FEMISE RESEARCH PROGRAMME

2008-2009

Performances productives et climat de l'investissement dans quatre pays de l'espace MENA : Algérie, Egypte, Maroc, Liban

Firm Productivity and Investment Climate in Developing Countries: How Does MENA Manufacturing Perform?

Article issued from Research n°FEM33-09
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February 2010

Ce rapport a été réalisé avec le soutien financier de l'Union Européenne au travers du Femise. Le contenu du rapport relève de la seule responsabilité des auteurs et ne peut en aucun cas être considéré comme reflétant l'opinion de l'Union Européenne.

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Abstract

This paper investigates the relationship between firm-level productivity and investment climate (IC) for a large number of developing countries (23) and eight manufacturing industries. We first propose three measures of firm productive performances: Labor Productivity (LP), Total Factor Productivity (TFP), and Technical Efficiency (TE). On average, MENA enterprises have performed poorly compared to other countries of the sample. Morocco, whose various measures of firm-level productivity rank close to the ones of the most productive countries, is an exception. Moreover, we show that firm competitiveness in MENA is handicapped by high Unit Labor Cost, compared to some competitors, China and India being the most influential worldwide. The empirical analysis also reveals that the investment climate matters for the firms' productive performances. This is true (depending on the industry) for the quality of a large set of infrastructures, the experience and level of education of the labor force, the cost and access to financing, as well as to a lesser extent, different dimensions of the government-business relation. These findings bear important policy implications by showing which dimension of the investment climate could help manufacturing firms in MENA to be more competitive in the world market.

Keywords: Manufacturing firms, Productivity, Investment Climate, Developing Countries, MENA.

JEL classification: D24, O14, O57.

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1. Introduction

The revival of interest in economic growth has renewed the question of the differences in productivity among countries and regions. Productivity, in the form of technical progress and technical efficiency, is actually seen as a potential, if not the major source of long-run economic growth and international convergence of economies. This question has justified that growing research has focused on the manufacturing industry as the place of innovation and the engine of growth. Productivity in the manufacturing industry is also central to international competitiveness, as developing countries face the increasing pressure of globalization. High productivity gains have been seen as a powerful means of improving export capacity and diversifying the economy. The persistence of productivity differences across countries, regions and firms, however, don't find any justification in the present situation of globalization characterized by capital mobility and diffusion of technology. These differences have to be explained by factors, which are specific to each country and region. It is in this context that a new branch of the literature has explored the question of the differences in the investment climate, as a major factor contributing to the differences in productivity[1].

Understanding the factors that affect industrial performances bears important policy implication in the case of MENA, who generally does not benefit from diversified economies and substantial manufacturing export capacities. Although MENA countries are, on average, defined as middle-income countries, economic performance in the region has most of the time been disappointing. This has been the case of growth and investment for more than three decades[2]. Attractiveness of FDI has also been weak, as well as competitiveness and exports of manufacturing[3]. In fact, MENA competitiveness has constantly been affected by poor exchange rate policies and insufficient economic reforms. But other factors, such as the investment climate, can surely explain the low productivity and the high production costs at the firm level, as various studies point out

[1] See at the macroeconomic level Bosworth and Collins (2003); Djankov and al. (2002); Hall and Jones (1999); Haltiwanger (2002); He et al. (2003); Loaya, Ociedo and Serven (2004); OECD (2001); Rodrik, Subramanian (2004); McMillan (1998 and 2004); World Bank (2003, 2004) Frankel (2002) and Rodrik (1999). See also Bastos and Nasir (2004); Dollar and al. (2005); Eifert and al. (2005); Escribano and Gasch (2005) for results on firms' performances at the microeconomic level.
[2] See Nabli. (2007); Nabli and Véganzonès-Varoudakis (2004); Aysan, et al. (2007a and 2007b).
[3] See Sekkat and Véganzonès-Varoudakis, (2007); Nabli and Véganzonès–Varoudakis (2007).

MENA investment climate deficiencies[4]. These deficiencies have been reported as participating in the slow economic activity in the region[5].

The World Bank Investment Climate (*ICA*) surveys collect data on inputs and outputs as well as on various aspects of the investment climate at the firm level. ICA surveys produce both subjective evaluations of obstacles, as well as other more objective information on the themes of infrastructure, human capital, technology, governance, and financial constraints. These standardized surveys of large, random samples of firms from different sectors permit comparative measures of firms' productive performance. They also provide information to estimate the contribution of investment climate to these performances. The ICA surveys can thus be seen as an instrument for identifying key obstacles to firms' productivity and competitiveness. They can be used as a support to policy reforms for an increased economic growth. The objective of this paper has been to help progress in that direction.

Drawing on the World Bank firm-surveys, we analyze the relationship between investment climate and firm-level productivity for a large number of countries (23 among which 5 MENA countries (for the list see *Annex 1*) and eight manufacturing industries[6]. We first propose different measures of the firms' productive performances by industry, such as Labor Productivity (*LP*), Total Factor Productivity (*TFP*), and Technical Efficiency (*TE*) using a production frontier approach. These indicators are compared with each other, as well as across countries in order to position MENA manufacturing firms amongst a wide range of firms from other regions. We reveal that enterprises in MENA perform poorly on average, compared to other countries of the sample. The exception is *Morocco*, whose various measures of firms' productive performance always rank close to the ones of the most productive firms in the sample. An originality of our approach has been, as well, to generate a few composite indicators of investment climate using the Principal Component Analysis (*PCA*) methodology, which summarizes the key dimensions of the investment climate clearly. This has also allowed the tackling of the problem of multicollinearity, when explaining firm productive performances with a wide range of correlated *IC* variables. We define four axes of the investment climate: the Quality of Infrastructure (*Infra*), the Business-Government Relations (*Gov*), the Human Capacity (*H*), and the Financing Constraints (*Fin*). We use, as well, city-sector averages to reduce the potential endogeneity problem underlying the investment climate (*IC*) variables. The analysis finally shows that investment climate matters for firms' productive performances. This has been done by estimating an efficiency function explaining firm-level productivity for each of our eight manufacturing industries.

The paper is organized as follows: The second section introduces different concepts of firm-level productivity and discusses the advantages and limits of the different measures.

[4] See the World Bank (2004), as well as the World Bank Investment Climate Assessments (*ICA*) of *Egypt* (2005 and 2006), *Morocco* (2001 and 2005), and *Algeria* (2002). *Doing Business* 2005-2009 (the World Bank, 2009) also places MENA low on business climate indicators compare to other regions.

[5] See see Elbadawi (2002); the World Bank (2004a); Aysan et al. (2007a).

[6] *Agro Processing*, *Leather*, *Textile*, *Garment*, *Wood & Furniture*, *Chemical & Pharmaceutical Products*, *Metal & Machinery Products*, and *Non Metal & Plastic Materials*.

Section three presents, briefly, the investment climate (*ICA*) surveys' data and summarizes their main limitations. The fourth section presents and compares, across countries, our different estimations of the firms' productive performances by industry. The fifth section introduces and categorizes the investment climate indicators used in the empirical analysis, and calculates our four broad *IC* indicators. In the sixth section, we estimate to which extent the investment climate constraints firms' productive performances. The last section concludes.

2. Measures of Firm-Level Productivity: Methodological Aspects

The first challenge has been to measure the firms' productive performance in a relevant way. We propose different approaches and measures. We first consider a non-parametric model of productivity, which consists of calculating productive performances without estimating a production function. The Non-parametric measure of productivity constitutes a simple and already meaningful way of assessing for example Productivity of Labor (*LP*) and Total Factor Productivity (*TFP*). Another way has been to calculate the firms' productive performance from a parametric production frontier. This more sophisticated methodology allows the identification of the most efficient firms of the sample and the comparison of MENA firms' performances to them.

2.1. Non Parametric Measures of Productivity and Unit Labor Cost

Productivity can easily be calculated as the ratio of an output to a specific factor of production, with labor (*L*) being the main input whatever the industrial sector. When all the relevant factors of the production technology are considered, it is referred to Total Factor Productivity (*TFP*). In this paper, due to the limited time dimension for the production factors (two or three years at best) and no time dimension for the Investment Climate (*IC*) variables, we concentrate only on productivity levels and focus our analysis on comparisons of firm-level productivity among enterprises, industries and countries[7].

In the empirical analysis, we first discuss Labor Productivity (*LP*). This indicator gives a first idea of firm productive performance. It has the advantage not to be affected by the error in measurement of the capital stock. However, the technology is only partially described and the productivity then suffers from an omitted variable. The Productivity of Labor can be complemented by calculations of a Unit Labor Cost defined as the ratio of the firms' average wage to firm labor productivity. This indicator allows comparisons of the organizational competitiveness across countries. In addition, Labor Productivity (*LP*) can be biased by the choice of the exchange rate when converting production into US dollars. This is less the case of *TFP,* because the same rate applies to the output (*Y*) at the numerator as well as the intermediate consumption (*ICO*) and the capital stock (*K*) at the

[7] Measuring productivity in level, although more restrictive than measuring growth rates (it requires for example specific functional forms of the production function) is less demanding in terms of data quality conditions. It allows, in particular, unbalanced panels with short term dimension, measurement errors, or constant value of *IC* variables (see Escribano and Guasch, 2005).

denominator. Under the hypothesis of constant returns to scale, (i.e., perfect competition for goods but also for factors that are remunerated at their marginal productivity), weights of Intermediate Consumptions (*ICO*) and of Labor (Wages, *W*) are calculated as the ratio of the cost of these factors to the Total Cost of Production including profit (*Y*). The contribution of Capital (*K*) is then calculated as the complement to one. The advantage of this approach based on the Solow residual is that it does not require the input to be exogenous or the input's elasticity to be constant. The disadvantage is that two hypotheses (which prove sometimes restrictive) have to hold: constant returns to scale and competitive input markets. Another limitation can be seen in the fact that productivity, being calculated as the residual of the production function, is considered as a random variable, which makes it difficult to justify that some exogenous factors can explain productive differences.

$$TFP_i = \frac{Y_i}{L_i^{\omega_{1i}} ICO_i^{\omega_{2i}} K_i^{(1-\omega_{1i}-\omega_{2i})}} \tag{1}$$

$$\omega_{1i} = \frac{W_i}{Y_i}, \quad \omega_{2i} = \frac{ICO_i}{Y_i} \tag{2}$$

2.2. Parametric Production Functions and Production Frontiers

In the parametric approach, *TFP* is calculated as the residual of an estimated production function, thus relaxing the hypotheses of constant returns to scale (but not automatically of productivity as a random variable). Various hypotheses can be made regarding the technology of production. The Cobb Douglas and the Translogarithmic production functions are the most commonly used. Although both present good mathematic properties, the elasticities of the production to the inputs are easy to read and to interpret with the Cobb Douglass technology. In the case of a parametric production function, production is derived from the optimization problem of the firms, which maximize current and expected profits by equating production prices to their marginal costs. This hypothesis does not permit any waste of resources or organizational weaknesses. The production frontier approach, however, allows for non-optimal behaviors of the firms. Enterprises can be positioned in regard to the most efficient firms that define an empirical production frontier. Firm-level Technical Efficiency (*TE*) can then be defined as the firms' productivity gap (or efficiency gap) to the "*best practice",* the empirical practice of firms, which are located on the production frontier.

