value 1 if the firm attempted to use alternative ways of resolution of conflicts with clients (e.g. arbitration or mediation).
	Dummy for lawsuit	Dummy variable that takes value 1 if the firm has been involved in a lawsuit in the last three years.
	Delayed payments	Percentage of monthly total sales to private customers that were not paid within the agreed time.
	Sales never repaid	Percentage of monthly total sales to private customers that were never repaid.

Table A.2 (III): Investment climate (IC) and control (C) variables

Blocks of ICAs	Name of the variable	Description of the variable
Finance and Corporate Governance	Dummy for credit line	Dummy variable that takes value 1 if the plant reports that it has a credit line.
	Dummy for loan	Dummy variable that takes value 1 if the plant reports that it has a bank loan.
	Dummy for loan outstanding	Dummy variable that takes value 1 if the firm has a loan outstanding from a financial institution.
	Dummy for loan bank	Dummy variable that takes value 1 if the firm has a loan from a domestic private commercial banks.
	Dummy for loan leasing	Dummy variable that takes value 1 if the firm has a loan from a leasing arrangement.
	Dummy for loan public	Dummy variable that takes value 1 if the firm has a loan from a state owned banks.
	Dummy for loan informal	Dummy variable that takes value 1 if the firm has a loan from Informal sources (e.g. money lender).
	Dummy for loan DOT	Dummy variable that takes value 1 if the firm has a loan from the Small and Medium Sized Industry Development Organization of Turkey (Incentive Credit for Export)
	Dummy for loan Turkish Lira	Dummy variable that takes value 1 if the loan is denominated in Turkish Lira.
	Dummy for loan foreign currency	Dummy variable that takes value 1 if the loan is denominated in a foreign currency.
	Dummy for loan with collateral	Dummy variable that takes value 1 if the loan is on collateral.
	Dummy for loan long term	Dummy variable that takes value 1 if the duration of the loan is more than 12 months.
	Borrows foreign	Percentage of borrows denominated in foreign currency.
	Dummy for external auditory	Dummy variable that takes value 1 if the plant uses an external auditory.

Table A.2 (IV): Investment climate (IC) and control (C) variables

Blocks of ICAs	Name of the variable	Description of the variable
Quality, Innovation and Labor Skills	Dummy for quality certification	Dummy variable that takes value 1 if the plant has a quality certification.
	Dummy for new product	Dummy variable that takes value 1 if the plant has developed a new product or product line.
	Dummy for product upgraded	Dummy variable that takes value 1 if the plant upgraded an existing product last year.
	Dummy for new technology purchased	Dummy variable that takes value 1 if the firm purchased any new technology during last year.
	Dummy for licensed technology	Dummy variable that takes value 1 if the firm used a licensed technology of a foreign company in the last year.
	Dummy for education of the manager	Dummy variable that takes value 1 if the manager of the plant has a bachelor or higher education degree.
	Conflicts with employees	Times in the last year the firm was taken to court by its current and former employees
	Duration of conflicts with employees	Average weeks that take to resolve a conflict with an employee from the moment the case was brought to court until the moment the court decided the case.
	Staff-skilled workers	Percentage of skilled workers in firm's staff.
	Staff-unskilled workers	Percentage of unskilled workers in firm's staff.
	Staff-professional workers	Percentage of professional workers in firm's staff.
	Staff-part time workers	Percentage of part time workers in firm's staff.
	Staff-female workers	Percentage of female workers in firm's staff.
	Staff-temporal workers	Percentage of temporal workers in firm's staff.
	Dummy for internal training	Dummy variable that takes value 1 if the plant provides internal training to its employees.
	Dummy for external training	Dummy variable that takes value 1 if the plant provides external training to its employees.
	Training skilled workers	Percentage of skilled workers that received training during last year.
	Training unskilled workers	Percentage of unskilled workers that received training during last year.
	Weeks of training of skilled workers	Number of weeks of training received by the skilled workers during last year.
	Weeks of training of unskilled workers	Number of weeks of training received by the unskilled workers during last year.
	Staff-university	Percentage of staff with at least one year of university.
	Staff-middle education	Percentage of staff with completed high school (11 years) or completed secondary school (8 years).
	Staff-basic education	Percentage of staff with primary school either completed or not.

Table A.2 (V): Investment climate (IC) and control (C) variables

Blocks of ICAs	Name of the variable	Description of the variable
Other Control Variables	Dummy for incorporated company	Dummy variable that takes value 1 if the plant is an incorporated company.
	Dummy for public	Dummy variable that takes value 1 if the firm belongs to the government.
	Dummy for foreign direct investment	Dummy variable that takes value 1 if any part of the capital of the firm is foreign.
	Age of the firm	Difference between the year that the plant started operations and current year.
	Number of competitors	Number of competitors in the main market (log).
	Dummy for exporter	Dummy variable that takes value 1 if exports are greater than 10%.
	Dummy for importer	Dummy variable that takes value 1 if imports are greater than 10%.
	Percentage of capacity utilization	Average percentage of capacity used during last year.
	Dummy for holding company	Dummy variable that takes value 1 if the firm belongs to a holding company.
	Market share	Market share of the firm (percentage).
	Competitive pressure	Categorical variable that takes value 1 if the number of competitors in firm's main market has increased during last year.
	Percentage of workforce unionized	Percentage of workers that belongs to a syndicate.
	Strikes	Days of production lost due to strikes (log).
	Dummy for rent land	Dummy variable that takes value 1 if the plant rents almost all its lands.
	Dummy for rent buildings	Dummy variable that takes value 1 if the plant rents almost all its buildings.
	Dummy for ownership	Dummy variable that takes value 1 if the firm previously belonged to the government.
	Dummy for industrial zone	Dummy variable that takes value 1 if the firm is located in an industrial zone.
	Dummy for foreign competition	Dummy variable that takes value 1 if the firm competes with foreign firms.
	Small	Dummy variable that takes value 1 if the firm employs 49 workers or less.
	Médium	Dummy variable that takes value 1 if the firm employs more than 49 workers and less or equal than 249.
	Large	Dummy variable that takes value 1 if the firm employs 250 workers or more.
	Young	Dummy variable that takes value 1 if the firm is 5 years old or less.
	Old	Dummy value that takes value 1 if the fir is more than 5 years old.

Table B.1: Total Number of Observations, Missing Values and Zeros for Production Function Variables in the Original Sample (2003-2004).

	Sales	Materials	Capital	Employment	Labor Cost
Total number of observations for each year 2003-2004.	**1323**	**1323**	**1323**	**1323**	**1323**
(1.A) Missing Values 2003	480	591	518	67	583
(1.B) Missing Values 2004	450	550	496	30	532
(2.A) Zeroes 2003	23	68	299	18	39
(2.B) Zeroes 2004	0	54	189	3	21
(3.A) Total number of observations not available 2003: (1.A)+(2.A)	**503**	**659**	**817**	**85**	**622**
(3.B) Total number of observations not available 2004: (1.B)+(2.B)	**450**	**604**	**685**	**33**	**553**
(4.A) Observations available 2003: (5.A)-(3.A)	820	664	506	1238	701
(4.B) Observations available 2004: (5.B)-(3.B)	873	719	638	1290	770
Final number of observations for each year after correction for outliers[1]	**1323**	**1323**	**1323**	**1323**	**1323**

[1] See the appendix of data transformation for a description of the methodology used to deal with outliers and to replace missing values and zeros.

Table B.2a: Representativeness of production function variables before and after cleaning missing values and outliers; by industry and region.

Region		Marmara		Ege		Ic Anadolu		Akdeniz		Karadeniz		Total	
Industry		#Obs.	Perc.	#Obs.	Perc.	#Obs.	Perc.	#Obs.	Perc.	#Obs.	Perc.	#Obs.	Perc.
Food and Beverages	Original Sample	208	7.9	126	4.8	160	6.0	42	1.6	28	1.1	564	21.3
	Without replacing	41	4.2	62	6.3	106	10.8	33	3.4	12	1.2	254	25.8
	With replacing	100	6.0	88	5.3	130	7.8	38	2.3	18	1.1	374	22.4
Textiles and Apparels	Original Sample	536	20.3	100	3.8	28	1.1	44	1.7	30	1.1	738	27.9
	Without replacing	116	11.8	51	5.2	12	1.2	33	3.4	15	1.5	227	23.1
	With replacing	264	15.8	66	3.9	14	0.8	32	1.9	20	1.2	396	23.7
Chemicals	Original Sample	186	7.0	44	1.7	58	2.2	40	1.5	24	0.9	352	13.3
	Without replacing	44	4.5	16	1.6	26	2.6	26	2.6	7	0.7	119	12.1
	With replacing	90	5.4	26	1.6	42	2.5	36	2.2	12	0.7	206	12.3
Non-metallic mineral products	Original Sample	38	1.4	28	1.1	44	1.7	28	1.1	28	1.1	166	6.3
	Without replacing	4	0.4	17	1.7	23	2.3	19	1.9	13	1.3	76	7.7
	With replacing	18	1.1	26	1.6	26	1.6	24	1.4	20	1.2	114	6.8
Metal products (ex. M&E)	Original Sample	124	4.7	24	0.9	78	2.9	32	1.2	26	1.0	284	10.7
	Without replacing	25	2.5	20	2.0	50	5.1	20	2.0	16	1.6	131	13.3
	With replacing	66	3.9	20	1.2	64	3.8	28	1.7	24	1.4	202	12.1
Machinery and Equipment	Original Sample	74	2.8	38	1.4	80	3.0	36	1.4	28	1.1	256	9.7
	Without replacing	10	1.0	17	1.7	44	4.5	25	2.5	22	2.2	118	12.0
	With replacing	32	1.9	24	1.4	70	4.2	32	1.9	22	1.3	180	10.8
Electrical machinery	Original Sample	50	1.9	24	0.9	22	0.8	24	0.9	14	0.5	134	5.1
	Without replacing	18	1.8	16	1.6	12	1.2	22	2.2	7	0.7	75	7.6
	With replacing	30	1.8	22	1.3	18	1.1	22	1.3	8	0.5	100	6.0
Transport equipment	Original Sample	40	1.5	32	1.2	36	1.4	34	1.3	10	0.4	152	5.7
	Without replacing	12	1.2	9	0.9	22	2.2	32	3.3	7	0.7	82	8.3
	With replacing	20	1.2	12	0.7	28	1.7	32	1.9	8	0.5	100	6.0
Total	Original Sample	1,256	47.5	416	15.7	506	19.1	280	10.6	188	7.1	2,646	100.0
	Without replacing	270	27.4	208	21.1	295	30.0	210	21.3	99	10.1	1,082	110.0
	With replacing	620	37.1	284	17.0	392	23.4	244	14.6	132	7.9	1672	100.0

Table B.2b: Percentage of observations lost due to missing values; by industry and region.

