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Do Developing Countries Benefit from Foreign Direct Investments?

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Abstract

In addition to the wide believed positive effects on growth, employment and wages, FDIs are often perceived as sources of funds for development. Developing countries, especially low income and emerging economies, welcome FDIs because of their favorable budgetary implications. All that resulted in increasing global FDIs. We discuss some specification and estimation problems that might affect the estimation of the rate of returns on FDI, and provide new figures for a number of FDI-receiving Arab countries. We compare the results to those of some Asian countries, and discuss the policy implications. There is evidence that Arab countries have, relatively, benefited from their efforts to open their economies, to reform their institutions and to attract FDIs.

JEL Classifications: C13, C14, C21, C23, C26, O24

Keywords: Rate of return on FDI, estimation and specification problems, panel data.

1. Introduction

The connection between trade, FDI and growth was made in Bhagwati (1978), who argued that the effects of FDI on economic growth are hypothesized to be stronger the more outward-oriented the country is. FDI affects growth by increasing the stock of capital and, probably, by spillover from foreign firms to local firms. It is hypothesized that FDI makes transfer of technology easier, increases employment, improves knowledge (whether human capital or R&D, or both, as a result of cooperation and competition) between domestic and foreign firms, modernizes management practices, and could enhance designs of existing products, i.e., development. Jones and Romer (2010) argue that there has been a positive trend in world trade and FDI, and that the two variables are correlated. The trade, FDI, and economic growth nexus has been tested extensively in the literature and most economists today seem comfortable with it even though the empirical evidence is mixed.[i] Interestingly, however, according to the theory of internalization, FDI only exists because of the absences of free trade, Coase (1937).[ii]

Further, the availability of FDI might be crucial for development. Middle Eastern and North African countries, for example, have been pursuing outward trade policies since the 1980s and encouraging inward FDI in general. Developing countries view FDI as a cost-effective source of funds for development plans. Various World Investment Reports (WIRs) seem to suggest continuous increases in FDI for developing countries. The WIR (2010) points out that, "Developing and transition economies attracted half of global FDI inflows, and invested one quarter of global FDI outflows." For example, the 2008 WIR (p.42, figure II.4) reported the rates of return on global FDI by trans-national companies (TNCs) for the period 1995–2007. These figures measure the profitability of foreign investors. The average returns are double digits, with returns on TNCs' FDI in developing countries exceeding 10 percent.

The main objective of this paper is to examine whether some developing countries, some are Arab and others are Asians, have benefited from FDI. We accomplish this by measuring the rate of returns on inward FDI in a number of Arab countries, which have been pursuing outward oriented policies and institutional reforms to attract FDIs.

These countries are Algeria, Egypt, Jordan, Morocco, and Tunisia, which have data for the period from 1980 to 2009. We compare the results to four Asian countries: China, South Korea, Malaysia, and Thailand.

Just like foreign investors calculate the expected rate of returns on their investments, policymakers at the receiving end of FDI should be interested in the rate of returns of inward FDIs. . The policymaker should also be interested in the factors that increase the average returns on FDI in order to design policies to achieve that.

Essentially, measuring the rate of returns on FDI requires the estimation of the elasticity of output with respect to FDI. The estimation, however, is significantly affected by a number of specification and estimation issues, which we discuss in detail in this paper.

We rely on the economic theory of production. The concept of the production function is firmly grounded in economic theory. Theory is needed to serve as a guide on the *external validity* of the econometric estimate of the elasticity of output with respect to FDI, Acemoglu (2010). Carkovic and Levine (2002) identified some of problems in the FDI-growth literature, which are related to our problem, but we discuss and attempt to remedy more problems. This approach is subject to specification and estimation problems. Specification problems include the choice of the production function's functional form (e.g., Cobb-Douglas, Constant Elasticity of Substitution (CES), Trans-log, etc.). The econometrician does not know the true data-generating-process (DGP). Specification errors occur if the true DGP is a CES production function, and the econometrician fits a Cobb-Douglas. Other specification and estimation problems can include nonlinearity, FDI flow versus stock, the order of integration and the specification of trend, omitted variable problems, consistency, endogeneity, serial correlation, small sample bias, and error-in-measurement problems.

Given the uncertainty about the estimated elasticity and returns arising for the problems above, we generate a rather *thicker* output, i.e., a number of estimates, instead of one estimate for the elasticity and the rate of returns, and then compute an average rate of returns, which has a smaller variance and is thus more reliable than a single estimate.[iii]

Since we do not know what the true model is, we address the problems above by estimating different types of production functions and regression specifications, and use different estimators to produce a number of estimates, for a panel of five Arab countries ($i = 1, \cdots N, \; N = 5$) over the period from 1980 to 2009 ($T = 30$). Then, we compare our estimates of the Arab countries to those we obtain from four Asian countries, China, South Korea, Malaysia, and Thailand, over the same time period.

The answer to our question, whether the Arab countries have benefited from FDI over the period from 1980 to 2009, is yes. We found that real GDP is fairly sensitive to small changes in FDI in the Arab countries, more so than the Asian countries, i.e., the size of the estimated elasticity is larger. However, the rate of returns in the Asian countries, especially in China and Korea, are higher than those of the Arab countries because average productivity levels are higher in China and Korea. China and Korea have relatively more and higher quality human capital than the Arab countries. The results might suggest that FDI would have a low average rate of return unless investments are made in human capital, i.e., skills, to produce skill-intensive goods and services, and increase productivity. These results are consistent with the findings in the growth–FDI literature.

Although comparisons with the rate of returns on TNCs investments in the developing country based on our calculations of the rate of returns on inward FDI in the Arab and Asian countries is not straightforward, it is well documented that U.S. FDI abroad earn more than foreign firms investing in the U.S.[iv]

We also found significant complementarities between FDI and human capital; when taken into account, higher returns in some countries resulted, and are expected to spur more FDI inflows in the future. We found significant nonlinear effects of FDI and the product of FDI and human capital on the level of GDP per capita.

Next, we layout the methodologies and discuss the specification and estimation issues pertinent to the calculation of the rate of return on FDI. The data are described in section 3. In section 4 we report and analyze the empirical evidence. Section 5 concludes.