In the stochastic model, the likelihood estimation method is typically applied to estimate a "composite" error term, which is split into two uncorrelated elements. The first term *(v)*, which is a random variable, represents the external shocks to the firm. These shocks, independent and identically distributed, follow a normal distribution, with zero average and σ^2 standard deviation. The second term represents the Technical Efficiency *(-u*). In our case we will suppose that u follows a truncated normal distribution[8]. In this specification, the firms' productive performances are not assimilated to a random variable and can then be explained by exogenous factors. The interest of this approach can also be seen in the fact that *TEs* having a relative form, firm productivity can be compared to (or benchmarked by) the most efficient ones across countries and regions. The model is as follows:

$$y_i = f(x_i, \beta) - u_i + v_i \tag{3}$$

With

- y: Production
- x: Production factors
- β : Parameters of the equation
- v : External shocks
- u : Technical Efficiency (*TE*)
- i: Firm index

2.3. Explaining Technical Efficiency

A complementary approach, after having calculated Technical Efficiency (*TE*), is to explain the reasons for the firms' diverse performances. The firms' inefficiency can be explained by "exogenous" factors, which affect either the technology of production, or the firms' ability to transform input into output. In the literature, these factors have been estimated in two different ways. A simple method consists of estimating the stochastic production frontier, and to regress the residuals of the estimation (the Technical Efficiency, *TE*) on a vector of explanatory factors (z). This method is called the "Two Steps" procedure. Different estimation procedures can be used. The simplest way is to run an OLS regression. Another possibility is to apply a tobit model, in order to address the question of the distribution of efficiency. The "Two Steps" procedure presents, however, several shortcomings. There is an identification problem in separating the Technical Efficiency (*TE*), from the production frontier. When any of the production frontier input (x) is influenced by common causes affecting efficiency, there is a simultaneity problem[9]. In general, one should expect that the Technical Efficiency term (*TE*) to be correlated with the production frontier inputs (x). In this case, due to the omission of important explanatory variables, the likelihood estimation of the stochastic production frontier is biased.

In fact, a relatively new branch of the literature proposes to estimate the production frontier and the factors explaining inefficiency at the same time. This is the "One Step" procedure. In this case, the parameters of the equation (here β and δ) are simultaneously

[8] Although there is a wide range of choices as regard the statistical distribution of the efficiency term (u), the ranking of firms according to the efficiency term is generally not sensible to the choice of the specific distribution (Coelli, Prasada Rao and Battese, 1998).
[9] See Marschak and Andrews (1944) and Griliches and Mairesse (1995).

estimated by the likelihood estimation method. The stochastic version of the model can be written:

$$y_i = f(x_i, z_i, \beta, \delta) - u_i + v_i \qquad (4)$$

With

- *y*: Production
- *x*: Production factors
- z: Factors explaining Technical Efficiency
- *v* : External shocks
- *u* : Technical Efficiency
- *β / δ:* Parameters of the equation
- *i*: Firm index

3. The ICA Firms Surveys: Data Limitations

The World Bank Investment Climate (*ICA*) surveys collect data on inputs and output, as well as on a large variety of quantitative and qualitative (perception-based) indicators of the investment climate. In building the database, we have tried to incorporate as much information as possible. We have integrated 23 countries in our sample, participating in the five main regions of the developing world: Sub-Saharan Africa (*AFR*), East Asia (*EAS*), South Asia (*SAS*), Latin America and the Caribbean (*LAC*), Middle East and North Africa (*MENA*, see *Annex* 1)[10]. In this sample, MENA is represented by 5 countries: *Algeria* (2002), *Saudi Arabia* (2005), *Lebanon* (2006), *Morocco* (2000, 2004) and *Egypt* (2004, 2006)[11]. *Syria* (2003) and *Oman* (2003) had to be removed from the sample because of a very low rate of answers to the questionnaire. By broadening the initial sample to a large number of countries from different regions, we have intended to compare MENA performances to the ones of emerging countries which appears as major competitors on the world market: *China* (2002) and *India* (2000, 2002), in particular.

To estimate firm-level productivity, a population of almost 20,000 firms, coming from 13 manufacturing industries was initially considered. This sample had to be reduced due to various limitations, particularly the lack of production technology variables and the necessity to remove some figures that proved to be poorly transmitted or recorded. Some industries also had to be merged, due to insufficient observations. In the end, 12,414 enterprises (3073 for the MENA region) regrouped in eight industries were retained when estimating production frontiers (see *Annex 2*)[12].

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[10] Some countries benefit from two surveys. This is the case of *Egypt* (2004, 2006), *India* (2000, 2002) and *Morocco* (2000, 2004).

[11] The year of the survey is into brackets. *Lebanon* and *Saudi Arabia* are, less represented than the other countries of the region. In the case of *Lebanon*, results are sometimes difficult to interpret due to a low number of observations.. For *Saudi Arabia*, firms' surveys cover only 3 of the 8 branches studied (*Agro-Processing*, *Wood & Furniture*, *Metal & Machinery*).

[12] For MENA, the loss of information fluctuates from 22% in *Garment* to 41% in *Wood & Furniture* (around 30% in *Metal & Machinery Products, Non Metal & Plastic Materials* and *Textile,* and 35% in

As for inputs and output, investment climate (*IC*) variables are subject to measurement errors. In the surveys, some firms did not report the full range of investment climate measures. Other firms reported numbers that were not credible. This is also due to the fact that most of investment climate factors are qualitative variables of perception, thus allowing answers to vary depending on the firms, the regions or the countries. Our choice has been to keep as many firms as possible, providing sufficient information on a wide range of investment climate variables. Once outliers were removed (on the basis of the standard regression diagnostics methods), as well as incomplete observations (i.e., firms with missing variables), 5002 observations were left, among which 1483 for the MENA region, which represent 34% of MENA initial population and 30% of the total number of enterprises with *IC* variables (see *Annex 2*)[13]. The *IC* variables considered here are the ones that we use to explain the firms' Technical Efficiency (*TE)* (see sections 5 and 6).

Another question relates to the endogeneity of the *IC* variables, due to the qualitative nature of investment climate factors. This is particularly true for perception variables (such as obstacles to operation) for which firms are asked to position their answer on a given scale[14]. The perception of the scale might be different across firms, industries, regions and countries. Besides, when answering the questions on their investment climate, firms may be influenced by the perception they have of their own productivity and may attribute their inefficiencies to external factors. High-performing firms, as well, may be proactive in reducing their investment climate constraints, for example by working with the authorities to limit inspections or secure more reliable power supply. In the empirical part, we assume this endogeneneity and use appropriate estimation techniques to evaluate the impact of the investment climate on the firms' productive performances. We measure, in particular, *IC* variables as city-sector averages of firm-level observations. This also helps to mitigate the effects of missing observations for some firms. Actually, if we take each investment climate indicator at the firm level, we end up with a smaller sample of observations in which all indicators are available[15].

The exchange rate constitutes another source of uncertainty, which may lead to over or under evaluate the firms' productive performances. This rate is used to convert

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Leather, Agro-Processing and *Chemical & Pharmaceutical Products).* This loss is of 20% to 25% for the whole sample of countries, what is lower than for MENA. This means that answers in MENA were, in average, less satisfactory than in the other countries of the sample. As for the contribution of MENA to the whole sample, when estimating the production frontiers, it varies from 11% in *Wood & Furniture* to 37% in *Non Metal & Plastic Materials* (25% in average for the whole manufacturing industry, see Annex 2), what is a bit less than, but consistent with, the contribution of MENA to the initial sample.

[13] This percentage is of 45 in the whole sample, what shows that firms in MENA did not answer as accurately as the rest of the sample. This is the case in all industries, but more particularly in *Agro-Processing*, *Chemicals & Pharmaceutical Products* and *Wood & Furniture*, in which almost 20% less enterprises have given correct *IC* information.

[14] Firms are asked to quantify their constraints on a scale going from none to very severe.

[15] A relative issue concerns the endogeneity of implantation, high-performing firms having more the possibility to choose a location with better infrastructure and production conditions. In the empirical analysis, we test this hypothesis by excluding from the sample foreign and large domestically owned firms employing more than 150 workers. Our results are unchanged and show that small domestic firms also suffer from investment climate deficiencies. Results of regressions are not reported for a question of space.

production and production factors into US dollars. Several exchange rates can be chosen to calculate and compare firm-level productivity across countries. In this study, we considered the current market rate in US dollars, which has the interest to be the rate that firms use for their economic calculations[16].

4. Firm-Level Productivity: MENA Performance Gap

In this section, we present our three measures of firm-level productivity: Productivity of Labor (*LP*), Total Factor Productivity (*TFP*) and Technical Efficiency (*TE*). The data have been pooled across the 23 countries of our sample. Firm-level productive performances are calculated for each of the 8 industries. Differences and similarities across countries have been analyzed. A pattern of generally low productive performances is observed in the MENA region, with, however, some countries showing better results.

4.1. Firm-level Productivity of Labor and the Unit Labor Cost

Firm-level Productivity of Labor (*LP*) is estimated as the ratio of the firms' Value Added to the Number of Permanent Workers. The Value Added is calculated as the difference between Total Sales and Total Purchase of Raw Material -- excluding fuel[17]. It is assumed that firms are price takers and purchase raw material at the world market price. This assumption is reasonable for the industries, which are competitive. Thus, the dollar value of raw material and the dollar value of output can be compared across countries. The equation is as follows:

$$LP_{i,j} = Y_{i,j} / L_{i,j} \tag{5}$$

With

[16] The choice of an adequate exchange rate depends, among other things, on the exchange rate regime of the country. In presence of a floating exchange rate regime, the volatility of the current exchange rate may affect the perception of the productive performances. This is particularly true for the Labor Productivity (*LP*). For Total Factor Productivity (*TFP*), this problem is somewhat attenuated by the fact that the same exchange rate is used to convert intermediate consumptions and capital in the denominator, and production in the numerator. Using current exchange rate introduces, as well, a bias for example when fixed exchange rate policy leads to an overvaluation of the currency or when the floating rate suffers from overshooting. Current exchange rate has the advantage to represent the rate that firms deal with when making their own economic calculations. This is the rate that the producer faces when he competes on external as well as domestic markets. Both, a constant exchange rate or the use of a Purchasing Power Parity (*PPP*) exchange rate with the US dollar, are surely more problematic for our analysis. *PPP* conversion rate is useful when comparing purchase power of income per capita. We know that the purchasing power in developing countries tends to be higher than when GDP per capita is converted using nominal exchange rate. But when dealing with production, current rate is more representative of the enterprises' economic reality. The choice of exchange rate does not seem, to change radically the perception of the firms' productive performances. The coefficient of correlation of our three measures of firm-level productivity using alternatively current and constant exchange rates is relatively high.

[17] In the surveys, data on Total Purchases of Raw Materials (excluding fuel) are more available compared to those on Direct Raw Material Costs.

- $Y_{i,j}$: Value Added.
- $L_{i,j}$: Number of Permanent Workers
- i / j: Enterprise and country index respectively.