Region		Marmara		Ege		Ic Anadolu		Akdeniz		Karadeniz		Total	
Industry		#Obs	Perc. Lost	#Obs	Perc. Lost	#Obs	Perc. Lost	#Obs	Perc. Lost	#Obs	Perc. Lost	#Obs	Perc. Lost
Food and Beverages	Original Sample	208		126		160		42		28		564	
	Without replacing	41	80.3	62	50.8	106	33.8	33	21.4	12	57.1	254	55.0
	With replacing	100	51.9	88	30.2	130	18.8	38	9.5	18	35.7	374	33.7
Textiles and Apparels	Original Sample	536		100		28		44		30		738	
	Without replacing	116	78.4	51	49.0	12	57.1	33	25.0	15	50.0	227	69.2
	With replacing	264	50.7	66	34.0	14	50.0	32	27.3	20	33.3	396	46.3
Chemicals	Original Sample	186		44		58		40		24		352	
	Without replacing	44	76.3	16	63.6	26	55.2	26	35.0	7	70.8	119	66.2
	With replacing	90	51.6	26	40.9	42	27.6	36	10.0	12	50.0	206	41.5
Non-metallic mineral products	Original Sample	38		28		44		28		28		166	
	Without replacing	4	89.5	17	39.3	23	47.7	19	32.1	13	53.6	76	54.2
	With replacing	18	52.6	26	7.1	26	40.9	24	14.3	20	28.6	114	31.3
Metal products (ex. M&E)	Original Sample	124		24		78		32		26		284	
	Without replacing	25	79.8	20	16.7	50	35.9	20	37.5	16	38.5	131	53.9
	With replacing	66	46.8	20	16.7	64	17.9	28	12.5	24	7.7	202	28.9
Machinery and Equipment	Original Sample	74		38		80		36		28		256	
	Without replacing	10	86.5	17	55.3	44	45.0	25	30.6	22	21.4	118	53.9
	With replacing	32	56.8	24	36.8	70	12.5	32	11.1	22	21.4	180	29.7
Electrical machinery	Original Sample	50		24		22		24		14		134	
	Without replacing	18	64.0	16	33.3	12	45.5	22	8.3	7	50.0	75	44.0
	With replacing	30	40.0	22	8.3	18	18.2	22	8.3	8	42.9	100	25.4
Transport equipment	Original Sample	40		32		36		34		10		152	
	Without replacing	12	70.0	9	71.9	22	38.9	32	5.9	7	30.0	82	46.1
	With replacing	20	50.0	12	62.5	28	22.2	32	5.9	8	20.0	100	34.2
Total	Original Sample	1,256		416		506		280		188		2,646	
	Without replacing	270	78.5	208	50.0	295	41.7	210	25.0	99	47.3	1,082	59.1
	With replacing	620	50.6	284	31.7	392	22.5	244	12.9	132	29.8	1672	36.8

Table B.3 (I): Total number of observations and response rate of IC and C variables in the original sample

Blocks of ICAs	Name of the variable	#Observations	Response rate
Infrastructures	Days to clear customs for exports	1358	51.3
	Days to clear customs for imports	898	33.9
	Average duration of power outages	2466	93.2
	Losses due to power outages	2324	87.8
	Number of power outages	2500	94.5
	Average duration of water outages	2498	94.4
	Number of water outages	2512	94.9
	Losses due to water outages	2476	93.6
	Wait for phone	1304	49.3
	Wait for electricity connection	964	36.4
	Wait for water connection	804	30.4
	Wait for health certification	644	24.3
	Shipment losses	2616	98.9
	Dummy for email	2646	100.0
	Dummy for internet page	2646	100.0
	Dummy for electronic invoice system	2646	100.0
Red Tape, Corruption and Crime	Dummy for criminal activity	2646	100.0
	Losses due to criminal activity	192	7.3
	Security expenses	2558	96.7
	Illegal payments for protection	2536	95.8
	Dummy for consulting	2646	100.0
	Dummy for payments to deal with bureaucratic issues	2446	92.4
	Manager's time spent in bureaucratic issues	2556	96.6
	Sales declared to taxes	2240	84.7
	Labor costs declared	2340	88.4
	Number of inspections	2494	94.3
	Dummy for payments to obtain a contract with the government	2646	100.0
	Conflicts with clients	1684	63.6
	Average duration of conflicts	430	16.3
	Absenteeism	2530	95.6
	Wait for a construction related permit	772	29.2
	Wait for a main operating license	858	32.4
	Dummy for new land or building	2646	100.0
	Delay to obtain a land or a building	1920	72.6
	Transaction fees to obtain a land or a building	1528	57.7
	Payment to government or private parties to obtain a land or a building	1084	41.0
	Dummy for contract enforcement	1270	48.0
	Dummy for alternative resolution of conflicts	1070	40.4
	Dummy for lawsuit	2646	100.0
	Delayed payments	2640	99.8
	Sales never repaid	2062	77.9

Table B.3 (II): Total number of observations and response rate of IC and C variables in the original sample

Blocks of ICAs	Name of the variable	#Observations	Response rate
Finance and Corporate Governance	Dummy for credit line	2646	100.00
	Dummy for loan	2646	100.00
	Dummy for loan outstanding	2646	100.00
	Dummy for loan bank	2646	100.00
	Dummy for loan leasing	2646	100.00
	Dummy for loan public	2646	100.00
	Dummy for loan informal	2646	100.00
	Dummy for loan DOT	2646	100.00
	Dummy for loan Turkish Lira	2646	100.00
	Dummy for loan foreign currency	2646	100.00
	Dummy for loan with collateral	2646	100.00
	Dummy for loan long term	2646	100.00
	Borrows foreign	2606	98.49
	Dummy for external auditory	2646	100.00
Quality, Innovation and Labor Skills	Dummy for quality certification	2646	100.00
	Dummy for new product	2646	100.00
	Dummy for product upgraded	2646	100.00
	Dummy for new technology purchased	2646	100.00
	Dummy for licensed technology	2646	100.00
	Dummy for education of the manager	2584	97.66
	Conflicts with employees	2610	98.64
	Duration of conflicts with employees	1070	40.44
	Staff-skilled workers	2622	99.09
	Staff-unskilled workers	2622	99.09
	Staff-professional workers	2622	99.09
	Staff-part time workers	2606	98.49
	Staff-female workers	2606	98.49
	Staff-temporal workers	2636	99.62
	Dummy for internal training	2646	100.00
	Dummy for external training	2646	100.00
	Training skilled workers	1316	49.74
	Training unskilled workers	1320	49.89
	Weeks of training of skilled workers	1234	46.64
	Weeks of training of unskilled workers	1282	48.45
	Staff-university	2550	96.37
	Staff-middle education	2646	100.00
	Staff-basic education	2550	96.37

Table B.3 (III): Total number of observations and response rate of IC and C variables in the original sample

Blocks of ICAs	Name of the variable	#Observations	Response rate
Other Control Variables	Dummy for incorporated company	2646	100.00
	Dummy for public	2646	100.00
	Dummy for foreign direct investment	2646	100.00
	Age of the firm	2646	100.00
	Number of competitors	1522	57.52
	Dummy for exporter	2646	100.00
	Dummy for importer	2646	100.00
	Percentage of capacity utilization	2596	98.11
	Dummy for holding company	2646	100.00
	Market share	1984	74.98
	Competitive pressure	2646	100.00
	Percentage of workforce unionized	2558	96.67
	Strikes	2546	96.22
	Dummy for rent land	2646	100.00
	Dummy for rent buildings	2646	100.00
	Dummy for ownership	2646	100.00
	Dummy for industrial zone	2646	100.00
	Dummy for foreign competition	2646	100.00
	Dummy for informal competition	2636	99.62

Table B.4 (I): List of Significant IC and C Variables, their Measurement Units, Equations in which they are Significant and Form (Industry-Region Averages or not) in which Each Variable Enters the Equations.

Blocks of ICAs	Name of the variable	Measurement Units	Equation/s	Industry-Region Averages
Infrastructures	Days to clear customs for exports	Logs	W	Yes
	Days to clear customs for imports	Logs	P, Exp and FDI	Yes
	Average duration of power outages	Logs	P	Yes
	Number of power outages	Logs	Exp	Yes
	No	Logs	W	Yes
	Wait for phone	Days	P	Yes
	Shipment losses	Fraction	W	Yes
	Dummy for e-mail	0 or 1	P, L and Exp	No
	Dummy for internet page	0 or 1	W	Yes
Red Tape, Corruption and Crime	Losses due to criminal activity	Logs	P	Yes
	Security expenses	Logs	W and Exp	Yes
	Illegal payments for protection	Logs	P	Yes
	Manager's time spent in bur. Issues	Percentage	P, L and W	Yes
	Sales declared to taxes	Percentage	P, L and Exp	Yes
	Labor cost declared	Percentage	L and W	Yes
	Number of inspections	Logs	P and Exp	No
	Dummy for payments to obtain a contract with the gov.	0 or 1	L and FDI	Yes but only in foreign direct investment eq.
	Absenteeism	Logs	P	Yes
	Dummy for Lawsuit	0 or 1	P	No
	Transaction fees to obtain a land or a building	Logs	L	Yes
	Dummy for informal competition	0 or 1		No
Finance and Corporate Governance	Dummy for credit line	0 or 1	L	No
	Dummy for loan	0 or 1	Exp	No
	Dummy for loan outstanding	0 or 1	L and IZ	No
	Dummy for loan bank	0 or 1	L	No
	Dummy for Loan informal	0 or 1	W and IZ	No
	Dummy for loan Turkish Lira	0 or 1	W and L	No
	Dummy for loan collateral	0 or 1	L	No
	Dummy for loan long term	0 or 1	W	No
	Dummy for rent land	0 or 1	L	No
	Dummy for rent buildings	0 or 1	W	Yes
	Dummy for external auditory	0 or 1	P, L and Exp	Yes but only in productivity eq.

P: productivity equation. L: employment equation. W: wage equation. Exp: exports equation. FDI: foreign direct investment equation.

Table B.4 (II): List of Significant IC and C Variables, their Measurement Units, Equations in which they are Significant and Form (Industry-Region Averages or not) in which Each Variable Enters the Equations.