2. Methodology

The estimation of the elasticity of output with respect to FDI stock, γ , i.e., the percentage change in GDP / percentage change in FDI stock, and our analysis are theory-based. We use the production function to describe the relationship between FDI and real GDP. We begin with the Cobb-Douglas production function, which is, despite some criticisms, very well-grounded in economic theory, easy to estimate, and has a good empirical record (Miller 2008).[v]

The Cobb-Douglas Production function is:

$$Y = AK^{\alpha} L^{\beta} e^{\varepsilon} \qquad (1)$$

Subscripts aside at this stage, Y is real output, A is a constant exogenous technical progress, K is the stock of physical capital, L is labor input, and ε is the error term, which has classical properties. To account for FDI in the production function we assume that the *effective* stock of capital consists of (K_d), which denotes the domestic stock of capital, and (K_f), which is the foreign stock of capital, i.e., FDI stock.[vi]

Equation (1) becomes:

$$Y = A\,(K_d)^{\alpha}(K_f)^{\gamma} L^{\beta} e^{\varepsilon} \qquad (2)$$

Dividing both sides by labor L (lowercase), and then taking log yields:

$$\ln y = a + \alpha \ln k_d + \gamma \ln k_f + \delta \ln L + \varepsilon \qquad (3)$$

Where $\delta = \alpha + \gamma + \beta - 1$ measures the deviation from constant returns to scale.

Estimating equation (3) would yield an estimate of the *long-run* elasticity or the share of FDI, $\hat{\gamma} = \dfrac{\Delta \ln y}{\Delta \ln k_f} \approx \dfrac{\%\Delta Y}{\%\Delta K_f} = \dfrac{\Delta Y}{\Delta K_f} . \dfrac{K_f}{Y}$, therefore the theory suggests that the real rate of return on FDI stock is $\dfrac{\Delta Y}{\Delta K_f} = \hat{\gamma} \dfrac{Y}{K_f}$, which hinges on the value of $\hat{\gamma}$.

To interpret the measure for example, let the estimated elasticity γ be 0.5, GDP is 6 dollars and FDI is 1 dollar. The rate of return is 0.5(6/1)=3 dollars. Thus, a 100 percent increase in FDI from 1 to 2 dollars increases GDP from 6 to 9 dollars reflecting the estimate of γ which is 0.50.

Below we list a number of the other challenges and problems.

First, an omitted variable problem might be present. Essentially, we will never be able to tell which and how many variables are omitted, which is why we rely on economic theory of the production function. The omitted variable problem results in biased and inconsistent Least Squares parameter estimates. A modified theory of production, however, considers the stock of human capital an additional explanatory variable that is actually missing from the original production function in equation (1). There is literature on technology diffusion where human capital is required. The theory is found in Nelson and Phelps (1966), Grossman and Helpman (1991, ch.11), and Barro and Sala-i-Martin (1995, ch.8). Borensztein *et al.* (1998) and Benhabib and Spiegel (1994) are widely cited examples of supporting empirical evidence. Thus, we consider having a measure of the stock of human capital as an additional regressor. Human capital can either be an additional exogenous factor of production, see Mankiw *et al.* (1992), or a factor influencing technical progress, A, in the production function. Also, we report a regression that includes the product of human capital and FDI stock to capture complementarities.[vii]

Second, errors-in-measurement lead to biased and inconsistent parameter estimates in Least Squares. We, however, focus on the long-run and not the short-run dynamics because we are interested in an estimate of γ in equation (3), and errors-in-measurement are less of a problem in the long run unless the errors are systematic and cumulate to I(1). We will show that the errors are actually stationary.

Third, endogeneity is also present as a problem (single equation bias). Instrumental Variable methods are usually prescribed as a remedy to this problem. We use the Generalized Method of Moment (GMM) estimator, which is a Generalized IV estimator. Finding the appropriate instruments is always challenging. Weak instruments often cause additional problems. We will test for the presence of endogeneity, discuss the choice of relevant instruments, which are correlated with the regressors especially the FDI, capital and human capital, and not correlated with the residuals.

Fourth, we have a small sample problem. The time series are short. Each country has 30 annual observations only, which makes the estimation of a country-by-country times series model inappropriate. To remedy this problem we estimate a panel, where T=30 and N= 1 to 5. The panel will also allow for a slope change and a fixed effect.

Fifth, it has been argued, see Stengos and Kottaridi (2010), that FDI and human capital have nonlinear effects on growth. We use a semi-parametric estimator to estimate quantile regressions, which will account for changes in the slope parameters over the distribution.

3. The data

We use annual data from 1980 to 2009 for five Arab countries, namely Algeria, Egypt, Jordan, Morocco, and Tunisia. We chose these countries because the UNCTAD data are available, and because these countries, more than others, have been pursuing outward oriented policies, reforming investment laws, patent laws, etc. and restructuring their economies and institutions to attract FDIs . Those countries are also non-oil producers, except for Algeria. We are interested in non-oil producers because it is difficult to interpret the rate of returns on FDI when output is large in size due entirely to oil production or high oil prices, and not to increasing productivity. For comparison we also use data from the same period from four Asian countries (China, South Korea, Malaysia, and Thailand) on the same basis.

Table 1 reports the percentage share of FDI in GDP. Share of FDI in GDP is significantly larger in the Arab countries than the Asian countries. The Asian countries' production is largely driven by technical progress, domestic capital, labor, and most importantly by skilled human capital.

Table 2 describes the data. All the data are in real terms. The stock of capital is constructed from gross capital formation using the Perpetual Inventory Method with a depreciation rate fixed at 6 percent, and a proxy for the initial stock K_0 equals to 2 times real GDP. Real GDP data are taken from World Development Indicators. The FDI stock is published by the UNCTAD. We use population of working age (15-64) to measure labor.

The stock of human capital is computed as in Barro and Lee (1993 and 2010) and it measures average years of schooling. Although there are other methods to measure the stock of human capital, we do not have sufficient data for the countries in our sample to use them.[viii] The available enrolment time series have missing values in the Arab countries, therefore we interpolate the data whenever that was required. Enrolments have trends as do the stocks of capital in the Arab countries. We use the Barro and Lee formula to compute the time series for the stock of human capital for each of the Arab countries, and enabled the constant term in the equation to vary across the countries. The equation is reported in Table 2. For the Asian countries, however, the formula above does not fit the data so we take the human capital reported in 5-year intervals as in Barro and Lee, and we interpolated the data using a geometric mean approach. Our estimates of human capital are plotted in figure 1.

Tables 3 and 4 report the allocation of FDI in different sectors. There are qualitative differences in FDI between the Arab and Asian countries. These differences stem from differences in the degree of industrialization. The Asian countries in our sample have manufacturing-related FDIs whereas the Arab countries have more oil- and gas-related FDIs, and some services. For Algeria, unspecified secondary includes manufacturing, electricity, gas, and water. About one-third to two-thirds of total FDI flows go into these sectors and we speculate that most of it is in the gas sector because Algeria is a major gas producer. Telecommunications received a very large FDI in 2005. In Egypt most of the FDI flows goes into petroleum and other services, which is mostly telecommunications. In Morocco, FDI is concentrated in manufacturing, real estate, tourism, and services. Tunisia's FDI is in the small oil and gas sector, manufacturing, and services. It is surprising that tourism did not receive a significant amount of FDI in Tunisia. UNCTAD does not report similar data for Jordan. A national website, www.jordaninvestment.com, reports that in 2004-2005, 75 percent of FDI inflows goes into the service sector, where financial services make up about 50 percent of these inflows. Less than 20 percent of the FDI goes to mining and quarrying, and only 6 percent to manufacturing. We should also emphasize that stateowned enterprises, which were privatized during the restructuring were recorded as FDI flows. For the Asian countries, table 4 shows that the bulk of the FDI is in manufacturing, with some significant FDI in services in South Korea.