Table 1 displays the averages of Labor Productivity (*LP*) while table 2 reflects the relative Unit Labor Cost. For each country, Labor productivity and Unit Labor Cost are expressed in percentage of the country with the most performing firms and the lowest Unit Labor Cost, respectively. The analysis reveals a relatively stable ranking of countries. On average, and in most industries, *South African* and *Brazilian* firms perform the best. This result is consistent with the relatively high *per capita* income in the two countries (2710 and 2780 dollars, respectively, see World Bank, 2005). *Morocco (2004)'s* firms also participate in the best performances of the sample, especially in *Metal & Machinery Products, Chemical & Pharmaceutical Products*, *Leather,* and *Agro-Processing.*

Table 1 - Firm-Level Relative Productivity of Labor

(Country average, in % of the country with the most productive firms)

Country*	**Textile**	**Leather**	**Garment**	**Agro Processing**	**Metal & Machinery Products**	**Chemic & Pharm Products**	**Wood & Furniture**	**Non Metal & Plastic Materials**
South Africa (2003)	52		**100**	**100**	94	97	87	**100**
Brazil (2003)	**100**	**100**	50	50	66	**100**	38	
***Morocco** (2004)*	*54*	*80*	*54*	*79*	**100**	*91*		*66*
***Morocco** (2000)*	*56*	*94*	*55*	*85*	*48*	*63*		*57*
***Saudi Arabia** (2005)*				*77*	*92*		**100**	
Ecuador (2003)	58	91	80	48	50	54	42	66
El Salvador (2003)	71	59	55	35	28	51		46
China (2002)	52	69	45		31			
Thailand (2004)	62		62	45	40		31	43
Guatemala (2003)	43		64	31	26	36	33	48
India (2002)	35	66	53	21	22	17		
Honduras (2003)	56		50	29	23	39	21	26
India (2000)	39		48		28	24		
Pakistan (2002)	40	35	49	22		17		
Tanzania (2003)				35			20	
Philippines (2003)	32		32	14				
***Algeria** (2002)*	*27*			*21*	*19*	*19*		*31*
Bangladesh (2002)	18	53	16	9		11		
Nicaragua 2003	13	38	26	17	13	17	16	21
Sri Lanka (2004)	13		27	9	17			28
Zambia (2002)	16			13	24	18		
Ethiopia (2002)	11	20	20	10			10	
***Egypt** (2006)*	*14*	*15*	*14*	*12*	*16*	*11*	*10*	*13*
***Egypt** (2004)*	*15*	*20*	*14*	*9*	*11*	*11*	*11*	*11*
***Lebanon** (2006)*	*11*		*17*	*8*			*7*	

Note : * Ranking is from countries with the most productive firms to the ones with the least productive firms.
Source. Authors' calculations

As far as other MENA countries are concerned, the ranking also remains rather stable. *Egyptian* and *Lebanese* firms are systematically among the least performing in all industries (although *Morocco* and *Egypt* have the same GDP *per capita*, at around 1300 US dollars in 2003). In *Algeria*, firm-level Productivity of Labor (*LP*) ranks in at an intermediate position, close to *India* in *Agro-Processing* and *Chemical & Pharmaceutical Products,* but behind in *Textile* and *Metal & Machinery Products* (the firms' performances are always lower than in *China*). *Moroccan* firms remain the most performing ones in the MENA environment, with levels of Labor Productivity (*LP*) far ahead from the two Asiatic giants (*China* and *India*), and close to the most productive firms/countries of the sample[18].

[18] It can be noted that firms in *Saudi Arabia* seem to perform very well in the sectors covered by the survey (*Agro-Processing, Metal & Machinery Products,* and *Wood & Furniture*).

Table 2 - Firm-Level Relative Unit Labor Costs

(Country average, % of the country with the highest unit cost)

Country*	Textile	Leather	Garment	Agro Processing	Metal & Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
El Salvador (2003)	52	**100**	**100**	85	**100**	63		87
Nicaragua (2003)	**100**	72	80	87	88	**100**	92	79
Guatemala (2003)	64		83	**100**	79	87	89	74
Algeria *(2002)*	*73*			*89*	*89*	*96*		**100**
Philippines 2003)	66		92	83				
South Africa (2003)	86		97	74	80	88	69	64
Morocco *2004)*	*81*	*79*	*91*	*75*	*75*	*76*		*60*
Honduras (2003)	36		78	88	76	63	96	86
Egypt *(2004)*	*51*	*66*	*77*	*77*	*55*	*86*	**100**	*57*
Egypt *(2006)*	*60*	*86*	*76*	*71*	*46*	*80*	*92*	*51*
Saudi Arabia *(2005)*				*89*	*59*		*55*	
Lebanon *(2006)*	*55*		*53*	*61*			*92*	
Morocco *(2000)*	*62*	*62*	*84*	*60*	*58*	*66*		*62*
Zambia (2002)	46			75	48	88		
Brazil (2003)	48	54	72	68	56	49	65	
Sri Lanka (2004)	86		64	71	39			32
Bangladesh (2002)	49	34	60	69		55		
Ethiopia (2002)	71	25	45	56			55	
Ecuador (2003)	48	59	52	50	42	32	62	53
Thailand (2004)	42		56	49	35		52	34
China (2002)	39	41	54		38			
Pakistan (2002)	31	41	33	47		51		
India (2000)	36		38		37	46		
India (2002)	32	27	35	42	35	44		
Tanzania (2003)				33			31	

Note : * Ranking is from countries with the most expensive labor to the ones with the least expensive one.
Source. Authors' calculations

This relative efficiency of some MENA countries, however, is not sufficient to understand the capacity of these countries in order to promote industrial and export activities. The remuneration of labor is an important factor, which should be in line with productivity. By combining information on Productivity of Labor (*LP*) and the cost of the labor input, the Relative Unit Labor Cost gives an idea of the competitiveness. Table 2 presents some information on the subject. It is worth noticing that the Unit Labor Cost in MENA is one of the highest of our sample of countries. This is particularly true in *Algeria* and *Egypt* – countries where firm-level Productivity of Labor (*LP*) is among the lowest – but also in *Morocco* and to some extent in *Lebanon*. In MENA, the Unit Labor Cost tends to be higher than in the majority of Asian economies (*India*, *China*, *Sri Lanka*, *Bangladesh* and *Thailand*). In *China* and *India,* salaries (around 100 US dollars per month for unskilled workers) are far lower than in *Morocco* (more than the double). In the labor-intensive sectors of *Textile* and *Garments*, the cost of labor is two to two and a half times higher in *Egypt* and *Morocco* than in *India*. This situation is the most important to address, if MENA wants to compete in the world market. If not, MENA will continue to suffer from the faster technological innovation in Asia, where wages remain low.

4.2. Firm-Level Total Factor Productivity

In this section, firm-level Total Factor Productivity (*TFP*) is calculated from a non-parametric relation. Production factors include Labor (*L*) and Capital (*K*). The ame hypotheses and definitions as before apply to input and output variables. The equation is as follows:

$$TFP_{i,j} = \text{Log}(Y_{i,j}) - \alpha \text{ Log } (K_{i,j}) - \beta \text{ Log } (L_{i,j}) \quad (6)$$

With

- $Y_{i,j}$: Value Added
- $L_{i,j}$: Number of Permanent Workers
- $K_{i,j}$: Gross Value of Property, Plant and Equipment
- β: Ratio of Total Wages (*W*) to Total Production Cost (*Y*).
- $\alpha = 1 - \beta$
- i / j: Enterprise and country index, respectively

Table 3 presents the firm-level relative *TFP* by industry under the reasonable assumption that a sector-based technology leads to a more homogeneous production function. As for the Productivity of Labor, results are presented in percentage of the average *TFP* of the most performing country. Conclusions are quite similar to that of Productivity of Labor. A first conclusion concerns the ranking of the most performing countries. As previously stated, *South Africa* and *Brazil* present, in most industries, the most performing firms. These countries are again followed by *Morocco*, where the firms' performances are quite good in most industries. When compared to *Brazil*, *Moroccan* firms show a *TFP* gap of 10% to 30%, depending on the industry we look at. As far as other MENA countries are concerned, the ranking is also quite similar to that of Productivity of Labor (*LP*). As stated previously, *Egypt* and *Lebanon* rank at the bottom of the sample, with a very limited number of enterprises for the latter country, while *Algeria* is in an intermediate position. *TFP* calculations thus confirm the productivity gap assessed through the Productivity of Labor[19].

[19] Interpretation of results is, however, more difficult for some countries. This is the case of *Lebanon*, for which the number of observations is too small (5 for *Textile* and 16 for *Agro-Processing*) to reach a reliable conclusion. The combination of two surveys for *Morocco* and *Egypt* allows more than one hundred observations by branch. *Morocco,* for example, benefits from 500 enterprises in *Garments*. In *Saudi Arabia*, firms present quite good productive performances, although most of the branches suffer also from a relative small number of observations. In *Wood and Furniture*, firm-level *TFP* is one of the highest of the sample. This result confirms the conclusion reached for Productivity of Labor.

Table 3 - Firm-Level Relative Total Factor Productivity

(Country average, in % of country with the most productive firms)

Country*	Textile	Leather	Garment	Agro Processing	Metal & Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
South Africa(2003)	88		**100**	**100**	91	82	**100**	**100**
Brazil (2003)	**100**	**100**	87	**100**	**100**	**100**	91	
***Morocco** (2000)*	*80*	*81*	*79*	*79*	*70*	*90*		*71*
Thailand (2004)	70		90	75	73		78	82
***Morocco** (2004)*	*73*	*64*	*77*	*77*	*70*	*79*		*80*
***Saudi Arabia**(2005)*				*70*	*68*		*81*	
Ecuador (2003)	69	74	76	73	75	72	78	64
El Salvador (2003)	76	70	66	64	61	69		76
Philippines (2003)	64		77	65				
***Algeria** (2002)*	*65*			*44*	*59*	*66*		*76*
Honduras (2003)	61		72	55	57	84	50	54
Guatemala (2003)	65		67	54	62	56	54	73
India (2000)	67		63		58	58		
China (2002)	59	58	56		45			
Zambia (2002)	58			52	55	52		
Pakistan (2002)	55	58	56	54		48		
India (2002)	59	61	49	54	51	50		
Tanzania (2003)				55			53	
Sri Lanka (2004)	41		51	61	51			56
Bangladesh (2002)	51	46	57	50		44		
Nicaragua (2003)	49	51	45	47	42	50	44	52
Ethiopia (2002)	51	34	46	49			36	
***Lebanon** (2006)*	*35*		*39*	*40*			*37*	
***Egypt** (2004)*	*41*	*36*	*35*	*39*	*34*	*33*	*36*	*43*
***Egypt** (2006)*	*37*	*30*	*33*	*41*	*34*	*34*	*31*	*38*

Note: * Ranking is from countries with the most productive firms to the ones with the least productive firms.

Source: Authors' calculations

4.3. Firm-Level Technical Efficiency

Firm-level Technical Efficiency is based on the likelihood estimation procedure. As seen in section 2.2., this method allows the splitting of the error term into two independent factors: the error term *(v),* which follows a normal distribution, and the technical efficiency *(u*), which obeys a truncated normal distribution. The technology of production explains the Value Added (*Y*) by the Capital (*K*) and the Labor (*L*). The same hypotheses and definitions as before apply to input and output variables. The equation is as follows:

$$\text{Log}(Y_{\text{i, j}}) = \alpha \text{ Log } (K_{\text{i, j}}) + \beta \text{ Log } (L_{\text{i, j}}) + dum_{\text{i,}} - u_{\text{i, j}} + v_{\text{ i, j}} \qquad (7)$$

With:

- $Y_{i, j}$: Value Added
- $L_{i, j}$: Number of Permanent Workers
- $K_{i, j}$: Gross Value of Property, Plant and Equipment
- dum_j: Country-dummy variables
- *α, β:* parameters of the equation
- $v_{i, j}$: Error term
- $u_{i, j}$: Technical Efficiency (*TE*).
- i / j: Enterprise and country index respectively.

Production frontiers have been estimated, one for each industry. This makes it easier to attribute the residual to differences in efficiency. Differences in coefficients of capital and labor have justified this choice; against an alternative assumption consisting of estimating the same production frontier for all sectors, with specific sector-based dummies.