Blocks of ICAs	Name of the variable	Measurement Units	Equation/s	Industry-Region Averages
Quality, Innovation and labor Skills	Dummy for quality certification	0 or 1	L and Exp	No
	Dummy for new product	0 or 1	FDI	Yes
	Dummy for new technology purchased	0 or 1	P and L	Yes but only in productivity eq.
	Dummy for licensed technology	0 or 1	FDI	No
	Education of the manager	0 or 1	L, Exp and FDI	Yes but only in foreign direct investment eq.
	Staff-skilled workers	Percentage	Exp	No
	Staff-unskilled workers	Percentage	P	No
	Staff-professional workers	Percentage	W	No
	Pstaff=part time workers	Percentage	P	No
	Staff-female workers	Percentage	W	No
	Staff-temporal workers	Percentage	W	No
	Dummy for internal training	0 or 1	L and FDI	Yes but only in foreign direct investment eq.
	Dummy for external training	0 or 1	L	No
	Training unskilled workers	Percentage	W	Yes
	Weeks of training of skilled workers	Logs	P	Yes
	Weeks of training of unskilled workers	Logs	Exp	No
	University staff	Percentage	P, L and FDI	No
Other Control Variables	Dummy for incorporated company	0 or 1	W, L, Exp and FDI	No
	Dummy for public	0 or 1	L	No
	Age of the firm	Logs	P	No
	Number of competitors	Logs	W and Exp	Yes
	Dummy for exporter	0 or 1	L and FDI	No
	Percentage of capacity utilization	Percentage	Exp	No
	percentage of workforce unionized	Percentage	W and Exp	Yes
	Dummy for ownership	0 or 1	P and L	No
	Dummy for industrial zone	0 or 1	W	No
	dummy for small firms	0 or 1	P	No
	Dummy for medium firms	0 or 1	P and W	No
	Dummy for young firms	0 or 1	L and W	No

P: productivity equation. L: employment equation. W: wage equation. Exp: exports equation. FDI: foreign direct investment equation.

Table B.5: Correlation matrix among productivity measures

	Two steps		Single step Restricted				Single step Unrestricted			
	Solow's Residual		Cobb Douglas		Translog		Cobb Douglas		Translog	
	Restr.	Unrestr.	OLS	RE	OLS	RE	OLS	RE	OLS	RE
Restricted Solow's residual	1									
Unrestricted Solow's residual	0.993	1								
Cobb Douglas OLS	0.926	0.918	1							
Cobb Douglas RE	0.923	0.915	0.999	1						
Translog OLS	0.915	0.908	0.993	0.993	1					
Translog RE	0.911	0.905	0.993	0.994	0.999	1				
Cobb Douglas OLS	0.596	0.611	0.637	0.638	0.639	0.638	1			
Cobb Douglas RE	0.591	0.609	0.633	0.634	0.635	0.635	0.99	1		
Translog OLS	0.046	0.007	0.052	0.049	0.044	0.043	-0.07	-0.089	1	
Translog RE	-0.001	-0.043	-0.008	-0.011	-0.017	-0.017	-0.127	-0.127	0.968	1

Notes:

a) Solow residuals in logs are obtained as sales (in logarithms or logs) minus a weighted sum of labor, materials, capital (all in logs) where the weights are given by the share in total costs of each of the inputs.

(1) Restricted case: the cost shares are calculated as the averages of the plant-level cost shares across the entire sample.

(2) Unrestricted by Industry case: the cost shares are calculated as the averages across plant-level cost shares for each of the eight industries.

(3) Outlier plants were defined as those which had ratios of materials to sales larger than one or had ratios of labor costs to sales larger than one.

b) Estimated Productivities in logs are obtained from Cobb-Douglas and Translog production functions of sales with inputs labor, materials, and capital estimated by OLS and by random effects under two different environments:

(1) Restricted: a single set of production function coefficients is obtained using data on plants, for all industries (excluding outliers).

(2) Unrestricted by Industry: a set of production function coefficients is obtained for each one of eight industries using data on all plants (excluding outliers).

Table C.1a: ICA elasticities and semi-elasticities with respect to productivity, restricted estimation.

Blocks of ICA variables		Two steps estimation		Single step estimation			
		Solow residual		Cobb-Douglas		Translog	
	Explanatory ICA variables	OLS	Random Effs.	OLS	Random Effs.	OLS	Random Effs.
Infrastructures	Days to clear customs to imports (a)	-0.171***	-0.171**	-0.199***	-0.198***	-0.198***	-0.202***
	Average duration of power outages (a)	-0.332***	-0.332***	-0.323***	-0.318***	-0.286***	-0.293***
	Delay to obtain a phone connection (a)	-0.005**	-0.005**	-0.005***	-0.005**	-0.004**	-0.004*
	Dummy for e-mail	0.074	0.074	0.160***	0.166**	0.129**	0.134**
Red tape, corruption and crime	Losses due to criminal activity (a)	-0.097***	-0.097***	-0.082***	-0.082***	-0.082***	-0.080***
	Manager's time spent in bur. issues (a)	-0.021***	-0.021**	-0.016**	-0.016*	-0.016**	-0.016*
	Illegal payments for protection	-0.254***	-0.254**	-0.205**	-0.216**	-0.229***	-0.238**
	Sales declared to taxes (a)	0.013***	0.013***	0.010***	0.010***	0.009***	0.009**
	Number of inspections	-0.032	-0.032	-0.027	-0.026	-0.028	-0.026
	Absenteeism (a)	-0.271**	-0.271*	-0.297**	-0.297**	-0.303**	-0.292**
	Dummy for lawsuit	-0.147***	-0.147***	-0.067	-0.069	-0.077*	-0.075
	Dummy for informal competition	-0.100**	-0.100**	-0.130***	-0.130***	-0.117***	-0.117**
Finance and corporate governance	Dummy for external auditory (a)	0.769*	0.769**	1.008***	0.992***	0.800**	0.842**
Quality, innovation and labor skills	Dummy for new technology purchased (a)	0.187	0.187	0.256	0.26	0.295	0.318
	Staff-unskilled workers	-0.182**	-0.182**	-0.087	-0.079	-0.086	-0.081
	Staff-part time workers	-0.005***	-0.005**	-0.004**	-0.004**	-0.003	-0.003
	Weeks of training of skilled workers (a)	0.041***	0.041**	0.014	0.015	0.017	0.016
Other control variables	Ageof the firm	-0.0001**	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	Dummy for ownership	0.344**	0.344	0.447***	0.445*	0.453***	0.472**
	Dummy for small firms	-0.243***	-0.243***	-0.769***	-0.817***	-0.875***	-0.933***
	Dummy for médium	-0.289***	-0.289***	-0.435***	-0.467***	-0.546***	-0.585***
	Observations	1516	1516	1516	1516	1516	1516
	R-squared	0.18	0.18	0.77	0.77	0.78	0.78

Notes.
Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors. The more relevant changes are in Dummy for external audit and Weeks of training of skilled workers, both variables are significant at 15% in this case.
Each regression includes a set of industry dummies, year dummies and a constant term.
(a) Variables instrumented with the industry-region-size average.

Table C.1b: ICA elasticities and semi-elasticities with respect to productivity, unrestricted estimation.

Blocks of ICA variables		Two steps estimation		Single step estimation			
		Solow residual		Cobb-Douglas		Translog	
	Explanatory ICA variables	OLS	Random Effs.	OLS	Random Effs.	OLS	Random Effs.
Infrastructures	Days to clear customs to imports (a)	-0.152**	-0.152**	-0.151**	-0.154**	-0.141**	-0.136*
	Average duration of power outages (a)	-0.293***	-0.293***	-0.268***	-0.255***	-0.170*	-0.159*
	Delay to obtain a phone connection (a)	-0.005**	-0.005**	-0.004**	-0.005**	-0.004**	-0.004*
	Dummy for e-mail	0.061	0.061	0.144**	0.151**	0.130**	0.141**
Red tape, corruption and crime	Losses due to criminal activity (a)	-0.095***	-0.095***	-0.076***	-0.074***	-0.069***	-0.068***
	Manager's time spent in bur. issues (a)	-0.020***	-0.020**	-0.021***	-0.020**	-0.022***	-0.022***
	Illegal payments for protection	-0.267***	-0.267**	-0.166*	-0.165	-0.195**	-0.208**
	Sales declared to taxes (a)	0.013***	0.013***	0.011***	0.011***	0.006*	0.006*
	Number of inspections	-0.036*	-0.036	-0.036*	-0.036	-0.022	-0.024
	Absenteeism (a)	-0.260**	-0.260*	-0.241**	-0.254*	-0.271**	-0.293**
	Dummy for lawsuit	-0.141***	-0.141***	-0.072*	-0.071	-0.123***	-0.116**
	Dummy for informal competition	-0.098**	-0.098**	-0.110***	-0.113**	-0.109***	-0.116***
Finance and corporate governance	Dummy for external auditory (a)	0.717*	0.717**	0.695*	0.669**	0.514	0.557*
Quality, innovation and labor skills	Dummy for new technology purchased (a)	0.241	0.241	0.212	0.203	0.526**	0.514**
	Staff-unskilled workers	-0.167**	-0.167**	-0.086	-0.087	-0.044	-0.038
	Staff-part time workers	-0.005***	-0.005**	-0.003*	-0.003	-0.001	-0.001
	Weeks of training of skilled workers (a)	0.043***	0.043**	0.019	0.017	0.006	0.003
Other control variables	Ageof the firm	-0.0001***	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	Dummy for ownership	0.350**	0.350**	0.350**	0.350**	0.350**	0.350**
	Dummy for small firms	-0.226***	-0.226***	-0.622***	-0.660***	-0.442***	-0.477***
	Dummy for médium	-0.294***	-0.294***	-0.376***	-0.397***	-0.148	-0.182*
	Observations	1516	1516	1516	1516	1516	1516
	R-squared	0.204	0.204	0.803	0.803	0.845	0.845

Notes.
Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors. The more relevant changes are in Dummy for external audit and Weeks of training of skilled workers, both variables are significant at 15% in this case.
Each regression includes a set of industry dummies, year dummies and a constant term.
(a) Variables instrumented with the industry-region-size average.