4. Empirical evidence

We believe that the Cobb-Douglas production function is an appropriate functional form for our purpose. We begin by estimating the following Cobb-Douglas log-linear specifications using a panel for the Arab countries, $i = 1 \cdots 5$ over the period 1980 to 2009.[ix] Later, we will examine a CES production function for robustness.

We fit three specifications of the log linear Cobb-Douglas function:

$$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{1it}, \qquad (4)$$

We keep labor in the regression so that δ captures the deviations from constant returns to scale $\delta = \alpha + \gamma + \beta - 1$ (remember that β is the share of labor in equation 1).

And the other specification includes human capital (H), which is labeled h in per cap capita form, as an additional regressor:

$$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}, \qquad (5)$$

where δ also captures the deviations from constant returns to scale $\delta = \alpha + \gamma + \rho + \beta - 1$.

And, to account for complementarities, we have $(k_f h)_{it}$, the per-unit of labor product of FDI stock and human capital, as an additional regressor:

$$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln(k_f\, h)_{it} + \delta \ln L_{it} + \varepsilon_{3it}, \qquad (6)$$

where $\delta = \alpha + \gamma + \beta - 1$ measures the deviation from constant returns to scale.

Understanding trend in time series is difficult. Phillips (2003) and White and Granger (2011), among others for examples, argue and explain why it is. Typically, practitioners test for unit root in the individual time series, and recently in the panel as well. A conclusion that has been reached by many macroeconomists, e.g., Stock (1991), Rudebusch (1993), and Christiano and Eichenbaum (1990), is that it is rather difficult to settle the issue of unit root especially in the case of the GDP data. Further, there are a large number of tests, where most suffer from short sample bias and lack of power against stationary alternatives. We use a number of tests with a variety of specifications. Razzak (2007) provides a testing strategy, where all available tests to the practitioner should be used with all possible specifications until a consensus emerges.[x] The results of all the tests indicate that the data have unit roots, which is not surprising. The inability of the test statistic to reject the null hypothesis often is a sign of weakness of the test.

The second step in trend identification issue is to test the null hypothesis that there is no co-integration among the variables, which is a necessary second step of testing.[xi] Following the same strategy we easily rejected the null hypothesis of no co-integration in the Arab countries panel and in the Asian panel.[xii] Rejecting the null hypothesis is encouraging because the power of the test is not a relevant issue when it rejects the null. Given these results, we will proceed with estimating the log-level production function because under the assumption of co-integrated I(1) variables the estimated coefficients are *super-consistent* and inference is possible.

We are set to estimate the above three specifications in levels. We begin with the EGLS estimator, which is the appropriate method to estimating panel data when the regressors are co-linear and the explanatory variables are assumed to be strictly exogenous. Our regressors are in log-levels and they are trending together. There is evidence of co-linearity. However, EGLS is just a benchmark estimator, and cannot be used in the presence of endogeneity, nonlinearity and other specification and estimation issues.

We suspect that endogeneity is present. We test for endogeneity of the stock of capital, k_{dit}, the stock of FDI, k_{fit} and the stock of human capital, h_{it}. We use the Hausman (1978) endogeneity test.[xiii] The hypothesis that all three regressors are exogenous is strongly rejected; hence, the GMM estimator will be used to estimate the production function.[xiv]

For instruments in GMM we use, constant term, two lags of FDI stock, the contemporaneous log of the European Union's real GDP which is strictly exogenous to the Arab countries, and a number of dummy variables taking the value of one when the programs begin and zero elsewhere. These are (1) IMF macro stability program; (2) joining the World Trade Organization; and (3) free-trade agreement year with the European Union. These variables are relevant and highly correlated with FDI flows and FDI stocks. For capital and human capital we use a number of shares of age groups in total populations, such as the share of people age 20-24, 25-29… 60-64. Cook (2002) explains that these instruments are highly correlated with capital and human capital because the life-cycle theory shows that both increase with age, peak at mid age, then decline. The same is true and clearly present in the data for employment, hours-worked and wages. We test for weak instruments. Lagged regressors used as instruments lead to a weak instruments' problem, which typically leads to a downward bias in the estimated share of capital and to, generally, biased results. We only have two lags of working age population as instruments. Our F-test does not show any such problem.

Table 5 reports the results for the EGLS and GMM estimators.[xv] In addition, we report results for the quantile regressions. We use a fixed effect model, where all coefficients are fixed across countries, except the FDI stock elasticity γ_{it}; the White's method to estimate the variance-covariance matrix; and report a number of diagnostic statistics.

The EGLS and GMM estimates are reported in the first and second columns of each of the two panels in table 5, but the focus is on GMM. The coefficient α (the share of capital) is kept fixed across countries to conserve on the number of degrees-of-freedom.[xvi] The estimates of α are sizable, which is typical in the Arab data.[xvii]

The average GMM estimates of γ_{it} across the three different regression specification are: 0.08, 0.38, 0.32, 0.19, and 0.31 percent in Algeria, Egypt, Jordan, Morocco, and Tunisia, respectively. The highest elasticity is in Egypt, Jordan, and Tunisia. Algeria has the lowest. The average elasticity across the Arab countries is approximately 0.25 percent.[xviii] It says that a 1 percent increase in the stock of FDI stock increases the level of real GDP by about a quarter of a one percent.

The quantile regressions are reported in the remaining columns of each of the panels of table 5. There is a significant nonlinear effect on GDP per capita level. The estimated elasticity is relatively larger in magnitude in the upper quantile for all countries. Taking Algeria for example, the average estimated elasticity in the upper quantile across all three regression specifications is 0.34 percent. This is significantly larger in magnitude than the 0.08 percent reported in GMM.

In EGLS and GMM δ is <0, except for the second specification, which is positive.[xix] The p values of the J statistics for GMM indicate that we cannot reject the over-identifying restrictions. The residuals pass the normality test. The main findings in table 5 are that both FDI and human capital have significant non-linear effects on output. The complementarities between FDI and human capital are evident in the regressions.