Table 4 - Estimations of Stochastic Production Frontiers

Independent Variables	*Dependant Variable: Value Added*							
	Textile	**Garment**	**Leather**	**Agro Processing**	**Metal & Machinery Products**	**Chemic & Pharm Products**	**Non Metal & Plastic Materials**	**Wood & Furniture**
Log (labor)	0.659 (30.53)***	0.811 (42.69)***	0.826 (20.20)***	0.695 (31.22)***	0.877 (33.21)***	0.673 (22.21)***	0.886 (22.35)***	0.941 (29.18)***
Log (capital)	0.354 (24.87)***	0.260 (20.96)***	0.277 (11.00)***	0.404 (28.62)***	0.289 (18.52)***	0.444 (22.89)***	0.281 (13.54)***	0.228 (12.79)***
Intercept	2.007 (18.94)***	1.350 (9.22)***	1.419 (9.81)***	1.863 (13.99)***	1.716 (15.61)***	2.065 (15.39)***	1.419 (9.73)***	1.644 (11.51)***
$\sigma^2 u$	0.33	0.22	0.80	0.73	1.12	0.39	1.30	0.79
σ^2	0.99	0.92	1.40	1.47	1.76	1.13	1.86	1.19
$\sigma^2 u / \sigma^2$	0.33*** (6.17)	0.24*** (3.00)	0.57*** (6.33)	0.50*** (8.17)	0.64*** (12.80)	0.35*** (5.00)	0.70*** (10.00)	0.66*** (13.20)
Observations	2011	2800	634	2190	1622	1274	907	1033

Note: * Significance level 10 %; ** 5 %; *** 1 %. Z statistics are into brackets. Regressions include country-dummy variables. *Source*: Authors' calculations

Table 4 presents the estimation results. In most industries, the sum of the coefficients relative to labor and capital inputs is close to one. It is a little bit higher for some sectors than can be suspected to face investment indivisibilities. For all industries, the coefficients are statistically significant at a 99% level of confidence. Table 4 also specifies the percentage of the residual explained by the Technical Efficiency (*TE*). In all industries, the efficiency term accounts for a significant part of the total residuals and is statistically significant at 99%. This result justifies the production frontier model, against the production function approach. In this model, *TE* explains from 24% of the error term in *Garment* to 70% in *Non Metallic & Plastic Materials*.

Table 5 - Firm-Level Technical Efficiency

(Country average, in % of country with the most productive firms)

Country*	Textile	Leather	Garment	Agro Processing	Metal& Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
South-Africa 2003	85		**100**	**100**	**100**	89	**100**	**100**
Brazil 2003	**100**	**100**	87	80	98	**100**	62	
***Morocco** 2004*	*58*	*70*	*81*	*70*	**100**	*72*		*92*
***Saudi-Arabia** 2005*				*72*	*76*		*81*	
***Morocco** 2000*	67	76	80	71	68	83		70
Thailand 2004	64		93	67	65		47	66
Ecuador 2003	57	86	61	61	63	60	57	63
El Salvador 2003	40	62	65	58	55	63		66
Guatemala 2003	51		77	45	57	45	48	67
Honduras 2003	58		66	42	48	60	37	48
India 2000	47		66		45	34		
India 2002	42	56	66	41	46	32		
Pakistan 2002	43	49	61	40		31		
China 2002	46	45	51		35			
Philippines 2003	36		53	39				
***Algeria** 2002*	*33*			*35*	*39*	*38*		*54*
Nicaragua 2003	22	55	41	34	38	30	31	49
Tanzania 2003				43			32	
Zambia 2002	29			30	41	21		
Sri Lanka 2004	17		37	26	33			39
Bangladesh 2002	24	41	32	28		19		
Ethiopia 2002	20	30	36	22			23	
***Egypt** 2004*	*21*	*30*	*21*	*17*	*22*	*17*	*19*	*32*
***Egypt** 2006*	*17*	*15*	*22*	*22*	*25*	*14*	*19*	*24*
***Lebanon** 2006*	*21*		*23*	*16*			*13*	

Note : * Ranking is from countries with the most productive firms to the ones with the least productive firms.

Source. Authors' calculations

TEs are distributed in an interval of 0 to 1 (1 is the value of the sector's most efficient firms). In Table 5, *TEs* are in percent of the average *TE* of the most performing country. On average, our results for Technical Efficiency (*TE*) are close to the ones obtained for the non-parametric *TFP* under the hypotheses of constant returns to scale. The ranking of countries, in particular, remains unchanged. Only in *Garment* and *Leather*, are *Moroccan's* firms surpassed by *Thailand* and *Ecuador,* respectively. The ranking of MENA countries also remains unchanged.

Annex 3 displays, by industry, the Spearman coefficients of correlation of our three measures of firm-level productivity. All coefficients are highly significant and show a high degree of correlation between the different measures. This is the case in all industries, but more specifically in *Wood & Furniture, Non Metallic & Plastic Materials,* and *Metal & Machinery Products* (after *Agro-Processing, Chemicals & Pharmaceutical Products, Leather,* and *Textile).* Beyond the proximity of the results, no matter the method we use, to what extent can we impute the variance of the *TEs* to some factors proceeding of the investment climate?

5. Assessing the Investment Climate of the Manufacturing Industries

The World Bank Investment Climate (*ICA*) surveys provide information on a large number of investment climate (*IC*) variables -- in addition to general information on the firms' status, productivity, sales and supplies. These *IC* variables are classified into 6 broad categories: (***a***) *Infrastructures and Services*, (***b***) *Finance*, (***c***) *Business-Government Relations*, (***d***) *Conflict Resolution/Legal Environment*, (***e***) *Crime*, (***f***) *Capacity, Innovation, Learning*, (***g***) *Labor Relations*.

In the surveys, there are multiple indicators that cover a similar theme. Within the same theme, the correlation between indicators is quite high. One solution applied in some studies has been to restrict the analysis to a limited number of indicators and accept the potential omitted variable bias. This option also poses the question whether the *IC* variables used provide a representative description of the investment climate and whether the strength of the results are due to the particular selection of variables. Another solution to overcome these problems consists of generating a few composite indicators. Because we intend to determine which investment climate variables are more detrimental to firm performances, we tried to take into consideration an as large as possible set of *IC* variables, which are not typically used in the literature. Since these variables are likely to be correlated, we applied Principal Component Analysis (*PCA*) to produce a limited number of composite indicators[20].

Based on the *ICA* surveys, we defined the investment climate by four broad categories: Quality of Infrastructure (*Infra*) and Business-Government Relations (*Gov*), what some

[20] See Manly (1994); Mardia, Ken and Bibby, (1997); Nagaraj and *al*. (2000); Mitra and *al*. (2002); Nabli and Véganzonès-Varoudakis (2007); Aysan and *al*. (2007a) and (2007b).

authors characterize by using hard and soft infrastructure concepts, respectively, but also Human Capacity (*Human*), and Financing Constraints (*Finance*). As seen in section 3, our choice of indicators has been restricted by several data limitations. This is also why we have not been able to cover all aspects initially developed in the surveys. Indicators have been selected on the bases of being available for as many countries as possible, as well as on capturing the different key dimensions of the investment climate. Besides, we have tried to complete, as much as possible, the qualitative (perception-based) *IC* indicators by quantitative information, in order to get a better picture of the investment climate in each industry.

The Quality of Infrastructure indicator (*Infra*) has been defined by five variables: Obstacle for the operation of the enterprise[21] caused by deficiencies in (***a***) Telecommunications, (***b***) Electricity, and (***c***) Transport; (***d***) The presence of a firm Generator, (***e***) and the percentage of electricity coming from that source; (***f***) the possibility for enterprise to access the Internet. Infrastructure deficiencies constitute an important constraint to private sector development in developing countries (see World Bank, 1994). In the literature, deficiency in infrastructure is seen as a burden for the enterprise's operations and investments. Infrastructures are considered, as well, as a complementary factor to other production inputs. In particular, infrastructure stimulates private productivity by raising the profitability of investment[22]. Furthermore, infrastructure also increases the firms' productive performances by generating externalities across firms, industries and regions[23].

The Business-Government Relations indicator (*Gov*) includes three to six variables (depending on the industries): Obstacle for the operation of the enterprise caused by (***a***) Tax Rate, (***b***) Tax Administration, (***c***) Customs and Trade Regulations, (***d***) Labor Regulation, (***e***) Business Licensing and Operating Permits, and (***f***) Corruption. We suppose that this indicator illustrates the capacity of the government to provide an investment-friendly environment and reliable conditions to the private sector. Corruption is seen as having an adverse effect on the firms' productive performances. This fact is well documented and often described as one of the major constraints facing enterprises in the developing world (see the World Bank, 2005). Corruption increases costs, as well as uncertainties about the timing and effects of the application of government regulations (see Tanzi and Davooli, 1997). Taxation and regulations also have a first order implication on the firms' costs and productivity. Although government regulations and taxation are reasonable and warranted in order to protect the general public and to generate revenues to finance the delivery of public services and infrastructures, over-regulation and over-taxation deter productive performances by raising business start-up and the firms' operating costs.

The Human Capacity indicator (*Human*) is represented by three to four variables: Obstacle for the operation of the enterprise caused by deficient (***a***) Skill and Education of

[21] Obstacles' value goes from *none* (0) to *very severe* (4).
[22] See Aschauer (1989), Argimon et al., (1997), Barro (1990), Blejer and Kahn (1984), Murphy, Shleifer, and Vishny (1989).
[23] For spatial externalities, see Holtz-Eakin and Schwartz (1995).

Available Workers; (***b***) Education level[24] and (***c***) Years of Experience of the Top Manager; (***d***) Training of the Firms' Employees. Human capital constitutes an essential factor of the firms' productive performance, stimulating capital formation by raising the firms' profitability. Human capital is also at the origin of positive externalities[25]. Because skilled workers are better in dealing with changes, a skilled work force is essential for firms to manage new technologies that require a more efficient organizational know-how (see Acemoglu and Shimer, 1999). New technologies generally involve significant organizational changes, which are better handled by a skilled workforce (see Bresnahan, Brynjolfsson and Hitt, 2002). Human capital also gives the opportunity to the enterprises to expand or enter new markets.

The Financing Constraints indicator (*Finance*) consists of three variables: Obstacle for the operation of the enterprise caused by: (***a***) Cost, and (***b***) Access to Financing; (***c***) Access to an Overdraft Facility or a Line of Credit. Access to (and cost of) financing represent major determinant(s) of the firms' productive performance. Access to financing allows firms to finance more investment projects, which leads to an increased productivity through higher capitalistic intensity and technical progress embodied in the new equipments. Besides, financial development has a positive effect on productivity as a result of better selection of investment projects and higher technological specialization through diversification of risk. A developed financial system creates more profitable investment opportunities by mobilizing and allocating resources to the most profitable projects (see Levine, 1997).

All four aggregated indicators have been generated at the branch level, thus defining in each country the specific investment climate of each industry. This has implied to produce 32 aggregated indicators (four indicators for each of the eight industries) by applying the Principal Component Analysis (*PCA*) methodology to the initial indicators[26]. The analysis usually treats the investment climate indicators as exogenous determinants of the firms' performance. As seen in section 3, however, this is not always the case. In order to address this issue, we have measured investment climate variables as city-sector averages of firm-level observations. This has helped, as well, to increase the number of observations, by integrating in the sample, firms for which information is insufficient. This has been done for "Infrastructure" and "Business-Government Relations". However, for "Human Capacity" and "Financing Constraints", the initial indicators have been

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[24] Education level goes from primary to post graduate

[25] See Lucas (1988), Psacharopoulos (1988), and Mankiw, Romer and Weil (1992).

[26] The principal components of the initial variables were extracted for each aggregated indicators. The four composite indicators were then constructed as the weighted sum of two or three principal components, depending of the explanatory power of each component. We chose the most significant principal components whose eighenvalues were higher than one. In this case, we explain around 70 percent of the variance of the underlying individual indicators. The weight attributed to each principal component corresponds to its relative contribution to the variance of the initial indicators (calculated from the cumulative R^2). The contribution of each individual indicator to the composite indicator can then be computed as a linear combination of the weights associated with the two or three principal components and of the loadings of the individual indicators on each principal component. For more details on the aggregation method using Principal Component Analysis (*PCA*) see Nagaraj et *al*. (2000), and Mitra et *al*. (2002).

interpreted as specific to each firm and the information has been kept at the firm level (except for the variable "Skill and Education of Available Workers").