Table D.1: Two stage least squares (2SLS) estimation of employment equation

		Restricted Solow residual[1]		Unrestricted Solow residual[1]	
Blocks of ICA vars.	**Explanatory ICA variables**	**Coefficient**	**% Contribution[2]**	**Coefficient**	**% Contribution[2]**
Productivity		-0.072**	-3.59	-0.074**	-3.66
Real wages		-0.101***	-21.98	-0.101***	-21.97
Infrastructures	Dummy for e-mail	0.267***	5.49	0.267***	5.48
Red tape, corruption and crime	Manager's time spent in bureaucratic issues (a)	0.018***	4.15	0.018***	4.17
	Dummy for informal competition	-0.077*	-0.96	-0.077*	-0.97
	Sales declared to taxes (a)	-0.015***	-19.89	-0.015***	-19.91
	Labor costs declared (a)	0.019***	34.19	0.019***	34.19
	Dummy for payments to obtain a contract with the government	-0.112**	-0.76	-0.113**	-0.76
	Transaction fees to obtain a land or a building (a)	-0.075**	-15.91	-0.074**	-15.77
Finance and corporate governance	Dummy for credit line	0.214***	2.77	0.215***	2.78
	Dummy for loan bank	0.156**	8.55	0.157**	8.49
	Dummy for Loan outstanding	0.333***	1.68	0.331***	1.69
	Dummy for loan Turkish Lira	-0.278***	-2.16	-0.277***	-2.14
	Dummy for loan with collateral	-0.269***	-2.08	-0.268***	-2.08
	Dummy for rent land	-0.210***	-9.19	-0.210***	-9.2
	Dummy for external auditory	0.239***	2.5	0.239***	2.51
Quality, innovation and labor skills	Qdummy for quality certification	0.448***	4.61	0.447***	4.61
	Dummy for new technology purchased	0.226***	2.59	0.226***	2.59
	Education of the manager	0.451***	7.89	0.451***	7.89
	Dummy for internal training	0.200***	2.65	0.199***	2.64
	Dummy for external training	0.325***	3.08	0.325***	3.08
	University staff	-0.013***	-3.63	-0.013***	-3.63
Other control variables	Dummy for incorporated company	0.253**	0.26	0.253**	0.26
	Dummy for public	0.722***	0.2	0.723***	0.2
	Dummy for exporter	0.353***	4.25	0.353***	4.25
	Dummy for ownership	0.755***	0.26	0.755***	0.26
	Dummy for young firms	-0.311***	-1.07	-0.311***	-1.07
Instruments evaluation	Partial R-squared F test (p-value)[5]	0		0	
	Hansen test (p-value)[6]	0.26		0.254	
	Observations	1638		1638	

NOTES:
Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors.
Each regression includes a set of industry dummies, year dummies and a constant term.
(a) Variables instrumented with the industry-region-size average.
[1] Productivity is endogenous and the list of variables used as excluded instruments is: Days to clear customs to imports (i-r av.), Losses due to criminal activity (i-r av.), Wait for a phone connection (i-r av.), Illegal payments for protection (i-r av.), Number of power outages (i-r av.), Absenteeism (i-r av.) and Weeks training for skilled workers (i-r av.)
[2] Results from equation (5.1b).
[5] The Hansen test is a test of overidentifying restrictions. The null hypothesis is that the instruments are valid instruments, that is, uncorrelated with the error term, and therefore the excluded instruments are correctly excluded from the estimated equation.

Table D.2: Two stage least squares (2SLS) estimation of real wages equation

		Restricted Solow residual[1]		Unrestricted Solow residual[1]	
Blocks of ICA vars.	**Explanatory ICA variables**	**Coefficient**	**% Contribution[2]**	**Coefficient**	**% Contribution[2]**
Productivity		0.470***	10.81	0.465***	10.57
Infrastructures	Days to clear customs for exports (a)	-0.180**	-2.64	-0.196**	-2.89
	Average duration of water outages (a)	-0.691**	-0.97	-0.637**	-0.9
	Shipment losses (a)	-0.136***	-3.24	-0.133***	-3.17
	Dummy for internet page (a)	0.731**	5.88	0.572*	4.59
Red tape, corruption and crime	Security expenses (a)	0.114***	11.54	0.133***	13.49
	Manager's time spent in bur. Issues (a)	0.089***	9.45	0.087***	9.19
	Labor costs declared (a)	-0.007*	-6.01	-0.008*	-6.61
	Absenteeism (a)	-0.361***	-1.34	-0.381***	-1.42
Finance and corporate governance	Dummy for loan informal	0.578*	0.03	0.848**	0.05
	Dummy for loan Turkish Lira	0.123**	0.44	0.123**	0.44
	Dummy for loan long term	0.118*	-0.07	0.119*	-0.07
	Dummy for rent buildings (a)	-0.248**	-5	-0.218**	-4.4
Quality, innovation and labor skills	Staff-professional workers	0.548***	1.01	0.529***	0.98
	Staff-part time workers	-0.693***	-0.77	-0.810***	-0.81
	Staff-female workers	-0.003***	-0.29	-0.003***	-0.34
	Training unskilled workers (a)	0.007**	3.79	0.008***	4.43
Other control variables	Dummy for incorporated Company	-0.394**	-0.18	-0.424**	-0.2
	Competitors (a)	-0.369***	-9.43	-0.372***	-9.52
	Trade union (a)	0.024***	1.52	0.025***	1.6
	Dummy for industrial zone	-0.172***	-1.26	-0.175***	-1.29
	Dummy for medium firms	0.160***	0.71	0.159***	0.7
	Dummy for young firms	0.194***	0.31	0.217***	0.34
Instruments evaluation	F-test (p-values)	0		0	
	Hansen test (p-value)[6]	0.212		0.172	
	Observations	1614		1614	

NOTES:

Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors. The more relevant changes are in Labor cost declared and Weeks of training of unskilled workers, both variables are significant at 20% in this case.
Each regression includes a set of industry dummies, year dummies and a constant term.

(a) Variables instrumented with the industry-region-size average.

[1] Productivity is endogenous and the list of variables used as excluded instruments is: Losses due to criminal activity (i-r av.), Wait for a phone connection (i-r av.), Illegal payments for protection (i-r av.), Number of power outages, Dummy for informal competition, Dummy for lawsuit, Weeks training for skilled workers (i-r av.)

[2] Results from equation (5.2b).

[5] The Hansen test is a test of overidentifying restrictions. The null hypothesis is that the instruments are valid instruments, that is, uncorrelated with the error term, and therefore the excluded instruments are correctly excluded from the estimated equation.

Table D.3: Two stage least squares (2SLS) estimation of probability of exporting equation

		Restricted Solow residual[1]		Unrestricted Solow residual[1]	
Blocks of ICA vars.	**Explanatory ICA variables**	**Coefficient**	**% Contribution[2]**	**Coefficient**	**% Contribution[2]**
Productivity		0.178**	74.01	0.180**	73.87
Infrastructures	Days to clear customs for imports (a)	-0.075*	-26.98	-0.077*	-27.8
	Number of power outages (a)	-0.123***	-57.25	-0.122***	-56.5
	Dummy for e-mail	0.136***	23.16	0.138***	23.54
Red tape, corruption and crime	Sales declared to taxes (a)	-0.003*	-32.14	-0.003*	-32.24
	Security expenses (a)	0.084***	153.44	0.084***	153.09
	Number of inspections	0.046***	9.76	0.047***	9.94
	Dummy for informal competition	-0.05	-4.71	-0.046*	-4.76
Finance and corporate governance	Dummy for loan	0.046*	5.37	0.047**	5.49
	Dummy for external auditory	0.073***	6.34	0.073***	6.37
Quality, innovation and labor skills	Dummy for quality certification	0.064**	5.43	0.064**	5.47
	Education of the manager	0.128***	18.61	0.129***	18.69
	Staff-skilled workers	0.089**	8.29	0.090**	8.39
	Weeks of training of unskilled workers (a)	0.015**	6.85	0.015**	6.92
Other control variables	Dummy for incorporated Company	0.178***	1.5	0.178***	1.5
	Number of competitors (a)	-0.141***	-65.19	-0.142***	-65.75
	Percentage of capacity utilization	0.003***	37.77	0.003***	38.34
	Percentage of unionized workers (a)	-0.014***	-16.43	-0.014***	-16.36
Instruments evaluation	F-test (p-values)	0		0	
	Hansen test (p-value)[6]	0.101		0.1	
	Observations	1528		1528	

NOTES:

Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors. The more relevant change is in Dummy for informal competition; the variable is significant at 12% in this case.
Each regression includes a set of industry dummies, year dummies and a constant term.

(a) Variables instrumented with the industry-region-size average.

[1] Productivity is endogenous and the list of variables used as excluded instruments is: Losses due to criminal activity (i-r av.), Manager's time spent in bureaucratic issues (i-r av.), Illegal payments for protection, (i-r av.) Dummy for external auditory (i-r av.), Dummy for new technology (i-r av.,) Absenteeism (i-r av.) and Weeks training for skilled workers (i-r av.).

[2] Results from equation (5.3b).

[5] The Hansen test is a test of overidentifying restrictions. The null hypothesis is that the instruments are valid instruments, that is, uncorrelated with the error term, and therefore the excluded instruments are correctly excluded from the estimated equation.

Table D.4: Two stage least squares (2SLS) estimation of probability of receiving FDI

		Restricted Solow residual[1]		Unrestricted Solow residual[1]	
Blocks of ICA vars.	**Explanatory ICA variables**	**Coefficient**	**% Contribution[2]**	**Coefficient**	**% Contribution[2]**
Productivity		0.037**	284.32	0.038**	294.13
Infrastructures	Days to clear customs for imports (a)	-0.040***	-270.99	-0.041***	-276.74
Red tape, corruption and crime	Dummy for payments to obtain a contract with the government (a)	-0.166**	-155.35	-0.168**	-156.81
Quality, innovation and labor skills	Dummy for new product (a)	0.143*	202.62	0.139*	197.43
	Dummy for licensed technology	0.028*	16.4	0.028*	16.31
	Education of the manager (a)	0.105***	281.28	0.105***	281.22
	Dummy for internal training (a)	0.148***	289.52	0.152***	297.05
	University staff	0.001**	48.58	0.001**	48.86
Other control variables	Dummy for incorporated Company	0.065*	10.16	0.065*	10.19
	Dummy for exporter	0.019**	35	0.019**	35.43
Instruments evaluation	F-test (p-values)	0		0	
	Hansen test (p-value)[6]	0.183		0.176	
	Observations	1644		1644	

NOTES:

Significance is given by robust standard errors.*significant at 10%; ** significant at 5%; *** significant at 1%
Similar results by robust cluster errors. The more relevant change is in Dummy for incorporate company; the variable is significant at 15% in this case.
Each regression includes a set of industry dummies and a constant term.

(a) Variables instrumented with the industry-region-size average.