Now we are in position to compute the rate of returns. We use our estimates of γ to calculate the rate of return on FDI for each country. For each country, we use the GMM estimated value of γ, and the average of output / FDI stock over the whole sample, and also report the overall average value of the returns. Results are in table 6. This table has three panels. Each panel represents a regression specification. Algeria has a high rate of return because output is high due to oil and gas production. Egypt has the second highest return 1.63, which is more meaningful than Algeria's figure because Egypt is not an oil-producing country and its gas production is small. Morocco and Jordan come next, and Tunisia has the smallest return, 0.64. All these numbers are measured in constant dollars. The estimated average rate of returns on FDI for all five Arab countries is approximately 1.30. These numbers mean that a one dollar increase in FDI stock increases the average output of all five Arab countries by 1.30 dollars, reflecting average elasticity of 0.25 percent.

For example, a 100 percent increase in the *average* FDI stock in all five Arab countries (from 25 billion dollars to 50 billions) increases average GDP of the five Arab countries from 120 billion to 150 billion dollars, reflecting the elasticity, which is 0.25 percent. A similar interpretation applies to each individual country.

All in all, our estimates of the rate of returns on inward FDI are significantly smaller than those reported by the World Investments Report (WIR) for the rates of returns to

TNCs on their FDI in the developing countries. This says that foreign firms receive and profit more in terms of returns on their FDI than the FDI-receiving countries. For example we also found (not reported) that Kuwait, a major oil-producing country which invests abroad more than its domestic investments, has an average rate of returns on its outward FDI equal to approximately 10 percent. The consequences of these return differentials are not well understood and ought to be researched in the future. Bosworth *et al.* (2007) and Hung and Mascaro (2004) show and explain the high rate of returns on American FDIs abroad.

Table 7 reports the rate of returns using the estimated elasticity for quantile regressions, which we reported in table 5 above. It is clear that the rate of returns on FDI increases with the quantiles, the higher the quantile the higher the rate of returns. FDI, just like human capital, has a significant nonlinear effect on output.

Now we compare our estimates of the rate of returns on FDI in the Arab countries to those of the Asian countries. We estimate the same specifications of the Cobb-Douglas production function in 4, 5 and 6 above using GMM only, and report the parameter estimates in table 8.[xx] We report the corresponding rates of returns in table 9.

The average share of capital is 0.66, which is larger than that in the Arab counterpart, which is about 0.50. And the production function is either a decreasing returns to scale or more probably a constant return to scales because the P values are relatively large.

The average estimated elasticities of FDI with respect to output are: 0.21, 0.10, 0.34, and 0.15 percents for China, Korea, Malaysia, and Thailand, respectively. The average across all four Asian countries is 0.20 percent. Thus, the elasticity is smaller in magnitude than the Arab estimate. This is because these Asian countries have massive domestic investments. We compute the rate of returns on FDI. China and South Korea have relatively larger returns. These two countries in particular have benefited significantly from human capital – FDI complementarities. In constant dollars, the average rates of returns on FDI across the three different specifications of the Cobb-Douglas production function are: 6.5 in China, 3.9 in Korea, 1.3 in Malaysia, and 1.6 in Thailand. China and South Korea produce relatively more skilled-intensive goods than the Arab countries. On average, a dollar increase in FDI across all four Asian increases GDP by 3.3 dollars. This is at least twice as much as the returns for the Arab countries in our sample, but still indicates that returns of foreign firms are much higher.

For Asia and over the sample, a 100 percent increase in the average FDI stock in all four countries, China, Korea, Malaysia and Thailand from 50 billion dollars to 100 billion dollars increases average GDP for the Asian countries by 80 billion dollars from 400 billions to 480 billions, reflecting an average elasticity of 0.20.

Figure 2 plots the average GMM estimate of γ across different specifications, by country. Figure 3 plots the corresponding average rate of returns to FDI by country.

Our results point to significant differences in the responsiveness of the Arab and the Asian economies to changes in FDI, where China and Korea are clearly reaping relatively more benefits from FDI than the other countries. There could be a number of reasons for this observation. One interesting difference between the Arab and the Asian countries is that there are significant differences in the levels of human capital and the quality of human capital. These differences suggest differences in the complementarities between human capital and FDI. Countries with high skill levels might attract foreign FDI. Our results might be consistent with the skill-biased technical change literature. Figure 4 plots the levels of human capital, measured by average years of schooling, which are clearly higher in the Asia countries than the Arab countries. Figure 5 plots a measure of the quality of human capital—a measure of cognitive skills is a country score of standardized tests in mathematics and science published by Trends in Math and Science Study, TIMMS. The plot measures the Arab country's score relative to Korea's.[xxi] The Arab countries have a significantly lower quality of human capital, i.e., lower cognitive skills.

Finally, we check the robustness and the sensitivity of the results to a different specification of the production function, namely the Constant Elasticity of Substitution (CES), and to some measurement issues. This functional form, on the other hand, does not require the assumptions of perfect competition and profit maximization. Kmenta (1967) shows that estimating these flexible forms is not really difficult (at least for two factor inputs) except that they require a large number of observations because there are more parameters to estimate than in the Cobb-Douglas.[xxii]

The CES production function could be written in different ways depending on the number of inputs. In our case, we have up to four inputs: physical capital, FDI capital, Labor, and human capital. General n-input CES function, Blackorby and Russel (1989) is given by:

$$Y = \phi\left(\sum_{i=1}^{n} \delta_i x_i^{-\rho}\right)^{-\frac{\nu}{\rho}} \tag{7}$$

With $\sum_{i=1}^{n} \delta_i = 1$,

Where n is the number of inputs and the $x's$ [[the 's does not have to be italics]] are the inputs. In our case, however, we can only be concerned with two inputs, physical capital and FDI capital, which might be substitutable. Estimation of the CES production function requires a large sample, which we do not have. We nested a CES in the Cobb-Douglas function:

$$Y = A[(\pi(K_d^{\rho}) + (1-\pi)(K_f^{\rho})]^{\nu/\rho} L^{\beta} \tag{8}$$

Normalizing by labor and following Kmenta (1976) log-linear approximation of the CES:

$$\ln Y = \log A + \nu\,\pi \ln K_d + \nu(1-\pi)K_f + \frac{\rho\nu}{2}\pi(1-\pi)(\ln K_d - \ln K_f)^2 + \beta \ln L \tag{9}$$

We estimate three specifications of the function for all countries, but to conserve on the degrees-of-freedom we do not allow the coefficients to vary across countries. The value of $\nu = 1$. We estimate the panel over the same sample. Lowercase denotes per capita measures.

$$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln k_{fit} + \tfrac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln k_{fit})^2 + \delta \ln L_{it} + \varepsilon_{1it} \tag{10}$$

$$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln k_{fit} + \tfrac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln k_{fit})^2 + \delta \ln L_{it} + \phi \ln h_{it} + \varepsilon_{2it} \tag{11}$$

$$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln(k_{fit}.h_{it}) + \tfrac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln(k_{fit}.h_{it}))^2 + \delta \ln L_{it} + \varepsilon_{3it} \quad (12)$$

We estimate the above equations for the named Arab and Asian countries and report the results in table 10. The main results are consistent with the previous findings. First, the estimated value of ρ, which is closer to zero rather than one, implies that the CES function approaches a Cobb-Douglas. Hence, the elasticity of substitution between the stock of foreign direct investment and domestic capital stock approaches unity. The average GMM estimate of the elasticity of FDI across the three different specifications is about 0.36, for the Asian countries is 0.26. Both the elasticity estimates and the rates of returns are slightly larger in magnitude than those of the Cobb-Douglas function.