All initial *IC* indicators are presented in *Annex 4*, along with some data on firm characteristics. The figures highlight clearly, on average, MENA deficient investment climate. This is true for all dimensions of Financing Constraints, as well as of most dimensions of Human Capacity and Government-Business relation. The MENA deficient financial system, as well as firm difficulties (SMEs in particular) in gaining credit, are important aspects often emphasized in the literature, at the same time as the limitations of various dimensions of the business environment and the lack of training and expertise of the labor force[27]. As far as the quality of infrastructures, different evaluations point to MENA limitations in this domain. Our results, while a bit different, may be due to the limited number of MENA countries incorporated in the sample.

6. Investment Climate and Firm-Level Productivity: Is there a Link?

In global economy, where technology diffuses rapidly and capital is mobile, the persistence of disparities in levels of productivity can be explained by differences in the investment climate. What determinants of productivity cause producers in one country to be more efficient than those in competing countries? Where should reform efforts be targeted to have the greatest impact on productivity? We link the investment climate to firm productive performance and identify the dimensions that account for cross-country differences in productivity. In this section, we estimate two variants of the same model. We show that our results are unambiguous and robust to the different specifications. All coefficients have been estimated by using the *one step procedure*, as discussed before. In other words, we simultaneously identify the production frontiers and the factors contributing to the firms' Technical Efficiency (*TE*).

6.1. Common Model with Individual Indicators of Investment Climate

Our empirical model considers the same representation for all industries. This model is estimated at the branch level, thus allowing the coefficients to vary across branches. We explain the Technical Efficiencies (*TE*) by regressing the logarithm of the production factors (capital and labor), as well as various plant characteristics and investment climate variables, on the logarithm of the firms' value added. At this first stage of investigation, we use initial *IC* variables before aggregation. The model is as follows:

[27] See in particular the World Bank Investment Climate Assessments (*ICA*) of *Egypt* (2005 and 2006), *Morocco* (2001 and 2005), and *Algeria* (2002). Doing Business 2005-2009 ranks as well MENA particularly low in reforms regarding the labor market, getting credit, enforcing contracts, construction permits, starting a business, closing a business and protection of investors (see the World Bank, 2009). Nabli (2007) also stresses MENA above average licenses, domestic taxation, import duties, regulatory and administrative barriers to firms start up and operations, opaque bidding procedures and official acceptance of uncompetitive practices, unpredictable judicial systems that do not facilitate the restructuring of viable business or the closure of nonviable ones, as well as weaknesses in infrastructure and financial system. With public bank dominating the banking system in many countries and favoring state enterprises, large industrial firms and offshore enterprises, small and medium firms in particular find it difficult to get the startup and operating capital they need.

$$\ln(y_{i,j}) = c_i + \alpha_1 \ln(l_{i,j}) + \alpha_2 \ln(k_{i,j}) + \beta\, Size_{i,j} + \gamma\, Foreign_{i,j} + \delta\, Export_{i,j}$$

$$+ \varepsilon_1\, RegElect_{i,j} + \varepsilon_2\, RegWeb_{i,j} + \lambda_1\, Cred_{i,j} + \lambda_2\, AccessF_{i,j} + \eta_1\, EduM_{i,j} + \eta_2\, ExpM_{i,j}$$

$$+ \eta_3\, Training_{i,j} + \mu_1\, RegLregul_{i,j} + \mu_2\, RegCorrup_{i,j} + c + v_{i,j}: \qquad (8)$$

With:

$y_{i,j}$	Value Added[28]
$l_{i,j}$:	Number of Permanent Workers
$k_{i,j}$:	Gross Value of Property, Plant and Equipment
$Size_{i,j}$:	Size of the firm
$Foreign_{i,j}$:	Foreign capital *(% of firms' capital*)
$Export_{i,j}$:	Export *(% of firms' sales*)
$RegElect_{i,j}$:	Electricity delivery (*obstacle for the enterprise, regional average*)
$RegWeb_{i,j}$:	Access to Internet services (*regional average*)
$Cred_{i,j}$:	Overdraft facility or credit line
$AccessF_{i,j}$:	Access to financing (*obstacle for the enterprise, regional average*)
$EduM_{i,j}$:	Level of education of the top manager (*number of years*)
$ExpM_{i,j}$:	Experience of the top manager (*number of years*)
$Training_{i,j}$:	Training of workers
$RegLreg_{i,j}$:	Labor regulation (obstacle for the enterprise, regional average)
$RegCorrup_{i,j}$:	Corruption (obstacle for the enterprise, regional average)
$c_{i:}$	Country-Dummy variables
c:	Intercept
$v_{i,j}$:	Error terms
i / j:	Enterprise and country index respectively

The choice of *IC* variables has been based on being available for as many firms/ industries/ countries as possible, as well as on capturing the different key dimensions of the investment climate. Our variables explain the various aspects of the investment climate very clearly and cover properly our four definitions of investment climate. To address the problem linked to the endogeneity of the *IC* variables when estimating the *TE* frontier models, we have considered the city/region averages of Electricity Delivery (*RegElect*), Access to the Internet (*RegWeb*), Labor Regulation (*RegLreg*), and Corruption (*RegCorrup*). The number of explanatory variables, however, has been limited by the multicollinearity between several *IC* variables when estimating the *TE* frontier models.

Other individual variables consist of the percentage of sales exported by the firms (*Export*), the percentage of foreign ownership in firms' capital ($Foreign_{i,j}$), and the firm size ($Size_{ij}$). The level of exports (*Export*) is included in the regressions because exporting is a learning process, which enables companies to improve productivity by learning from customers and by facing international competition. Likewise, foreign ownership

[28] We will recall that the Value Added is calculated as the difference between "Total Sales" and "Total Purchase of Raw Material" (excluding fuel).

($Foreign_{i,j}$) may increase productivity if foreign investors bring new technologies and management techniques. As for the size ($Size_{ij}$), we intend to test the hypotheses of scales economies and increasing returns to scale in large enterprises[29]. It is worth noting that the expected sign for these variables is negative, due to the fact that the one step procedure explains firm-level inefficiency. The same precautions must be taken when interpreting the sign of the coefficients of the other variables. Country-dummy variables have also been introduced when estimating the production frontiers. These dummies pick up the effect of country specific factors, such as endowment in natural resources, national-level institutions, macro or political instability, trade policy, etc. Country-dummy variables are intentionally not included in the second part of the equation, when explaining (*TEs*), since they could reduce the impact of some *IC* variables.

The equation (*8*) has been estimated on unbalanced panels, going from 380 observations (in *Leather*) to 1601 observations (in *Garment*), depending on the industry. A Cobb-Douglass production function has been chosen to estimate the production frontiers. We have also maintained our previous assumption in regards to the specification of the technology, as well as of the *TEs*. Although the sample size modifies when incorporating the regressors explaining the firm distance to the frontier, the coefficients of the technology are marginally (but downwardly) affected. These modifications display the potential impact of the interactions and the limitation that we would face when estimating the *TE* determinants through the two-stage method, as previously discussed[30]. Sector-based estimates are presented in Table 6.

A first set of conclusions concerns the production frontier models. Our regressions confirm the choice to estimate a production frontier by industry. Elasticities of capital and labor reveal to be different from one industry to another. The impact of capital is strong in *Chemicals & Pharmaceutical Products*, *Agro-Processing* and, to a lesser extent, *Textile*. On the opposite side, the elasticity of labor is high in *Metal & Machinery, Non Metal & Plastic Materials, Wood & Furniture, Leather,* and *Garment*. These industries appear to be more intensive in labor, although two of them (*Metal & Machinery* and *Non Metal & Plastic Materials*) are usually considered as applying more capitalistic technologies in developed countries. This result is confirmed by the computation of the ratio of the two elasticities (capital/ labor). All coefficients are highly significant (at 1% level), which stresses the robustness of our results. Another result shows that we are close to the constant returns to scales, legitimating the hypothesis underlying the non-parametric *TFP* measures (see section 2.1). Our estimations also highlight that some differences in production frontiers can be explained by country specific conditions. This

[29] The new literature on international trade associates firms' size with increasing returns to scale, market imperfections and product heterogeneity linked to technological innovation. The literature on corporate governance, as well, describes the difficulties in inciting and controlling big enterprises, although they are more able to reduce transaction costs and facilitate economic calculations. Small enterprises are described as less capitalistic and more flexible in a volatile environment, in particular in economies characterized by rigidities which encourage the development of the informal economy.

[30] For two sectors: *Chemicals & Pharmaceutical Products*; and *Wood & Furniture,* coefficients of capital and labor are slightly smaller than in previous estimation (see table 5).

hypothesis is supported by the data, as country-dummies are significant at this stage of estimations.

Table 6 - Estimation Results: Common Model with Individual *IC* Variables

(Dependant Variable: Value Added)

Independent Variables	Textile	Leather	Garment	Agro Industry	Metal& Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
ln(l)	0.657 *(16.14)****	0.789 *(28.82)****	0.735 *(7.12)****	0.560 *(13.32)****	0.871 *(21.75)****	0.540 *(11.09)****	0.883 *(18.78)****	0.860 *(10.18)****
ln(k)	0.321 *(14.61)****	0.255 *(14.93)****	0.242 *(7.18)****	0.395 *(24.64)****	0.268 *(13.21)****	0.444 *(20.01)****	0.235 *(11.28)****	0.249 *(8.81)****
Intercept	0.720 *(1.55)*	1.597 *(4.21)****	1.993 *(2.25)***	3.780 *(5.79)****	1.654 *(4.88)****	2.985 *(6.08)****	0.157 *(0.55)*	1.251 *(2.22)***
Size	0.018 *(0.11)*	-0.105 *(0.21)*	-0.092 *(0.48)*	-0.195 *(2.57)***	0.600 *(0.96)*	-0.193 *(1.92)**	-0.316 *(1.29)*	0.014 *(0.07)*
Foreign	-0.242 *(0.53)*	-0.384 *(0.43)*	-0.011 *(1.30)*	-0.005 *(3.36)****	-0.397 *(1.16)*	-0.005 *(1.88)**	-0.000 *(0.01)*	-0.007 *(1.07)*
Export	-0.006 *(1.06)*	-0.183 *(1.43)*	-0.007 *(2.87)****	-0.001 *(1.06)*	-0.107 *(0.97)*	-0.005 *(1.64)*	-0.019 *(1.22)*	-0.009 *(1.32)*
RegElect	0.077 *(0.54)*	0.323 *(0.60)*	0.228 *(1.94)**	0.042 *(0.83)*	1.006 *(1.92)**	0.053 *(0.86)*	-0.025 *(0.16)*	0.068 *(0.60)*
RegWeb	-2.641 *(2.43)***	2.138 *(1.26)*	0.329 *(0.94)*	-0.426 *(2.07)***	0.768 *(0.50)*	-0.757 *(3.39)****	-1.542 *(1.77)**	-0.847 *(1.57)*
Cred	-1.011 *(2.08)***	-2.421 *(2.42)***	-0.403 *(2.74)****	-0.144 *(2.38)***	-1.842 *(2.07)***	-0.085 *(1.02)*	-0.304 *(1.25)*	-0.554 *(2.26)***
AccessF	0.006 (0.11)	0.118 (0.65)	0.059 (1.41)	0.044 (2.34)**	-0.022 (0.11)	0.068 (2.43)**	0.126 (1.74)*	-0.051 (1.22)
Training	-0.135 *(0.43)*	0.234 *(0.33)*	-0.142 *(0.93)*	-0.217 *(3.23)****	0.428 *(0.56)*	-0.123 *(1.22)*	-0.400 *(1.34)*	-0.103 *(0.59)*
EduM	-0.148 (2.02)**	-0.282 (1.53)	-0.076 (2.08)**	-0.064 (3.03)***	-0.673 (2.61)***	-0.073 (1.96)*	-0.096 (1.46)	-0.158 (2.84)***
ExpM	-0.037 *(2.26)***	0.045 *(1.50)*	-0.000 *(0.05)*	-0.003 *(0.90)*	0.014 *(0.48)*	-0.002 *(0.38)*	-0.006 *(0.56)*	-0.000 *(0.04)*
RegLregul	0.024 *(0.13)*	-0.827 *(1.52)*	-0.069 *(0.50)*	0.007 *(0.10)*	0.362 *(0.70)*	0.020 *(0.20)*	-0.112 *(0.53)*	-0.006 *(0.05)*
RegCorrup	0.081 *(0.51)*	0.074 *(0.17)*	0.168 *(1.53)*	-0.054 *(0.96)*	-0.272 *(0.59)*	-0.008 *(0.11)*	0.073 *(0.52)*	0.124 *(1.40)*
Constant	1.460 *(2.87)****	-2.422 *(1.25)*	1.493 *(2.00)***	3.388 *(5.45)****	-2.612 *(1.34)*	2.358 *(4.94)****	1.279 *(1.91)**	1.568 *(2.66)****
Observations	942	380	1601	1494	838	695	774	480
sigma_u	0.75	1.69	0.77	0.90	1.46	0.75	1.10	0.64
sigma_v	0.86	0.81	0.54	0.43	0.76	0.46	0.57	0.67
Wald chi2	1351.45	2787.67	241.01	1306.40	2484.52	1060.30	1321.23	300.67
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The one step procedure explains firm-level inefficiency. Variables *Size*, *Foreign* and *Export* are expected with a negative coefficient. All regressions contain country-dummy variables when estimating the production technology. * Significance level 10%; ** 5%; *** 1%. Absolute value of z statistics are in parentheses.