[1] Productivity is endogenous and the list of variables used as excluded instruments is: Losses due to criminal activity (i-r av.), Manager's time spent in bureaucratic issues (i-r av.), Sales declared to taxes (i-r av.), Wait for a phone connection (i-r av.), Illegal payments for protection (i-r av.), Dummy for external auditory (i-r av.), Number of power outages (i-r av.), Dummy for new technology (i-r av.), Absenteeism (i-r av.), Dummy for informal competition, Dummy for e-mail, Weeks training for skilled workers (i-r av.) , Dummy for small firms and Dummy for medium firms.

[2] Results from equation (5.4b).

[5] The Hansen test is a test of overidentifying restrictions. The null hypothesis is that the instruments are valid instruments, that is, uncorrelated with the error term, and therefore the excluded instruments are correctly excluded from the estimated equation.

Table E.1: Economic performance effects (I): effects among economic performance measures

	Dependent Variable				
Explanatory Variable	**Productivity**	**Employment**	**Real wages**	**Probability of exporting**	**Probability of receiving FDI**
Productivity		-	+	+	+
Employment					
Real wages		-			
Probability of exporting		+			+
Probability of receiving FDI					

Source: Authors' calculations with World Bank's Investment Climate Assessment data.

Table E.2: IC effects on economic performance measures (I)

Explanatory Investment Climate Variable		Dependent Variable				
		Productivity	Employment	Real wages	Probability of exporting	Probability of receiving FDI
Infrastructures	Days to clear customs for exports			-		
	Days to clear customs for imports	-			-	-
	Average duration of power outages	-				
	Power outages				-	
	Average duration of water outages			-		
	Water outages					
	Wait for phone					
	Shipment losses			-		
	Dummy for e-mail	+	+		+	
	Dummy for internet page			+		
	Delay to obtain a phone connection	-				
Red Tape, Corruption and Crime	Losses due to criminal activity	-				
	Security expenses				+	
	dummy for illegal payments for protection	-				
	Manager's time spent in bur. Issues	-	+	+		
	Sales declared to taxes	+	-	-	-	
	Labor cost declared		+			
	Number of inspections	-			+	
	Payments to obtain a contract with the government		-			-
	Absenteeism	-		-		
	Dummy for lawsuit	-				
	Transaction fees to obtain a land or a building		-			
	Sales never repaid					
	Dummy for informal competition	-	-		-	
Finance and Corporate Governance	Dummy for credit line		+			
	Dummy for loan				+	
	Dummy for loan outstanding of credit institutions		+			
	Dummy for loan from bank		+			
	Dummy for loan from leasing					
	Dummy for loan from informal sources			+		
	Dummy for loan in Turkish Lira		-	+		
	Dummy for loan with collateral		-			
	Dummy for long term loan			+		
	Dummy for external auditory	+	+		+	
	Dummy for firm that rents land		-	+		
	Dummy for firm that rents buildings			-		

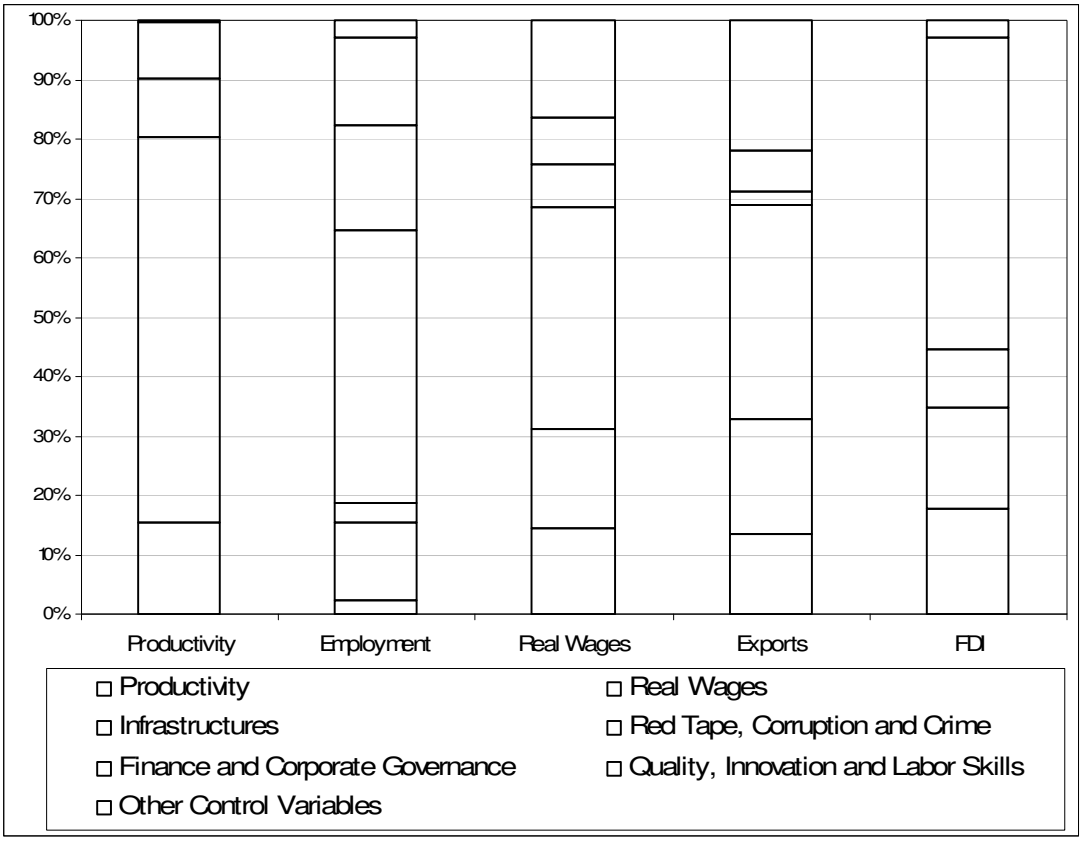
Source: Authors' calculations with World Bank's Investment Climate Assessment data.

Table E.3: IC effects on economic performance measures (II)

Explanatory Investment Climate Variable		Dependent Variable				
		Productivity	Employment	Real wages	Probability of exporting	Probability of receiving FDI
Quality and Innovation and labor skills	Dummy for quality certification		+		+	
	Dummy for new product					+
	Dummy for new technology purchased	+	+			
	Dummy for foreign licensed technology					+
	Education of the manager		+		+	+
	Perc. of skilled workers in staff				+	
	Perc. of unskilled workers in staff	-				
	Perc. of professional workers in staff			+		
	Perc. of part-time workers in staff	-		-		
	Perc. of female workers in staff			-		
	Perc. of temporal workers in staff					
	Dummy for internal training		+			+
	Dummy for external training		+			
	Dummy for training to unskilled workers			+		
	Weeks of training of skilled workers	+				
	Weeks of training of unskilled workers				+	
	Percentage of university workers in staff		-			+
Other Control Variables	Dummy for incorporated company		+	-	+	+
	Dummy for public firm		+			
	Age of the firm	-				
	Number of competitors			-	-	
	Percentage of capacity utilization				+	
	Percentage of unionized workers				-	
	Dummy for recently privatized firm	+	+			
	Dummy for firm located in an industrial zone			-		
	Dummy for small size firm	-				
	Dummy for medium size firm	-		+		
	Dummy for young (less than 5 years)		-	+		

Source: Authors' calculations with World Bank's Investment Climate Assessment data.

Figure 1
ICA Percentage Absolute Contribution on Economic Performance Variables



	Productivity	Employment	Real Wages	Exports	FDI
Productivity	-	2.17	14.29	13.38	17.83
Real Wages	-	13.30	-	-	-
Infrastructures	15.42	3.32	16.82	19.41	17.00
Red Tape, Corruption and Crime	64.96	45.90	37.45	36.16	9.74
Finance and Corporate Gov.	9.81	17.50	7.32	2.12	-
Quality, Innovation and labor skills	9.58	14.79	7.74	7.08	52.59
Other Control Variables	0.23	3.01	16.37	21.85	2.83
Total	100.00	100.00	100.00	100.00	100.00

NOTE:

Each decomposition represents, the contributions of IC blocks of variables, relative to the total IC effects on each dependent variable, computed according to equations (3.5), (5.1b), (5.2b), (5.3b) and (5.4b), in absolute values.

Figure 2.1
Absolute Percentage Contribution of IC Variables on Average Log-Productivity

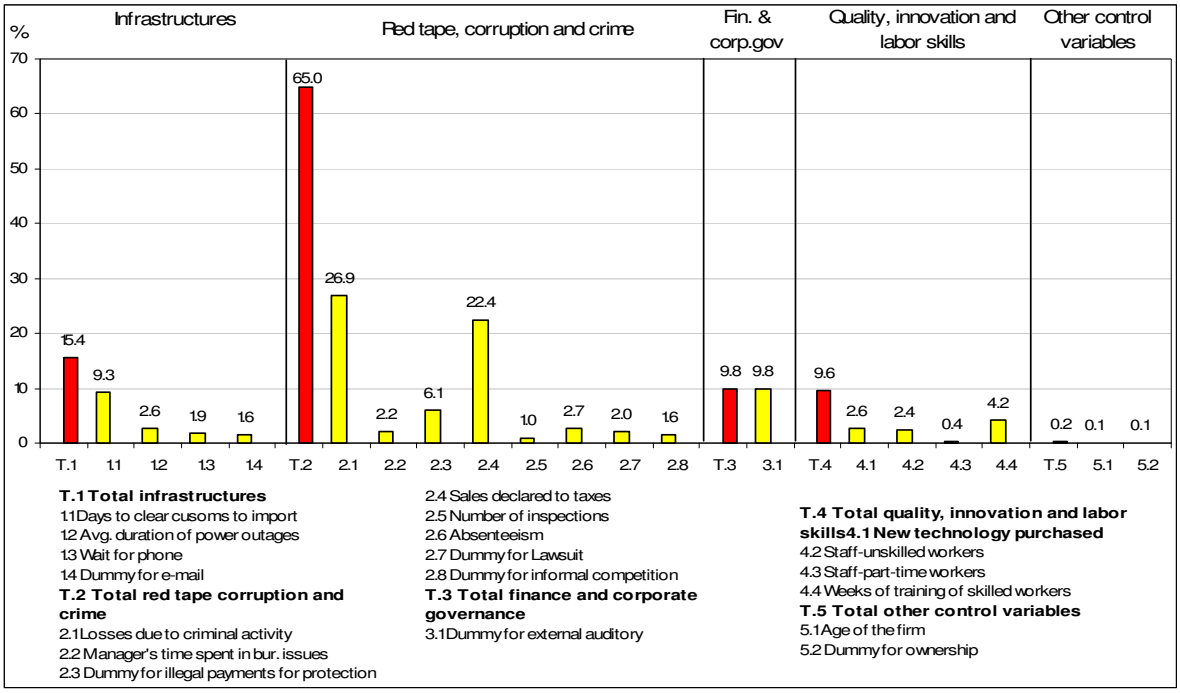


Figure 2.2
Absolute Percentage Contribution of IC Variables on the Average Log-employment