We also estimated all the equations in this paper using real GDP in PPP-adjusted dollars instead of constant dollars. We also examined different measures of capital stock and FDI stock data using the Perpetual Inventory Method. Regarding PPP, the results are qualitatively similar to what we reported. However, there seems sensitivity to how the FDI stock is measured, which is typical.

5. Conclusions

For many developing countries, foreign direct investment (FDI) is a method to finance development; they welcome FDIs because of their favorable budgetary implications. It is often perceived as a source of funds for development. But most importantly, there is some evidence in the literature that FDI could enhance the overall economics, employment, and wage growth rates. To attract FDI, Egypt, Jordan, Morocco, and Tunisia in particular have been revising their commercial, trade, patent and other relevant laws, and pursuing micro- and macroeconomic policies friendly to FDI. Consequently, they have attracted more FDI in recent decades. European agencies, which evaluate the business climate, rate some of these countries as good places for investment.

This paper estimates the rate of returns on inward FDI in the Arab countries, Algeria, Egypt, Jordan, Morocco and Tunisia, and compares the results to China, South Korea, Malaysia, and Thailand. Estimates of the rate of returns on FDI comprise important information for policymakers. However, the calculation of the rate of returns on FDI depends crucially on the estimated elasticity of FDI with respect to real output. In this paper we discussed the problems involved in the estimation of this parameter. We presented some specification and estimation problems (such as small sample problems, error-in-measurement, endogeneity, omitted variable, nonlinearity, etc. that affect the estimates) were confronted. Given the uncertainty about the estimated elasticity arising for such problems, we provided remedies and generated a number of estimates (thick modeling) instead of one estimate for γ and then computed an average rate of returns, which has a smaller variance, therefore more reliable than a single estimate.

Our calculations show that the overall cross-country and cross-estimators average elasticity for the five Arab countries is approximately 0.25 percent. Thus, a 1 percent increase in FDI stock increases the *level* of GDP by about one-quarter of a percent. The rate of returns, which reflects the estimated elasticity, is approximately 1.30 dollars for every dollar increase in FDI stock.

We also found that complementarities between FDI and human capital are evident in the data. There is evidence that Algeria and Egypt have relatively sizeable investments, which includes higher shares of their FDI in skill-intensive goods and services sectors, such as telecommunications, water desalination, solar energy, gas, etc., where the stock of human capital is large. There is also evidence that distributional effects exist where the rate of returns increases at the upper end of the distribution.

The average rate of returns in Asia, which corresponds to the estimated elasticity, is 3.34 dollars for every dollar increase in FDI. The Asian countries, especially China and South Korea, have significantly higher rates of returns to FDI than the Arab countries in our sample.

For policy evaluation, the costs and benefits from inward FDI ought to be clearly counted. The questions that are typically asked and requires evidence are those related to the growth effect of FDI, the employment and wage effects of FDI, productivity effects of FDI, and whether there might be negative unemployment consequences resulting from business cycle downturns in the economies of the investor countries.

Our findings ought to be useful for policymakers. They suggest that governments, which are interested in increasing inward FDIs, should aim for policies to increase not only the stock of human capital, but also its quality. This would, in turn, give foreign investors incentives to invest in the production of skill-intensive goods, which increases the returns to the economy.

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Table 1: FDI flows as % of GDP

	1980	2008	2009
Algeria	0.8	1.6	2.0
Egypt	2.3	5.7	3.6
Jordan	0.8	13.3	10.4
Morocco	0.4	2.9	1.5
Tunisia	2.8	7.0	4.3
China	0.02	2.45	1.91
Korea, Republic of	0.03	0.90	0.90
Malaysia	3.67	3.24	0.75
Thailand	0.58	3.10	1.89
Source : UNCTAD database			

Table 2: Definition of data variables
1980 – 2009 Annual Data

GDP, Y	Gross Domestic Product at constant prices 2000. Source: World Development Indicators database, WDIs, (World Bank).
FDI stock, K_f	Foreign Direct Investment data stocks. Source: UNCTAD database. It is deflated by the gross capital formation price from the WDIs database.
Domestic Capital, K_d	Total capital stock constructed using gross fixed capital formation and the perpetual inventory method with a depreciation rate of 6% and the initial capital equal 2 times real GDP of 1979. Domestic capital stock is the total minus FDI stock.
Human capital , H	The Barro-Lee formula for the developing countries, including the Arab countries in our sample is given by $H_{it} = [Constant + 0.439\,Pe + 2.665\,Se + 8.092\,Te]$, where Pe is primary, Se is secondary and Te is tertiary shares of gross enrolments. The constant term is allowed to vary across countries.
Working age population L	Working age population 15-64 years, a proxy for labor. Source: WDIs database.

Table 3: Shares of inward FDI flows by main sectors in percent (Arabic sample)

Algeria	2005	2006	2007	2008
Agriculture and hunting	0.8	0.0	0.0	0.0
Unspecified secondary	28.9	67.4	66.0	50.3
Unspecified tertiary	0.8	18.9	16.8	1.8
Transport, storage and communications	66.5	2.4	2.2	0.2
Hotels and restaurants	0.0	10.0	0.4	0.0
Construction	3.0	1.3	14.6	47.8
Total FDI	100.0	100.0	100.0	100.0
Egypt	**2006**	**2007**	**2008**	**2009**
Agriculture and hunting	0.2	0.7	0.6	2.4
Petroleum	37.5	45.5	75.3	68.8
Unspecified secondary	8.1	8.6	6.6	4.1
Finance	17.7	12.3	3.4	7.9
Other Services	36.5	33.0	14.0	16.7
Total FDI	100.0	100.0	100.0	100.0

Source for Algeria and Egypt: UNCTAD and International Trade Center: www.investmentmap.org

Morocco	2006	2007	2008	2009	2010
Agriculture and fishing	0.1	0.1	0.2	0.1	0.2
Energy and mining	0.4	7.4	5.6	0.6	1.0
Manufacturing industries	34.4	8.7	6.4	10.8	10.3
Real estate	15.8	20.0	32.7	22.0	22.9
Tourism	30.0	32.7	20.3	11.4	10.2
Other Services	18.9	30.7	34.7	55.0	55.1
Unspecified	0.4	0.3	0.1	0.2	0.3
Total FDI	100.0	100.0	100.0	100.0	100.0