Source. Authors' estimations.

What is more interesting is that our estimations verify that differences in the investment climate participate in the firms' *TEs* discrepancies. This is true for all aspects of the investment climate, except for the Government-Business Relations. Our results confirm that a good quality of infrastructure (proxied by the quality of the electric network and the availability of Internet access), a satisfactory access to financing, as well as the availability of expertise at the firm level (such as education level and experience of the manager, and training of the employees) are important factors for the enterprise's productive performances. This outcome, which is consistent with the theory, makes a real contribution to the empirical literature by validating, for a large sample of industrial firms in developing countries, the role of a substantial set of *IC* variables on the firms' productive performances.

This finding appears, however, quite different from one industry to another. First, as expected, it looks like estimations have suffered from the collinearity of several *IC* variables. In fact, although each broad category of *IC* variables (except Government-Business Relation) ends up being significant in almost all industries, it is very rare to find two significant *IC* variables in the same category[31]. The impact of *IC* variables can also vary. Access to credit seems more detrimental in *Leather, Metal & Machinery Products* and *Textile*) and access to the Internet looks more critical in *Textile* and *Wood & Furniture*. As for Human Capacity, the education of the top manager should be more of a high priority in *Metal & Machinery Products*, *Textile* and *Non Metal & Plastic Materials.* In an interesting turn, *Textile* and *Metal & Machinery Products* look more sensitive to *IC* deficiencies. Besides, the firms' performances depend on more dimensions of the *IC* in these two sectors. This finding may be explained by the fact that these industries are more exposed to international competition and need a supportive investment climate to be able to compete efficiently.

As for Business-Government Relations, neither labor regulations (*RegLreg*), nor corruption (*RegCorrup*) emerge as an obstacle to the firms' productive performance, although this outcome has to be considered with caution because of the probable high correlation between explanatory variables. Difficulties have also occurred in validating the impact of other individual variables. The firms' size (*Size*) and foreign ownership of capital (*Foreign*) justify scales economies and externalities linked to participation of foreign capital in just two sectors (*Agro-Processing,* and *Chemical & Pharmaceutical Products*). Export orientation (*Export*) appears as a determinant of productivity in only one sector: *Garment*. This result corresponds, however, to what we know about this

[31] For Infrastructure, the quality of the electrical network (*RegElect*) appears to increase firms' performances in *Garment* and *Metal & Machinery Products*. It is, however, the access to internet (*RegWeb*) which emerges as a factor of productivity in more industries (*Textile*, *Agro-Processing, Chemical & Pharmaceutical Products* and *Wood & Furniture).* As far as Human Capacity is concerned, level of education of top manager (*EduM*) is significant in almost all sectors (except *Leather* and *Wood & Furniture)*, meanwhile number of years of expertise of manager (*ExpM*) and training of employees (*Training*) seem to play a role in only one sector each (*Textile* and *Agro-Processing* respectively). Same conclusions can be drawn for Financing Constraints, where access to credit line or overdraft facility (*Cred*) appear to generally stimulate productivity gains (except in *Chemical & Pharmaceutical Products* and *Wood & Furniture*), though the qualitative variable of access to financing (*AccessF*) is significant in only three sectors (*Agro-Processing, Chemical & Pharmaceutical Products,* and *Wood & Furniture*).

sector, where external competitive markets and flexible partnership with foreign companies stimulate sources for a high productivity level. Identically, regression results are poor in two sectors: *Leather* and *Wood & Furniture*[32]. All these difficulties, when individual factors are considered, explain why we focus our analysis on a few composite indicators of investment climate. These indicators are tested econometrically in the next section.

6.2. Common Model with Composite Indicators of Investment Climate

In this specification, the *IC* individual variables have been replaced by our four composite indicators: Quality of Infrastructure (*Infra*), Business-Government Relations (*Gov*), Human Capacity (*Human*), and Financing Constraints (*Finance*). This model allows the introduction of many more *IC* variables than before[33]. Like in the first empirical model, we have considered the same representation for all industries. The model is still estimated at the branch level and explains the logarithm of the firms' value added and *TEs* by using the *one step* procedure. Other control variables are unchanged. The model is as follows:

$$\ln(y_{i,j}) = c_i + \acute{\alpha}_1 \ln(l_{i,j}) + \acute{\alpha}_2 \ln(k_{i,j}) + \beta\, Size_{i,j} + \gamma\ Foreign_{i,j} + \delta\, Export_{i,j}$$

$$+ \varepsilon_1\, RegInfra_{i,j} + \varepsilon_2\ {}_{,}RegGov_{i\,j} + \varepsilon_3\ Human_{i,j} + \varepsilon_4\ Finance_{i,j} + c + v_{i,j}: \qquad (10)$$

Results of estimation by the industry are given in Table 7. Estimation results reinforce our previous findings. Production frontiers are robust to the introduction of different *IC* variables, with few changes in returns to scales or in the elasticities of production factors across industries. The countries' specific conditions are also validated by the data. One of the most interesting outcomes, nevertheless, concerns the investment climate, which four dimensions are now significant with the expected sign[34]. Besides, our model validates the impact of a much more substantial number of *IC* variables incorporated in the aggregated indicators. This result is the most important for the MENA countries, where improvement of different dimensions of the investment climate could contribute to the firms' efficiency and regional improvement with more efficient and competitive economies.

The findings by the industry also bring quite interesting comments. Human capital (*Human*), Infrastructure (*Infra*), and Financing Constraints (*Finance*) appear to be the most statistically significant investment climate factors for firm-level productivity. All

[32] In these industries, a few factors seem to explain efficiency (only access to credit line (*Cred*) in the case of *Leather* and, internet access (*RegWeb*) and access to financing (*AccessF*) in the case of *Wood & Furniture*). On the opposite, *Agro-Processing, Chemical & Pharmaceutical Products, Garment,* and *Textile* display a broader set of factors explaining firms' productivity gains.

[33] Six instead of two for Infrastructures (*Infra*), and Business-Government Relations(*Gov*), four instead of three for Human Capacity(*Human*), three instead of two for Financing Constraints (*Finance*)..

[34] As we actually explain firm-level inefficiency, a positive coefficient is expected for three out of our four indicators. This is the case of *RegInfra*, *RegGov* and *Fin*, which are interpreted as obstacle for the operation of the firms. On the opposite, *H* being constituted of variables which are supposed to improve Technical Efficiency, a negative coefficient is expected for this variable (see section 5 for the definition of the axes of the composite indicators).

three broad indicators explain productivity discrepancies quite well in most industries while Business-Government Relations (*Gov*) constitutes a less constant dimension. Our empirical analysis also reveals that some industries, *Textile* (for *Human*, *Infra* and *Finance*), *Metal & Machinery Products* (for *Human* and *Gov*) and *Wood & Furniture* (for *Human* and *Finance*), appear more sensitive and vulnerable than others in front of a deficit of their investment climate (the estimated coefficients of the *IC* variables are higher for these industries). This comment may be extended to *Non Metal & Plastic Materials* and *Garment* for, respectively, Human Capacity (*Human*) and Government-Business Relation (*Gov*). These findings confirm, in a different way, some conclusions of the previous model. As mentioned before, this result may be due to the fact that most of these industries face international competition. This fragility justifies that a particular attention be paid when making decisions that may affect investment climate in these sectors. This also means that the pay off of an improvement of the investment climate would be more substantial in these industries, which could play a leading role for industrial progress and export development.

Table 7 - Estimation Results: Common Model with Aggregated *IC* Variables

(Dependant Variable: Value Added)

Independent Variables	Textile	Leather	Garment	Agro Industry	Metal & Machinery Products	Chemic &Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
ln(l)	0.637 *(16.01)****	0.778 *(27.90)****	0.879 *(15.19)****	0.551 *(12.54)****	0.885 *(25.26)****	0.578 *(11.84)****	0.836 *(17.87)****	0.923 *(15.50)****
ln(k)	0.337 *(15.06)****	0.252 *(16.57)****	0.196 *(7.40)****	0.397 *(24.54)****	0.258 *(13.11)****	0.447 *(20.05)****	0.248 *(11.91)****	0.254 *(9.31)****
Intercept	1.081 *(2.01)***	2.149 *(5.93)****	1.326 *(4.62)****	4.302 *(5.77)****	1.883 *(5.90)****	2.868 *(4.26)****	1.738 *(4.54)****	1.223 *(2.78)****
Size	-0.809 *(1.54)*	-0.333 *(1.77)**	-0.037 *(0.33)*	-0.212 *(2.75)****	-0.159 *(0.22)*	-0.198 *(1.99)***	-0.490 *(2.22)***	0.273 *(1.10)*
Foreign	-0.426 *(0.90)*	-0.006 *(0.76)*	-0.014 *(0.50)*	-0.005 *(3.48)****	-0.541 *(1.05)*	-0.006 *(1.72)**	0.004 *(0.54)*	-0.019 *(1.28)*
Export	-0.016 *(0.81)*	-0.020 *(1.95)**	-0.078 *(1.81)**	-0.001 *(1.14)*	-0.114 *(1.04)*	-0.008 *(1.49)*	-0.017 *(1.53)*	-0.186 *(1.08)*
RegInfra	0.762 *(2.52)***	-0.079 *(0.66)*	-0.057 *(0.95)*	0.014 *(0.27)*	0.833 *(1.83)**	0.204 *(2.35)***	0.262 *(1.71)**	0.318 *(2.32)***
Human cap	-0.716 *(1.76)**	-0.138 *(0.79)*	-0.116 *(1.08)*	-0.253 *(5.03)****	-1.174 *(1.52)*	-0.147 *(1.71)**	-0.488 *(2.33)***	-0.768 *(2.24)***
RegGov	-0.259 *(1.21)*	-0.072 *(0.72)*	0.185 *(2.48)***	-0.047 *(1.48)*	0.706 *(1.70)**	-0.068 *(1.39)*	-0.060 *(0.54)*	0.136 *(0.86)*
Finance	0.778 *(2.40)***	0.219 *(1.68)**	0.035 *(0.50)*	0.124 *(3.86)****	0.257 *(0.54)*	0.148 *(2.67)****	0.330 *(2.36)***	-0.208 *(1.26)*
Constant	-0.961 *(0.95)*	0.162 *(0.19)*	0.506 *(1.84)**	3.243 *(4.82)****	-6.121 *(2.83)****	1.508 *(2.32)***	0.703 *(1.04)*	-0.522 *(0.71)*
Obs	929	433	1555	1481	826	741	750	461
sigma_u	1.31	1.11	0.25	0.91	1.98	0.70	1.10	0.56
sigma_v	0.86	0.60	0.73	0.37	0.65	0.56	0.53	0.75
Wald chi2	1579.56	2375.90	925.66	1343.79	3117.04	1010.55	1490.81	893.91
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The one step procedure explains firm-level inefficiency. The expected sign of the *IC* aggregated variables is positive for *RegInfra*, *RegGov* and *Fin,* and negative for H (see definition of variables in section 5). Variables *Size*, *Foreign* and *Export* are also expected with a negative coefficient. All regressions contain country-dummy variables when estimating the production function. * significance level 10%; ** 5%; *** 1%. Absolute value of z statistics are in parentheses.