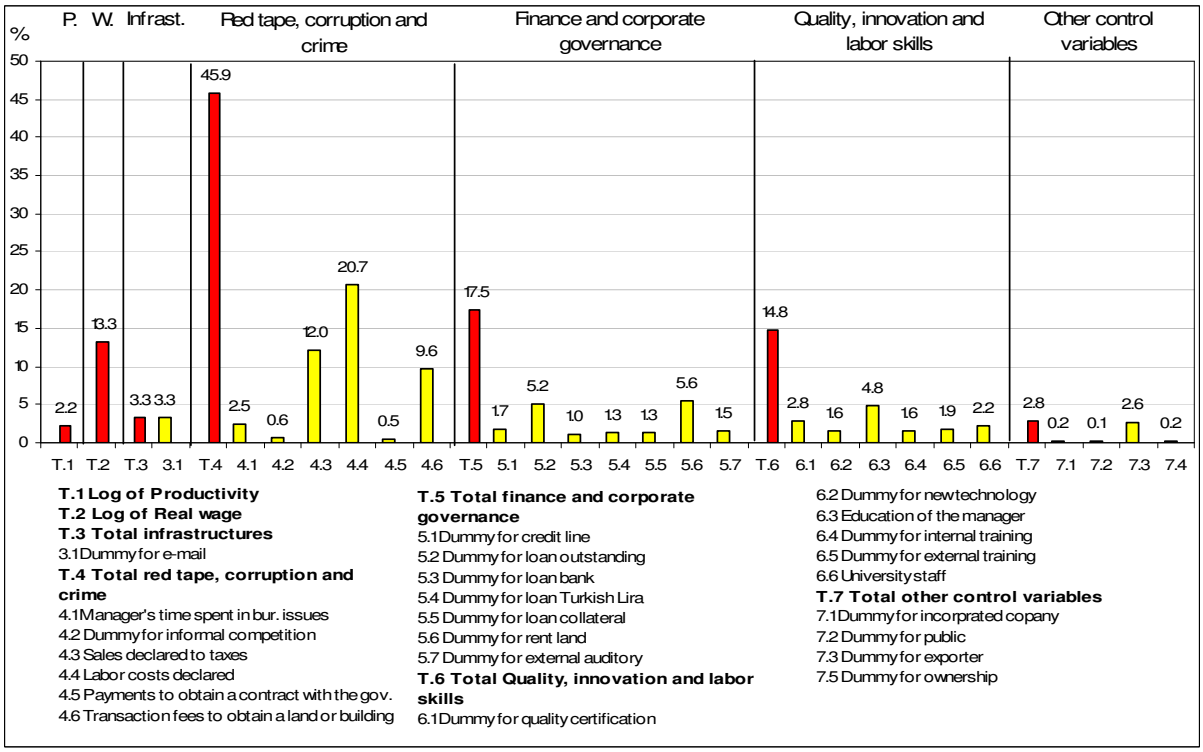
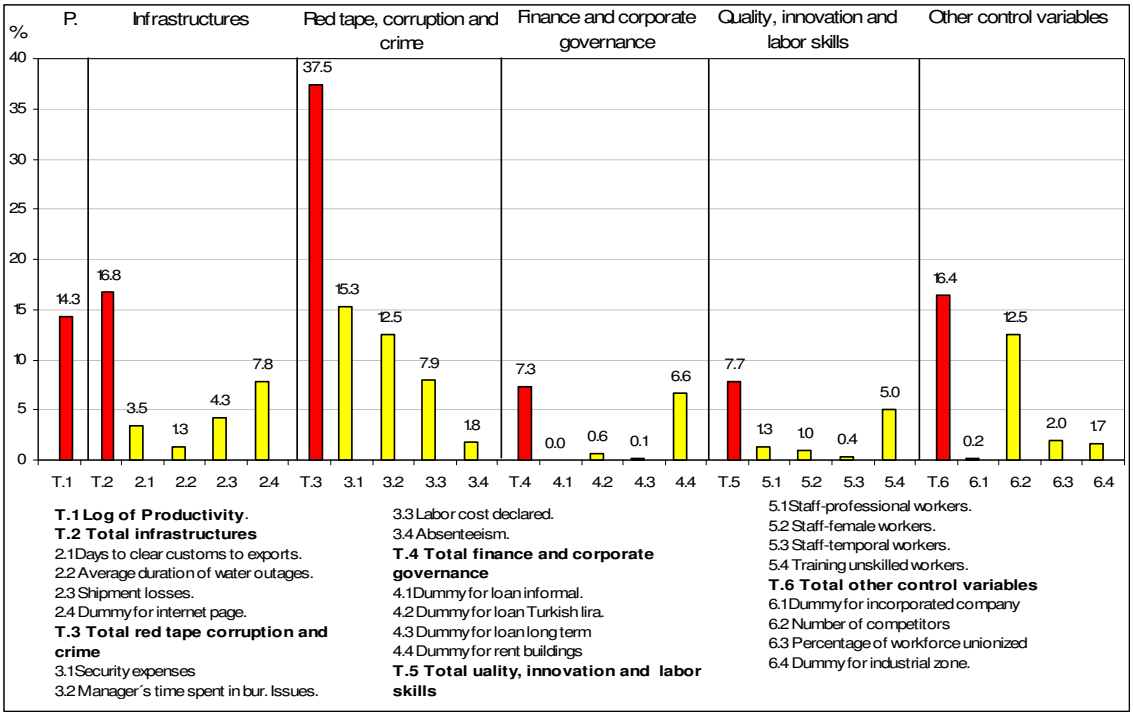
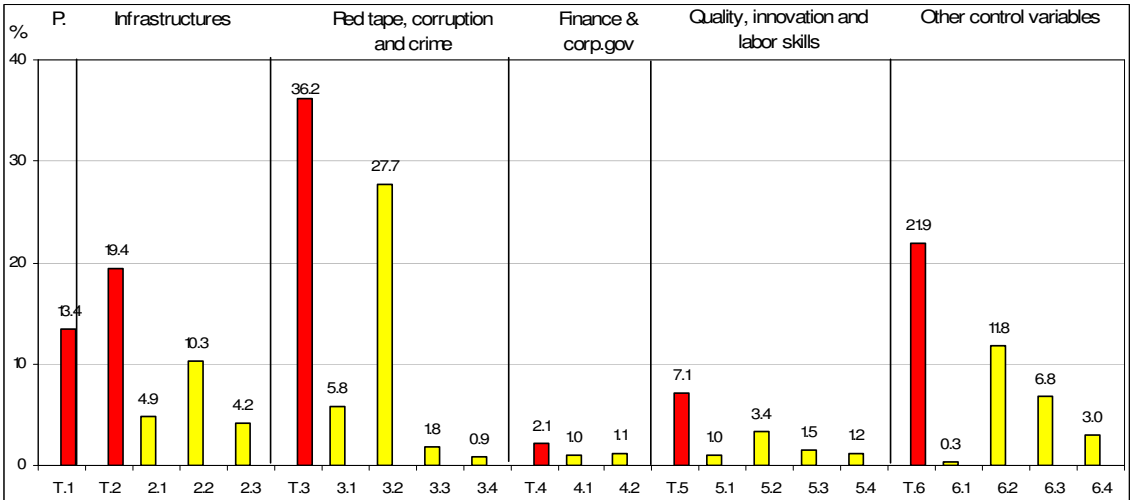


Figure 2.3
Absolute Percentage Contribution of IC Variables on Average Log-real Wage



T.1 Log of Productivity.
T.2 Total infrastructures
2.1 Days to clear customs to exports.
2.2 Average duration of water outages.
2.3 Shipment losses.
2.4 Dummy for internet page.
T.3 Total red tape corruption and crime
3.1 Security expenses
3.2 Manager´s time spent in bur. Issues.
3.3 Labor cost declared.
3.4 Absenteeism.
T.4 Total finance and corporate governance
4.1 Dummy for loan informal.
4.2 Dummy for loan Turkish lira.
4.3 Dummy for loan long term
4.4 Dummy for rent buildings
T.5 Total uality, innovation and labor skills
5.1 Staff-professional workers.
5.2 Staff-female workers.
5.3 Staff-temporal workers.
5.4 Training unskilled workers.
T.6 Total other control variables
6.1 Dummy for incorporated company
6.2 Number of competitors
6.3 Percentage of workforce unionized
6.4 Dummy for industrial zone.

Figure 2.4
Absolute Percentage Contribution of IC Variables on the Probability of Exporting



T.1 Log of Productivity.
T.2 Total infrastructures
2.1 Days to clear customs to imports.
2.2 Number of power outages.
2.3 Dummy for e-mail.
T.3 Total red tape corruption and crime
3.1 Sales declared to taxes.
3.2 Security expenses.
3.3 Number of inspections.
3.4 Dummy for informal competition
T.4 Total finance and corporate governance
4.1 Dummy for loan
4.2 Dummy for external auditory.
T.5 Total quality, innovation and labor skills
5.1 Quality certification.
5.2 Education of the manager.
5.3 Staff-skilled workers.
5.4 Weeks of training of unskilled workers.
T.7 Total other control variables
6.1 Dummy for incorporated Company.
6.2 Number of competitors.
6.3 Percentage of capacity utilization.
6.4 Percentage of workforce unionized.