Source: Office des changes du Maroc; www.oc.gov.ma

Tunisia	2006	2007	2008	2009	2010
Agriculture	0.3	0.4	0.6	0.7	0.1
Energy	21.4	65.6	56.9	54.1	60.8
Manufacturing industries	7.9	23.5	18.9	33.9	26.5
Tourism and real estate	0.4	3.5	5.8	3.8	4.4
Services and others	70.0	7.1	17.8	7.5	8.2
Total FDI	100.0	100.0	100.0	100.0	100.0

Source: www.investintunisia.com

Table 4: Shares of inward FDI flows by main sectors in percent (Asian sample)

China	2005	2006	2007	2008	2009
Agriculture, hunting, forestry, fishing, mining and quarrying	1.5	1.5	1.9	1.9	2.1
Manufacturing industries	58.6	57.7	54.7	54.0	51.9
Business activities	13.1	18.7	31.4	30.2	29.8
Other services	26.8	22.1	12.0	13.9	16.1
Total FDI	100.0	100.0	100.0	100.0	100.0

Source: http://www.investmentmap.org/TimeSeries_Industry_fdi.aspx?prg=1

Malaysia	2005	2006	2007	2008	2009
Agriculture and hunting	2.5	-1.7	24.0	0.8	-4.4
Mining and quarrying	26.7	13.3	14.8	-8.9	84.7
Manufacturing	44.8	20.5	37.4	52.1	-44.8
Finance	13.4	54.3	24.2	53.2	80.9
Other services	12.6	13.5	-0.4	2.9	-16.3
Total FDI	100.0	100.0	100.0	100.0	100.0

Source: http://www.investmentmap.org/TimeSeries_Industry_fdi.aspx?prg=1

Republic of Korea	2008	2009	2010
Services	71.6	66.1	48.4
Machinery and equipment	21.8	26.2	40.1
Manufacturing	3.9	6.2	10.7
Others	2.7	1.4	0.9
Total FDI	100.0	100.0	100.0

Source: http://www.investmentmap.org/TimeSeries_Industry_fdi.aspx?prg=1

Thailand	2006	2007	2008
Agriculture and hunting, Mining and quarrying	1.9	8.2	0.1
Machinery and equipment	13.4	12.2	15.1
Other manufacturing	25.4	24.0	63.6
Business activities	22.9	14.9	13.8
Other services and unspecified services	36.4	40.7	7.4
Total FDI	100.0	100.0	100.0

Source: http://www.investmentmap.org/TimeSeries_Industry_fdi.aspx?prg=1

Table 5: Cobb-Douglas Production Function Estimated Elasticity For Arab Countries

	Specification 1					Specification 2					Specification 3				
	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{1it}$ [iii]					$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}$ [iii]					$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln(k_f h)_{it} + \delta \ln L_{it} + \varepsilon_{3it}$ [iii]				
	EGLS	GMM[i]	Quantile[ii] 0.25	Quantile[ii] 0.50	Quantile[ii] 0.75	EGLS	GMM[i]	Quantile[ii] 0.25	Quantile[ii] 0.50	Quantile[ii] 0.75	EGLS	GMM[i]	Quantile[ii] 0.25	Quantile[ii] 0.50	Quantile[ii] 0.75
α	0.667 (0.0000)	0.786 (0.0000)	0.540 (0.0001)	0.785 (0.0000)	0.622 (0.0000)	0.282 (0.0003)	0.347 (0.0000)	0.552 (0.0000)	0.637 (0.0000)	0.299 (0.0668)	0.396 (0.0009)	0.772 (0.0000)	0.572 (0.0000)	0.756 (0.0000)	0.360 (0.0002)
$\gamma_{Algeria}$	0.126 (0.0000)	0.145 (0.0000)	0.107 (0.0256)	0.201 (0.0001)	0.291 (0.0002)	-0.092 (0.0217)	-0.016 (0.2874)	0.076 (0.0447)	0.132 (0.0074)	0.358 (0.0000)	0.070 (0.0004)	0.111 (0.0000)	0.097 (0.0103)	0.164 (0.0000)	0.372 (0.0000)
γ_{Egypt}	0.389 (0.0000)	0.419 (0.0000)	0.084 (0.0746)	0.235 (0.0000)	0.274 (0.0003)	0.313 (0.0000)	0.378 (0.0000)	0.072 (0.1087)	0.155 (0.0013)	0.285 (0.0000)	0.360 (0.0000)	0.371 (0.0000)	0.087 (0.0387)	0.193 (0.0000)	0.1318 (0.0000)
γ_{Jordan}	0.339 (0.0000)	0.371 (0.0000)	0.128 (0.0000)	0.201 (0.0000)	0.230 (0.0000)	0.200 (0.0000)	0.253 (0.0000)	0.040 (0.4758)	0.084 (0.0672)	0.174 (0.0000)	0.264 (0.0000)	0.337 (0.0000)	0.099 (0.0000)	0.148 (0.0000)	0.228 (0.0000)
$\gamma_{Morocco}$	0.189 (0.0000)	0.164 (0.0000)	0.151 (0.0001)	0.277 (0.0000)	0.312 (0.0001)	0.186 (0.0000)	0.210 (0.0000)	0.136 (0.0001)	0.200 (0.0000)	0.328 (0.0000)	0.225 (0.0000)	0.160 (0.0000)	0.142 (0.0001)	0.232 (0.0000)	0.355 (0.0000)
$\gamma_{Tunisia}$	0.472 (0.0000)	0.510 (0.0000)	0.122 (0.0000)	0.197 (0.0000)	0.228 (0.0000)	0.080 (0.1311)	0.175 (0.0003)	0.078 (0.0061)	0.115 (0.0013)	0.214 (0.0000)	0.300 (0.0000)	0.247 (0.0000)	0.108 (0.0000)	0.159 (0.0000)	0.253 (0.0000)
ρ	--	--	--	--	--	0.534 (0.0000)	0.536 (0.0000)	0.282 (0.0778)	0.292 (0.0030)	0.294 (0.0001)	--	--	--	--	--
δ	-0.103 (0.0187)	-0.054 (0.0000)	0.150 (0.2026)	0.000 (0.9943)	-0.046 (0.4312)	0. 262 (0.0000)	0.182 (0.0000)	0.237 (0.0084)	0.160 (0.0265)	0.136 (0.0318)	-0.225 (0.0000)	-0.130 (0.0000)	0.079 (0.5009)	-0.061 (0.3692)	-0.237 (0.0000)
σ [iv]	0.0668	0.0647	0.1324	0.0961	0.1199	0.0705	0.0630	0.1330	0.0980	0.1339	0.0569	0.0557	0.1288	0.0957	0.1387
J	--	25.068 (0.1988)	--	--	--	--	23.916 (0.1994)	--	--	--	--	25.844 (0.1346)	--	--	--
Jarque-Bera	3.830 (0.1473)	0.413 (0.8133)	--	--	--	0.457 (0.7954)	1.041 (0.5942)	--	--	--	1.618 (0.4452)	1.055 (0.5899)	--	--	--
Wald[v]	--	--		0.0000					0.0000		--	--		0.0000	

We do not report the constant terms, and P values are in parentheses.