Source. Authors' estimations

By using our *IC* aggregate indicators, however, we don't always explain productivity better. This is somehow the case of *Metal & Machinery Products* and *Agro-Processing*, but essentially of *Garment* for which very few aspects of the investment climate seem to help firms to perform better[35]. No improvement is seen, either, in *Leather*, which is again poorly explained by the model. This fact is, however, largely compensated by the tremendous gain of information through the large set of *IC* variables now explaining firm-level productive performances, as well as by the validation of another variable of interest: the Government-Business Relation (Gov)[36].

Another addition of the model consists in validating the role of more plant characteristics in explaining firm-level Technical Efficiency. This is true for the variable *Size*, which justify scale economies in four industries instead of two previously: *Wood and Furniture, Leather* in addition to *Agro-Processing* and *Chemicals and Pharmaceutical Products*. This constitutes an interesting result that could justify a concentration of small enterprises. Concentration could be seen as a powerful means of boosting efficiency and competitiveness of the industrial sector, thus contributing to industrial development and economic growth. This is also true for our MENA economies, which are characterized by a relatively small size of firms (see *Annex* 4). Besides, export orientation (*Export*) explains externalities linked to export activities in *Leather* in addition to *Garment* (with a stronger coefficient for *Garment*), which confirms the exposure to international competition of these two industries. The increase of the export capacity of some industries then appears as another means to stimulate firm-technical efficiency and to promote a diversified economic growth process where industry is subject to play a major role.

7. Conclusions

In this paper, we show that MENA manufacturing enterprises perform poorly on average compared to a broad sample of firms from different countries. This is true for our three measures of the firms' productive performances: Labor Productivity (*LP*), Total Factor Productivity (*TFP*) and Technical Efficiency (*TE*). The exception is *Morocco*, whose various measures of productivity rank close to the ones of the most productive countries. These average low performances have been linked to MENA investment climate deficiencies, which add to the cost born by the firms and handicap MENA industrial efficiency and competitiveness.

To explain MENA disparity in industrial performances, we have focused on the role of four broad measures of investment climate, generated by the *PCA* of a large set of *IC* individual variables. We show that differences in quality of various infrastructures, in experience and level of education of the labor force, in cost and access to financing, as well as, to a lesser extent, in several dimensions of the government-business relation explain, in a significant way, the industrial performances discrepancies. Our results are

[35] Loss of information appears essentially for "Human Capacity" and "Infrastructure" for which one of the initial individual indicators was previously significant.
[36] Besides, this model explains better *Wood & Furniture.*

stronger than those usually found in the literature, because of the large number of countries and industrial branches, as well as indicators of investment climate on which our analysis is based. This supports the idea that deficiencies in the investment climate can be at the origin of a loss of domestic and international competitiveness, as well as of export capacities. Our results show, therefore, that enhancing investment climate constitutes a powerful engine for productivity and competitiveness of the manufacturing industry, as well as for industrial takeoff. These results constitute an important means of an appreciation of the positive impact of an improvement of the investment climate, since MENA suffers from a deficient industrial diversification, as well as an integration into the world markets.

Our study allows, moreover, the identification some industries where Technical Efficiency (*TE*) depends particularly on investment climate limitations. This is the case of *Textile* and *Metal & Machinery Products*, as well as, to a lesser extent, of *Non Metal & Plastic Material and Garment*. An improvement of various dimensions of the investment climate (depending on the sectors) would show a comparatively stronger impact in these industries, which could then play a leading role in the development of an efficient manufacturing sector. Moreover, our results show that, in some industries, the size and, to a lesser extent, the export capacity appears as another means to enhance a higher level of productive efficiency. In fact, with the implementation of a broad economic reform agenda, MENA's export-capacity strengthening could become a priority. Improving manufacturing productivity could thus represent a powerful factor of economic growth, facilitating the long-run convergence process of the MENA region. Targeting reforms on small and medium enterprises, which the importance in MENA is high, as well as on those investment climate variables and industries that most favor productivity and competitiveness, could constitute an important element of MENA strategy of growth and employment.

Actually, like other developing countries, MENA is increasingly concerned about improving competitiveness and productivity, as the region faces the intensifying pressure of globalization. The World Bank firm surveys provide a standard instrument for identifying key obstacles to firm-level performances and prioritize policy reforms. This instrument can be used to boost competitiveness and diversify MENA economies, if the region wants to face the increasing competition of countries such as *China* and *India,* which have successfully diversified their economy and benefit, in addition, from low labor costs.

Annex 1: List of Countries

MENA*	LAC	AFR	SAS	EAP
Algeria (2002)	Brazil (2003)	Ethiopia (2002)	Bangladesh (2002)	China (2002)
Egypt (2004/2006)	Ecuador (2003)	South Africa (2003)	India (2000/2002)	Philippines (2003)
Morocco (2000/2004)	El Salvador (2003)	Tanzania (2003)	Pakistan (2002)	Thailand (2004)
Oman (2003)	Guatemala (2003)	Zambia (2002)	Sri Lanka (2004)	
Lebanon (2006)	Honduras (2003)			
Saudi Arabia(2005)				
Syria (2003)	Nicaragua (2003)			

MENA : Middle East and North Africa; ***LAC:*** Latin America and the Caribbean; ***AFR*** : Sub Sahara Africa; ***SAS:*** South Asia; ***EAS*** : East Asia.

Annex 2: ICA Surveys: Data Limitations

Industries/ (number of firms and %)	**Textile**	**Garment**	**Leather**	**Agro-Processing**	**Metal & Machinery Products**	**Chemical & Pharmac. Products**	**Non Metal & Plastic Materials**	**Wood & Furniture**	**Total**
Total Enterprises	2496	3794	821	2815	2163	1728	1159	1317	16293
MENA Enterprises	761	906	257	655	758	364	487	199	4387
(% total)	*(30%)*	*(24%)*	*(31%)*	*(23%)*	*(35%)*	*(21%)*	*(42%)*	*(15%)*	*(27%)*
Total Frontier	1998	2796	634	2184	1604	1270	897	1031	12414
(% total enterprises)	*(80%)*	*(74%)*	*(77%)*	*(78%)*	*(74%)*	*(73%)*	*(77%)*	*(78%)*	*(76%)*
MENA Frontier	541	711	167	436	538	241	335	120	3073
(% total MENA)	*(69%)*	*(78%)*	*(65%)*	*(67%)*	*(71%)*	*(66%)*	*(69%)*	*(59%)*	*(70%)*
(% total frontier)	*(26%)*	*(25%)*	*(26%)*	*(20%)*	*(34%)*	*(19%)*	*(37%)*	*(11%)*	*(25%)*
Total with *IC* variables	942 *(38%)*	1604 *(42%)*	380 *(46%)*	1525 *(54%)*	841 *(39%)*	738 *(43%)*	478 *(41%)*	778 *(59%)*	5002 *(45%)*
MENA with IC variables	215	371	91	228	258	95	162	63	1483
(% total MENA)	*(28%)*	*(41%)*	*(35%)*	*(35%)*	*(34%)*	*(26%)*	*(33%)*	*(32%)*	*(34%)*
(% total *IC*)	*(23%)*	*(23%)*	*(24%)*	*(15%)*	*(31%)*	*(13%)*	*(34%)*	*(8%)*	*(30%)*

Sources: Authors' calculations.

Annex 3:

Sperman Correlation Coefficient of the Three Measures of Firm-Level Productivity

Textiles Nobs: 1998	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7077*	1	
LP	0.7615*	0.6012*	1

Leather Nobs: 634	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7703*	1	
LP	0.6427*	0.6756*	1

Garment Nobs: 2796	**TE**	**TFP**	**LP**
TE	1		
TFP	0.5571*	1	
LP	0.5675*	0.6370*	1

Agro-Processing Nobs: 2184	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7047*	1	
LP	0.7814*	0.5861*	1

Metals & Machinery Products Nobs: 1604	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7483*	1	
LP	0.7762*	0.6810*	1

Chemicals & Pharmaceutic Products Nobs: 1270	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7349*	1	
LP	0.7542*	0.6270*	1

Wood & Furniture Nobs: 1031	**TE**	**TFP**	**LP**
TE	1		
TFP	0.8456*	1	
LP	0.8885*	0.7532*	1

Non-Metallic & Plastic Materials Nobs: 901	**TE**	**TFP**	**LP**
TE	1		
TFP	0.7394*	1	
LP	0.8028*	0.6293*	1

Note : *: significant at 1%,.
TE : Technical Efficiency, *TFP* : Total Factor Productivity, *LP* : Labor Productivity.
Source : Authors' calculations

Annex 4: Investment Climate and Firm Characteristics

	MENA			NON MENA			Ho: No difference in means
	Mean	Standard Deviation	Number of firms	Mean	Standard Deviation	Number of firms	[p-values]
Size	127.1	266.9	3075	192.4	555.9	9350	0.0
Export (% sales)	16.8	34.1	2987	18.7	35.0	8815	0.0
Foreign ownership (% K)	8.3	25.4	3072	6.2	21.7	9292	0.0
Use of E-mail (% firms)	52.0	50.0	2289	60.5	48.9	8940	0.0
Use of website (% firms)	26.7	44.2	2550	35.6	47.9	8233	0.0
Telecommunication*	4.7	21.2	2493	11.4	31.8	8635	0.0
Electricity*	18.2	38.6	2512	33.2	47.1	8650	0.0
Transport*	7.6	26.5	2332	15.1	35.8	8634	0.0
% firm with generator	22.5	41.8	3040	38.1	48.6	9332	0.0
% elect from generator	4.8	16.6	2999	7.5	18.7	9110	0.0
Overdraft facility (% firms)	42.6	49.5	3069	56.4	49.6	8519	0.0
Financing Access*	51.5	50.0	2032	34.7	47.6	8492	0.0
Financing Cost*	56.9	49.5	2051	42.0	49.4	8477	0.0
Top Manager: Educational. Level	3.9	1.4	2261	4.3	1.5	8083	0.0
Top Manager: Experience in firm (years)	12.5	10.9	2218	8.0	9.0	8260	0.0
% Workers with Formal Training	19.8	39.9	3052	39.8	49.0	9248	0.0
Availability of Skilled Workers*	30.1	45.9	2505	24.0	42.7	8625	0.0
	0.0	0.0		0.0	0.0		
Labor Regulation*	26.9	44.3	2505	21.8	41.3	8430	0.0
Tax Rate*	57.0	49.5	2493	41.8	49.3	8628	0.0
Tax Administration*	38.5	48.7	2486	34.8	47.6	8618	0.0
License/Operating Permits*	20.8	40.6	2486	15.5	36.2	8408	0.0
Customs/Trade Regulations*	18.4	38.7	2448	24.9	43.2	7844	0.0
Corruption*	40.6	49.1	2489	44.6	49.7	8635	0.0
Source: ICA datasets, World Bank							

** Percentage of firms ranking the variable as a major or severe constraint*

Source : Authors' calculations

References

Acemoglu, Daron, and Robert Shimer. 1999. "Efficient Unemployment Insurance." *Journal of Political Economy* 107, no.5: 893-928.