Figure 2.5
Absolute Percentage Contribution of IC Variables on the Probability of receiving FDI

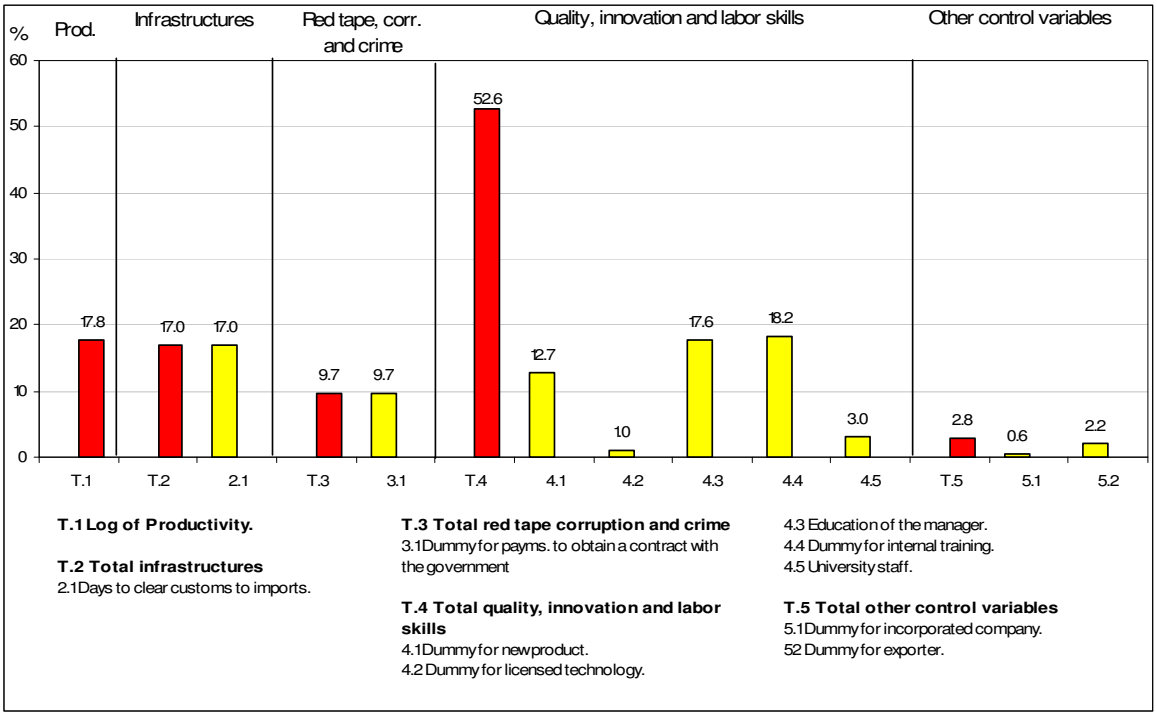


Figure 3.1
Relative ICA effects by groups of variables on average log-productivity; by size

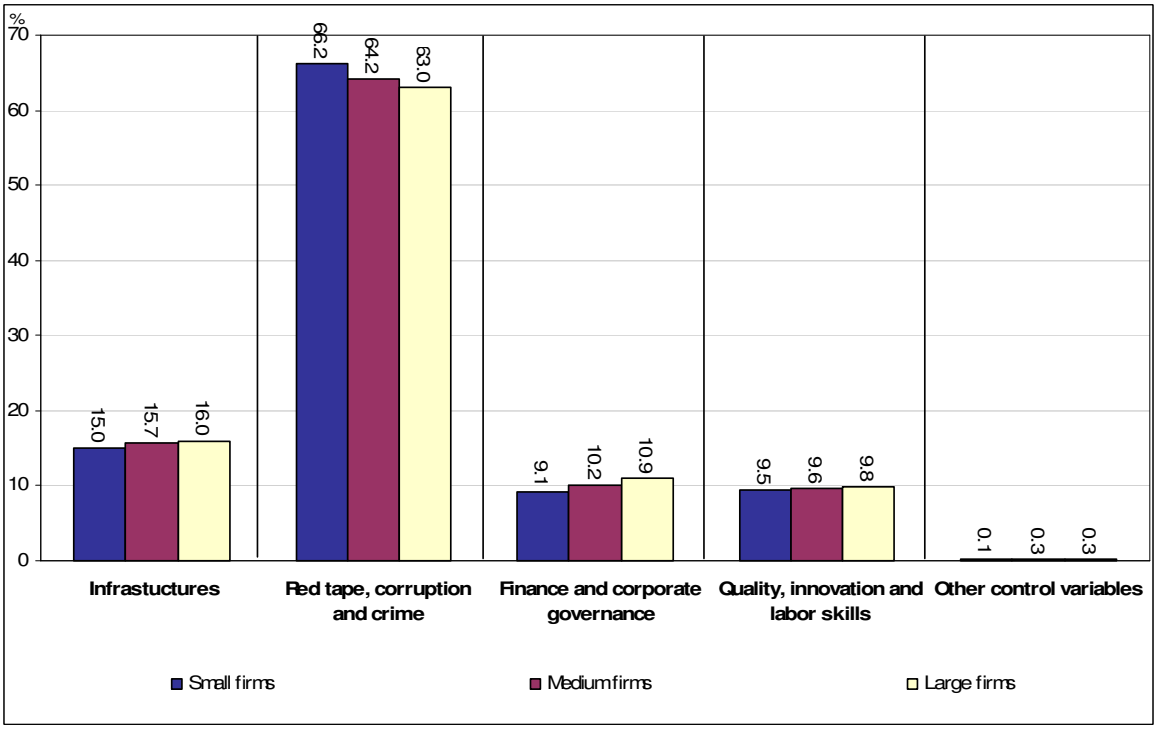


Figure 3.2
Relative ICA effects by groups of variables on average log-employment; by size

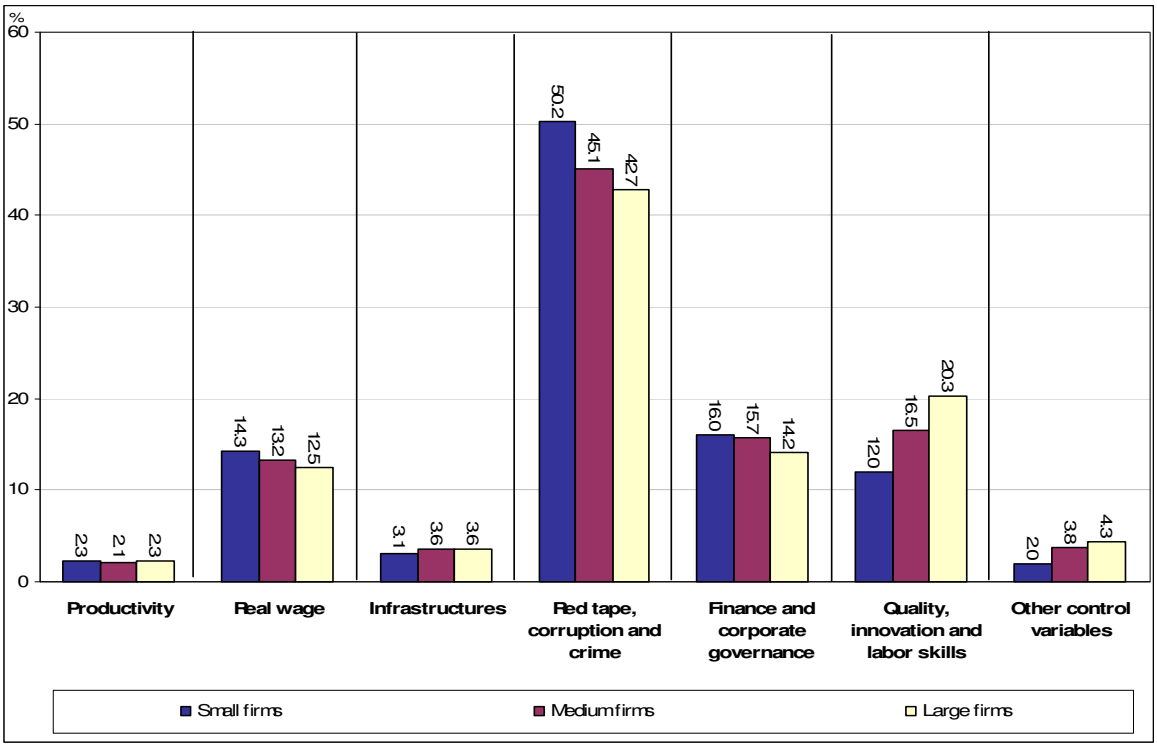


Figure 3.3
Relative ICA effects by groups of variables on average log-real wage; by size

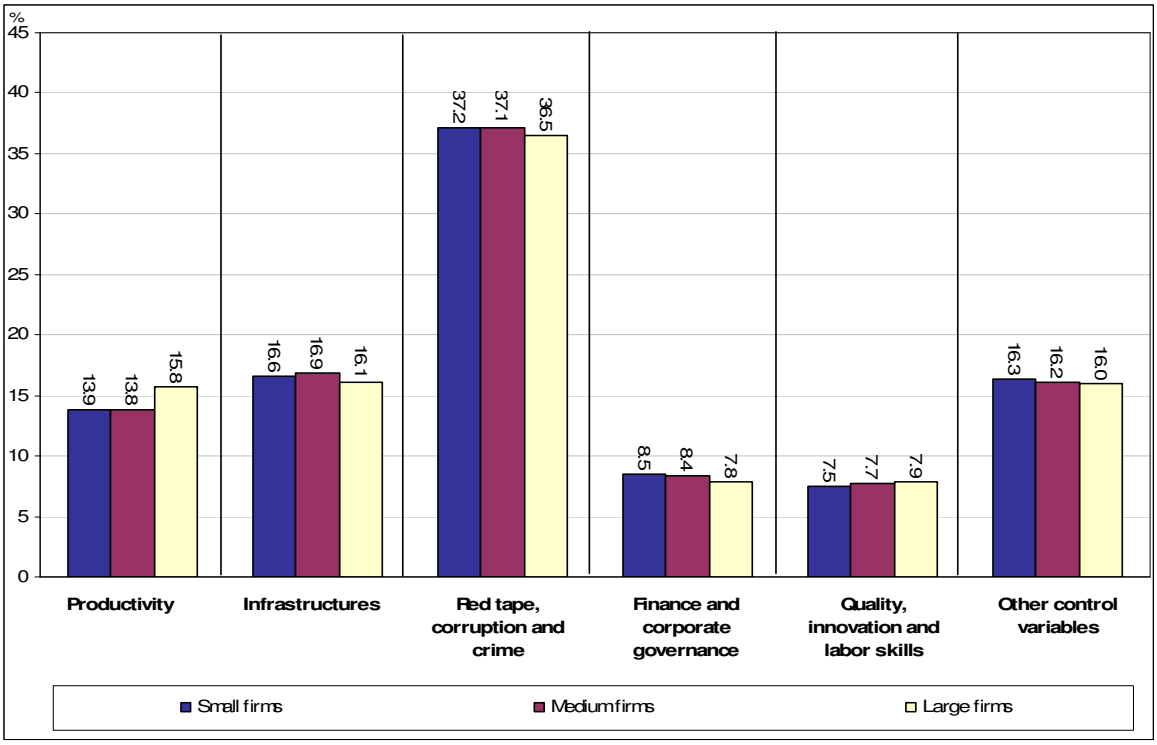


Figure 3.4
Relative ICA effects by groups of variables on the probability of exporting; by size