T is 1980 -2009, N is 5..

i Panel GMM regression fixed effect with cross-section weights for GLS weight, white cross section for GMM weighting matrix, and white cross section for coefficients standard errors and covariance matrix (with corrected degree of freedom). The instruments are constant term, log GDP for the European Union, dummy variables for the IMF macro stability program, equals 1 when joining the program and zero outside, for WTO, Continued – table 5

joining year= 1, free trade agreement year with European Union=1 since the agreement starts and zero before, log share of age group in total population (eg., people age 20-24, 25-29,…, 60-64), two lags of log FDI stocks for the first and second specification, and two lags of log interaction term for the third specification.. **ii** In the quintile regressions, we used the Huber Sandwich for coefficient standard errors and covariance, Kernel (Epanechnikov) using residuals and Hall-Sheather, band width=0.18666.

ii $\delta = \alpha + \beta + \gamma - 1$ measures the distance from constant returns to scale. The coefficient β is the share of labor in the Cobb-Douglas production function. For the second specification, $\delta = \alpha + \beta + \gamma + \rho - 1$.

iii σ is the Standard error of the regression.

iv P values**. v** The p-values for Wald test of hypothesis that $\gamma_{0.25} = \gamma_{0.50} = \gamma_{0.75}$ called slope equality test in E-views.

J is the test statistic for over-identifying restrictions.

Jarque-Bera is the normality test for the residuals.

Table 6: The Rate of Returns on Inward FDI measured in Arab Countries

	Specification 1[i]	Specification 2[i]	Specification 3[ii]	Average
Country	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{i1t}$	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}$	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln (k_{fit} . h_{it}) + \delta \ln L_{it} + \varepsilon_{3it}$	
Algeria	3.07	0.00	2.47	1.85
Egypt	1.96	1.10	1.83	1.63
Jordan	1.08	0.56	1.24	0.96
Morocco	1.28	1.64	1.29	1.41
Tunisia	0.88	0.30	0.76	0.64
Average	1.65	0.72	1.52	1.30

i The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right)$

ii The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right) + \gamma * average\left(\frac{Y}{H}\right)\left(\frac{\Delta Y}{\Delta H}\right)$

Table 7: Estimated Returns for quintile regressions

		First Specification		Second Specification		Third Specification	
	Quintiles	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{i1t}$		$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}$		$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln (k_{fit}.h_{it}) + \delta \ln L_{it} + \varepsilon_{3it}$	
		Elasticity	Return [i]	Elasticity	Return [i]	Elasticity	Return [ii]
Algeria	Q1=0.25	0.11	0.68	0.08	0.48	0.10	0.61
	Q2=0.50	0.20	2.24	0.13	1.48	0.16	1.83
	Q3=0.75	0.29	5.32	0.36	6.54	0.37	6.79
Egypt	Q1=0.25	0.08	0.11	0.07	0.09	0.09	0.11
	Q2=0.50	0.24	0.57	0.16	0.38	0.19	0.47
	Q3=0.75	0.27	1.04	0.29	1.09	0.32	1.21
Jordan	Q1=0.25	0.13	0.09	0.04	0.03	0.10	0.07
	Q2=0.50	0.20	0.35	0.08	0.15	0.15	0.26
	Q3=0.75	0.23	0.62	0.17	0.47	0.23	0.61
Morocco	Q1=0.25	0.15	0.18	0.14	0.17	0.14	0.17
	Q2=0.50	0.28	0.71	0.20	0.51	0.23	0.59
	Q3=0.75	0.31	1.39	0.33	1.47	0.35	1.58
Tunisia	Q1=0.25	0.12	0.08	0.08	0.05	0.11	0.07
	Q2=0.50	0.20	0.18	0.11	0.10	0.16	0.15
	Q3=0.75	0.23	0.31	0.21	0.29	0.25	0.34

i The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right)$

ii The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right) + \gamma * average\left(\frac{Y}{H}\right)\left(\frac{\Delta Y}{\Delta H}\right)$

Table 8: Cobb-Douglas Production Function Estimated Elasticity For Asian Countries

	Specification 1	Specification 2	Specification 3
	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{i1t}$ [i]	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}$ [i]	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln (k_f h)_{it} + \delta \ln L_{it} + \varepsilon_{3it}$ [i]
α	0.665 (0.0000)	0.669 (0.0000)	0.667 (0.0000)
γ_{China}	0.233 (0.0000)	0.207 (0.0000)	0.195 (0.0000)
γ_{Korea}	0.112 (0.0000)	0.090 (0.0001)	0.102 (0.0000)
$\gamma_{Malaysia}$	0.378 (0.0000)	0.340 (0.0000)	0.313 (0.0000)
$\gamma_{Thailand}$	0.167 (0.0000)	0.140 (0.0000)	0.147 (0.0000)
ρ	--	0.203 (0.3314)	--
δ [ii]	-0.456 (0.0121)	-0.289 (0.2644)	-0.451 (0.0118)
σ [iii]	0.0787	0.0728	0.0728
J	13.761 (0.3160)	15.323 (0.2876)	12.380 (0.3357)
Jarque-Bera	2.269 (0.3215)	2.055 (0.3578)	2.653 (0.2652)

Constant terms are not reported.
T is 1980 – 2009, and N is 4..
i Panel GMM regressions, fixed effect, cross-section GLS weight, white diagonal instrument for weighting matrix, and white diagonal for coefficients standard errors and covariance matrix (with corrected degree of freedom). The instruments are constant term, dummy variable WTO joining year= 1 and zero thereafter, log of (import plus export) as ratio to GDP, three lags of y_{it}, three lags of log k_{fit}, three lags of interaction term, linear trend.
ii $\delta = \alpha + \beta + \gamma - 1$ measures the distance from constant returns to scale. The coefficient β is the share of labor in the Cobb-Douglas production function. For the second specification, $\delta = \alpha + \beta + \gamma + \rho - 1$.
iii σ is the Standard error of the regression.

Continued – table 8

J is the test statistic for over-identifying restrictions.

Jarque-Bera is the normality test for the residuals.