Acemoglu, Daron; Simon Johnson; and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91, no. 5: 1369-1401.

Algeria, 2002, Algeria Investment Climate Assessment, Pilot Investment Climate Assessment, International Finance Corporation. The World Bank, Washington, D.C., June.

Argimon, Isabel; Jose Manuel Gonzales-Paramo; and Jose Manuel Roldan. 1997. "Evidence of Public Spending Crowding-Out from a Panel of OECD Countries." *Applied Economics* 29, no. 8: 1001-1010.

Aschauer, David. 1989. "Is Public Expenditure Productive?". Journal *of Monetary Economics* 23: 177-200.

Aysan, Ahmet; Mustapha Nabli; and Marie-Ange Véganzonès-Varoudakis. 2007a. Governance Institutions and Private Investment: An application to the Middle East and North Africa." *The Developing Economies* 45, no. 3: 339-377.

Aysan, Ahmet; Gaobo Pang; and Marie-Ange Véganzonès-Varoudakis. 2007b. "Uncertainty, Economic Reforms and Private Investment in the Middle East and North Africa." *Applied Economics* (December).

Barro, Robert J. 1990. " Government Spending in a Simple Model of Endogenous Growth". *Journal of Political Economy* 98, no 5, part II, S103-S125, October.

Bastos, Fabiano, and John Nasir. 2004. "Productivity and Investment Climate: What Matters Most?" *World Bank Policy Research Paper* 3335, June.

Blejer, Mario I., and Mohsin S. Kahn. 1984. "Government Policy and Private Investment in Developing Countries". *IMF Staff Papers*, 31. IMF, Washington, D.C..

Bosworth, Barry, and Susan Collins. 2003. *The Empirics of Growth: An Update*. The Brookings Institutions. Washington D.C., processed.

Bresnahan, Timothy; F.Erik Brynjolfsson; and Lorin Hitt. 2002. "Information, Technology, Workplace Organization and the Demand of Skilled Labor: Firm-Level Evidence". *Quarterly Journal of Economics* 117, no. 1: 339-776.

Calderon, Cesar, and Alberto Chong. 2000. "Causality and Feedback between Institutional Measures and Economic Growth". *Economic and Politics* 12, no 1: 69-81.

Coelli Timothy; D.S. Prasada Rao; and George E. Battese. 1998. *An Introduction to Efficiency and Productivity Analysis*. Kluwer Academic Publishers.

Djankov, Simeon; Rafael La Porta; Florencio Lopez-de-Silanes; and Andrei Sheifer. 2002. "The Regulation of Entry". *Quartely Journal of Economics* 117, February.

Dollar, David; Mary Hallward-Driemeier; and Taye Mengistae. 2005. "Investment Climate and Firm Performance in Developing Economies". *Economic Development and Cultural Change* 54, no. 1: 1-21.

Easterly, William, and Ross Levine. 2003. "Tropics, Germs, and Crops: How Endowments Affect Economic Development". *Journal of Monetary Economics* 50 (January): 3-39.

Egypt, 2005. "Egypt: Toward a Better Investment Climate for Growth and Employment Creation, Middle East and North Africa Region, Private Sector, Financial Sector and Infrastructure Group." The World Bank, Washington, D.C.

Egypt, 2006. "Egypt's Investment Climate: A Survey-Based Update, Middle East and North Africa Region, Private Sector, Financial Sector and Infrastructure Group." The World Bank, Washington, D.C., December.

Eifert, Benn; Alan Gelb; and Vijaya Ramachandran. 2005. *Business Environment and Comparative Advantage in Africa: Evidence from the Investment Climate Data*. The World Bank, Washington D.C., processed.

Elbadawi, Ibrahim A. 2002. "Reviving Growth in the Arab World." Working Paper Series, 0206, Arab Planning Institute, Safat, Kuwait.

Escribano, Alvaro and J. Luis Guasch. 2005. "Assessing the Impact of the Investment Climate on Productivity Using Firm-Level Data: Methodology and the Case of Guatemala, Honduras and Nicaragua." World Bank Policy Research Working Paper, WPS3621, World Bank, June.

Evans, Peter, and James Rauch. 2000. "Bureaucratic Structure and Bureaucratic Performance in the Less Developed Countries." *Journal of Public Economics* 75, no. 1: 49-71.

Frankel, Jeffrey. 2002. "Promoting Better National Institutions: The Role of the IMF." Paper presented at the Third Annual IMF Research Conference, Washington, November 7-8.

Griliches, Zvi and Jacques Mairesse. 1995. "Production Functions: The Search for Identification." NBER Working Paper, 5067(March).

Gupta, Sandeev; Hamid Davooli; and Rosa Alonso-Terme. 2002. "Does Corruption Affect Income Inequality and Poverty." *Economics of Governance*, 3, no. 1: 23-45.

Hall, Robert, and Charles Jones. 1999. "Why Do Some Countries Produces So Much More Output per Workers that Others?" *Quarterly Journal of Economics* 114: 83-116.

Haltiwanger, John. 2002. "Understanding Economic Growth. The Need for Micro Evidence." *New Zealand Economic Paper* 36, no. 1: 33-58.

He, Kathy S.; Randall Morck; and Bernard Yeung. 2003. "Corporate Stability and Economic Growth." William Davidson Working Paper, 553.

Hernando de Soto, 2000. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. Random House, New York.

Holtz-Eakin, Douglas, and Amy Ellen Schwartz. 1995. "Spatial Productivity Spillovers from Public Infrastructure: Evidence from State Highways." NBER Working Paper, W5004 (February).

Knack, Stephen, and Philip Keefer. 1995. "Institutions and Economic Performance: Cross Country Tests Using Alternative Institutional Measures." *Economics and Politics* 7, no. 3: 207–227.

Levine, Renelt. 1997. "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature* 35: 688-726.

Loayza, Norman V.; Ana Maria Oviedo; and Luis Serven. 2004. "Regulation and Macroeconomic Performance". World Bank Policy Research Working Paper no 3469. Washington, D.C..

Lucas, Robert Jr. 1988. "On the mechanics of economic development." *Journal of Monetary Economics* 22, no 1: 3-42.

McMillan, John. 1998. "Managing Economic Change: Lessons from New Zealand." *The World Economy* 21: 827-843.

McMillan, John. 2004. "A Flexible Economy? Entrepreneurship and Productivity in New Zealand". Working Paper, Graduate School of Business, Stanford University, Stanford, CA.

Maddala, G. S. 1988. *Introduction to Econometrics*, McMillan Publishing Cie, New York.

Mankiw, Gregory; David Romer; and David Weil. 1992. "A Contribution to the Empirics of Economic Growth". *Quarterly Journal of Economics* 106: 407-37.

Manly, Bryan F.J. 1994. *Multivariate Statistical Method: A Primer*. 2nd ed. New York: Chapman&Hall.

Mardia, Kantilal Varichand; John T. Kent; and John M. Bibby. 1997. *Multivariate Analysis.* 6th ed. New York: Academic Press.

Marschak, Jacob, and Andrews Williams. 1944. "Random Simultaneous Equation and the Theory of Production". *Econometrica* 12, no. ¾: 143-205.

Mauro, Paolo. 1995. "Corruption and Growth". *Quarterly Journal of Economics,* 110: 681-712.

Mitra, Arup; Aristomène Varoudakis; and Marie-Ange Véganzonès. 2002. "Productivity and Technical Efficiency in Indian States' Manufacturing: The Role of Infrastructures". *Economic Development and Cultural Change* 50, no. 2: 395-426.

Mo, Park Hung. 2001. "Corruption and Economic Growth." *Journal of Comparative Economics* 29, no. 1: 66-79.

Morocco, 2001. "Moroccan Manufacturing Sector at the Turn of the Century. Result of the Firm Analysis and Competitiveness Survey, Pilot Investment Climate Assessment", International Finance Corporation, The World Bank, Washington, D.C.

Morocco, 2005. "Evaluation du Climat d'Investissement au Maroc, Middle East and North Africa Region, Private Sector, Financial Sector and Infrastructure Group". The World Bank, Washington, D.C.

Murphy, Kevin M; Andrei Shleifer; and Robert W. Vishny. 1989. "Industrialization and the Big Push". *The Journal of Political Economy* 97, no 5: 1003-1026.

Nabli, Mustapha. K., and Marie-Ange Véganzonès-Varoudakis. 2004. "How Does Exchange Rate Policy Affect Manufactured Exports in the Middle East and North Africa". *Applied Economics* 36, no. 19: 2209-2220.

Nabli, Mustapha. K., and Marie-Ange Véganzonès-Varoudakis. 2007. "Reforms Complementarities and Economic Growth in the Middle East and North Africa". *Journal of International Development* 19: 17-54.

Nabli, Mustapha K, 2007. *Breaking the Barriers to Higher Economic Growth*. World Bank, Washington, DC.

Nagaraj, Rayaprolu; Aristomène Varoudakis; and Marie-Ange Véganzonès. 2000. "Long-Run Growth Trends and Convergence Across Indian States: The Role of Infrastructures". *Journal of International Development* 12, no 1: 45-70.

North, Douglas C. 1990. *Institutions, Institutional Change, and Economic Performance*. Cambridge, U.K.: Cambridge University Press.

Organization for Economic Cooperation and Development, 2001. Businesses' Views on Red Tape, Paris, OECD. http:/ www.oecd.org/publication/e-book/4201101E.PDF.

Psacharopoulos, George. 1988. "Education and Development: A Review". *World Bank Research Observer,* Oxford University Press 3, no. 1: 99-116.

Rodrik, Dani. 1999." Institutions for High-Quality Growth: What They Are and How to Acquire them". Paper presented at the IMF Conference on Second Generation Reforms, Washington, November 8-9.

Rodrik, Dani; Arvind Subramanian; and Francesco Trebbi. 2002. "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development". NBER Working Paper 9305, National Bureau of Economic Research, Cambridge, Massachusetts.

Rodrik, Dani, and Arvind Subramanian. 2004. *From Hindu Growth to Productivity Surge: The Mystery of the Indian Growth Transition*. Harvard University. Cambridge, Mass. Processed.

Saleh, Jahangir. 2004. "Property Rights Institutions and Investment". The World Bank Policy Research Working Paper Series 3311, The World Bank, Washington D.C.

Sekkat, Kalid, and Marie-Ange Véganzonès-Varoudakis. 2007. "Openness, Investment Climate, and FDI in Developing Countries". *Review of Development Economics* 11, no. 4, 607-620.

Tanzi, Vito, and Hamid Davooli. 1997. "Corruption, Public Investment, and Growth." IMF Working Papers 97/139, International Monetary Fund, Washington, D.C.

World Bank, 2004. Better Governance for Development in the Middle East and North Africa: Enhancing Inclusiveness and Accountability. MENA Development Report, The World Bank, Washington, D.C.

World Bank, 2005, World Development Report 2005: A Better Investment Climate for Everyone, The World Bank and Oxford University Press, Washington, D.C.

World Bank, 2009. Doing Business in 2009: Comparing Regulations in 181 Economies. The World Bank, Washington, D.C.