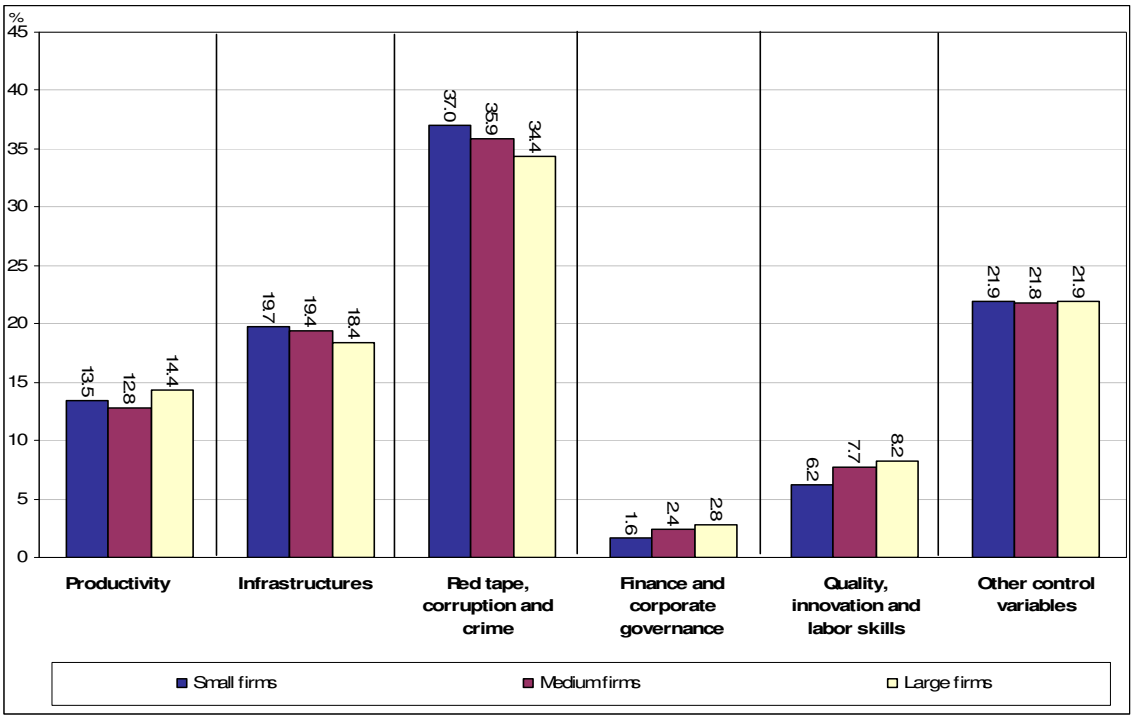


Figure 3.5
Relative ICA effects by groups of variables on the probability of receiving FDI; by size

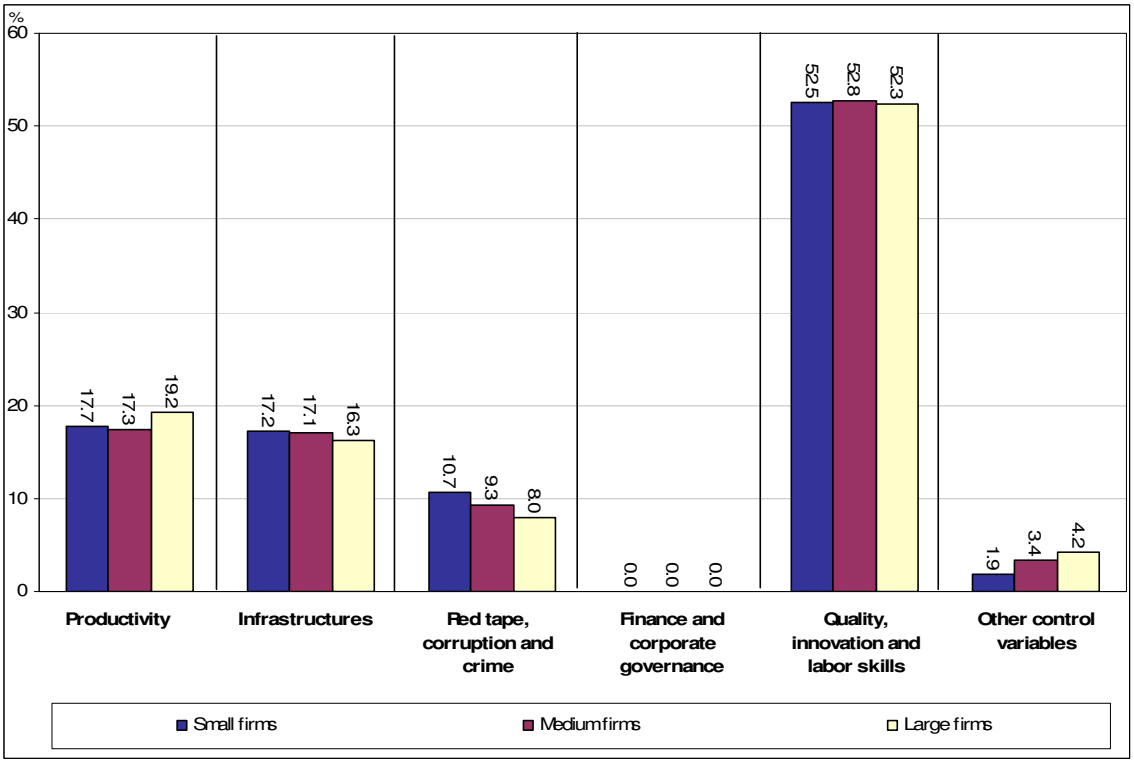
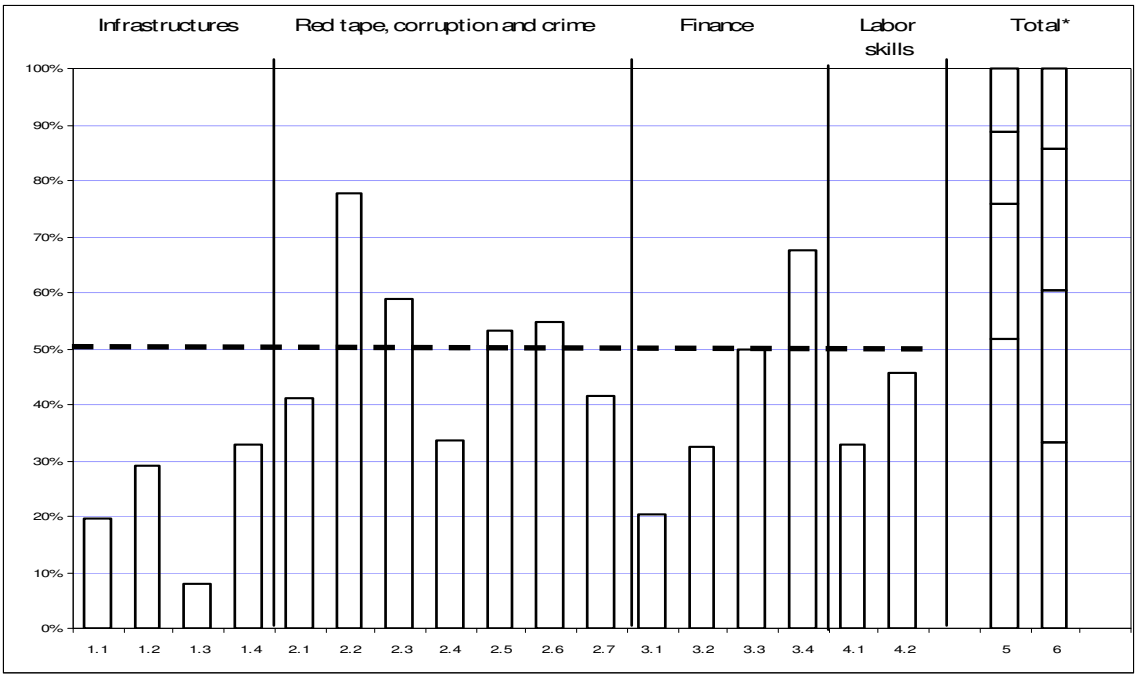


Figure 4
Firm's perceptions; percentage of firms that considers each one of the following problems as a severe obstacle to firms' economic performance



* The last two columns represent the relative contribution of each IC group to the total. In the last column we compensate the different number of questions in each IC group by computing the contribution to the mean of each group.

LEGEND:

1 Infrastructures.
1.1 Telecommunications
1.2 Electricity
1.3 Transportation
1.4 Customs and trade regulations

2 Red tape, corruption and crime.
2.1 Business Licensing and Operating Permits
2.2 Tax Rates
2.3 Tax Administration
2.4 Corruption
2.5 Crime, theft and disorder
2.6 Anti-competitive or Informal Practices
2.7 Legal system/ Conflict Resolution

3. Finance.
3.1 Access to Land
3.2 Access to Finance
3.3 Cost of Finance
3.4 Macroeconomic uncertainty

4. Labor skills.
4.1 Labor Regulations
4.2 Skills and Education of Available Workforce

5. Total relative weights.
6. Average group relative weights.
* (Totals are computed as the relative weigh of each group of perceptions over the sum of all perceptions' weights)

Figure 5: Comparison of Turkey's performance with 4 selected economies according to World Bank's Doing Business Report 2007

Ranking out of 178 economies, in parentheses is the ranking within the sample of five economies included in the figure. Highlighted in red are the factors for which Turkey is below the middle of the ranking, says 89 out of 178. Source: Doing Business Report 2007, World Bank, Washington D.C.

Economy	Ease of Doing Business Rank	Starting a Business	Dealing with Licenses	Employing Workers	Registering Property	Getting Credit	Protecting Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Closing a Business
Chile	28 (1)	33 (1)	59 (2)	67 (1)	32 (2)	45 (1)	32 (1)	34 (1)	35 (1)	63 (1)	98 (2)
Mexico	41 (2)	62 (3)	20 (1)	134 (4)	79 (3)	45 (1)	32 (1)	140 (4)	69 (2)	79 (2)	23 (1)
Turkey	**65 (3)**	**40 (2)**	**126 (4)**	**138 (5)**	**30 (1)**	**62 (3)**	**62 (5)**	**85 (2)**	**73 (4)**	**36 (4)**	**114 (3)**
Brazil	113 (4)	120 (5)	95 (3)	116 (3)	109 (5)	80 (5)	62 (5)	139 (3)	70 (3)	112 (3)	136 (5)
India	132 (5)	93 (4)	133 (5)	83 (2)	108 (4)	62 (4)	32 (3)	158 (5)	142 (5)	177 (5)	135 (4)