Table 9: The Rate of Returns on Inward FDI measured in Asian Countries

	Specification 1[i]	Specification 2[i]	Specification 3[ii]	Average
Country	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \delta \ln L_{it} + \varepsilon_{i1t}$	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln k_{fit} + \rho \ln h_{it} + \delta \ln L_{it} + \varepsilon_{2it}$ [i]	$\ln y_{it} = a + \alpha \ln k_{dit} + \gamma \ln (k_f h)_{it} + \delta \ln L_{it} + \varepsilon_{3it}$	
China	7.17	6.39	6.04	6.53
Korea	4.37	3.49	3.97	3.94
Malaysia	1.42	1.28	1.20	1.30
Thailand	1.74	1.46	1.57	1.59
Averages	3.68	3.15	3.20	3.34

i The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right)$

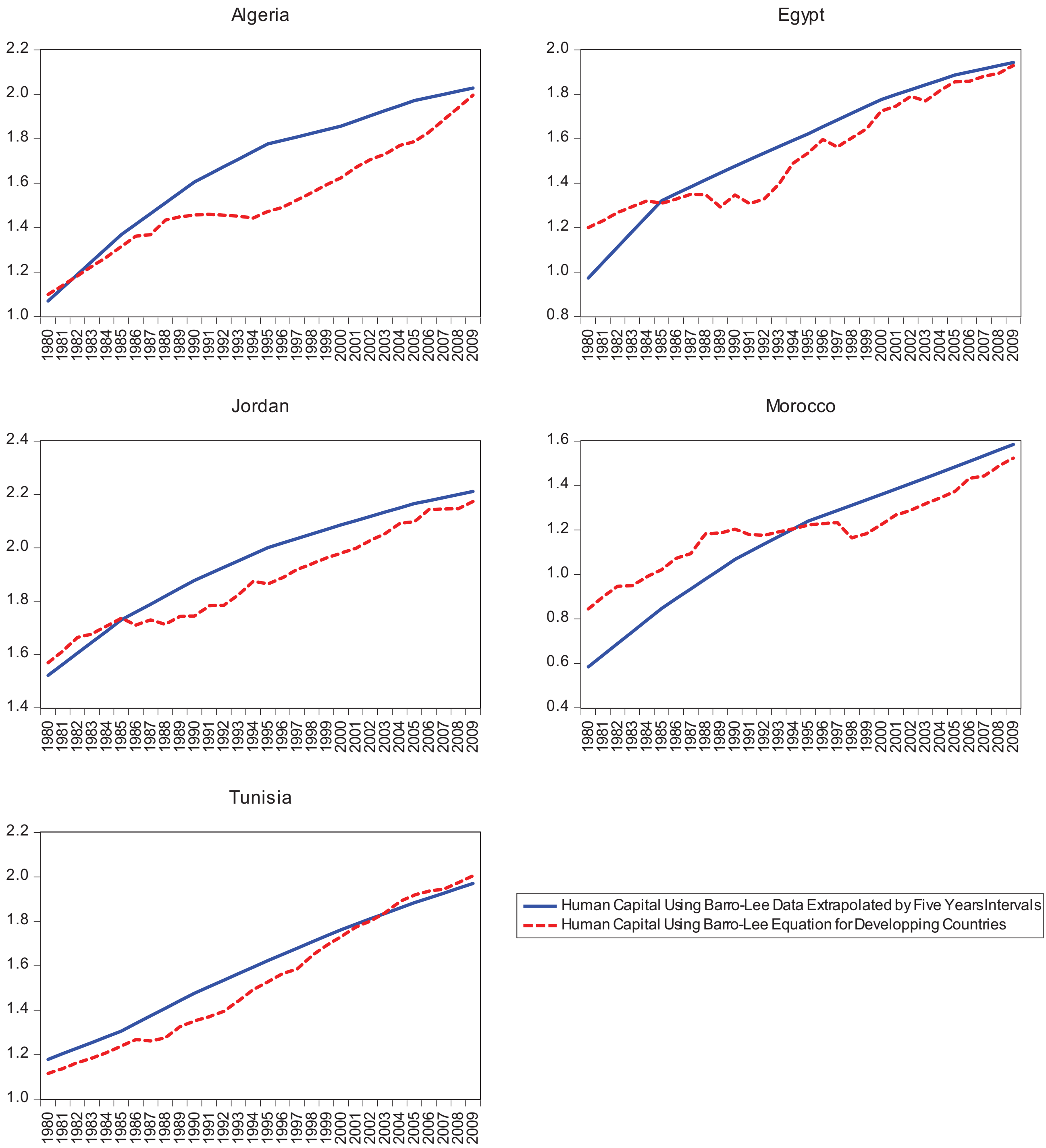
ii The rate of returns on FDI is $\gamma * average\left(\frac{Y}{K_f}\right) + \gamma * average\left(\frac{Y}{H}\right)\left(\frac{\Delta Y}{\Delta H}\right)$

Table 10: CES Estimated Elasticity

	Arab Countries				**Asian Countries**	
	First Specification					
	$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln k_{fit} + \frac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln k_{fit})^2 + \delta \ln L_{it} + \varepsilon_{1it}$					
	EGLS		GMM		GMM	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
π	0.558	0.000	0.582	0.000	0.692	0.000
ρ	-0.302	0.000	-0.338	0.103	-0.326	0.000
δ	-0.081	0.151	0.091	0.000	-0.457	0.000
σ	1.432		1.510		1.483	
	Second Specification					
	$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln k_{fit} + \frac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln k_{fit})^2 + \delta \ln L_{it} + \phi \ln h_{it} + \varepsilon_{2it}$					
	EGLS		GMM		GMM	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
π	0.556	0.000	0.580	0.000	0.694	0.000
ρ	-0.316	0.000	-0.330	0.000	-0.324	0.000
δ	-0.011	0.847	0.079	0.165	-0.461	0.000
ϕ	0.556	0.000	0.580	0.000	0.694	0.000
σ	1.461		1.493		1.480	
	Third Specification					
	$\ln y_{it} = a + \pi \ln k_{dit} + (1-\pi)\ln (k_{fit}.h_{it}) + \frac{1}{2}\pi(1-\pi)\rho(\ln k_{dit} - \ln (k_{fit}.h_{it}))^2 + \delta \ln L_{it} + \varepsilon_{3it}$					
	EGLS		GMM		GMM	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
π	0.715	0.000	0.740	0.000	0.843	0.000
ρ	-0.323	0.000	-0.325	0.000	-0.393	0.000
δ	-0.212	0.000	-0.104	0.109	-0.547	0.000
σ	1.478		1.481		1.649	

T is 1980 – 2009, and N is 5.

Figure 1
Log Average Years of Schooling



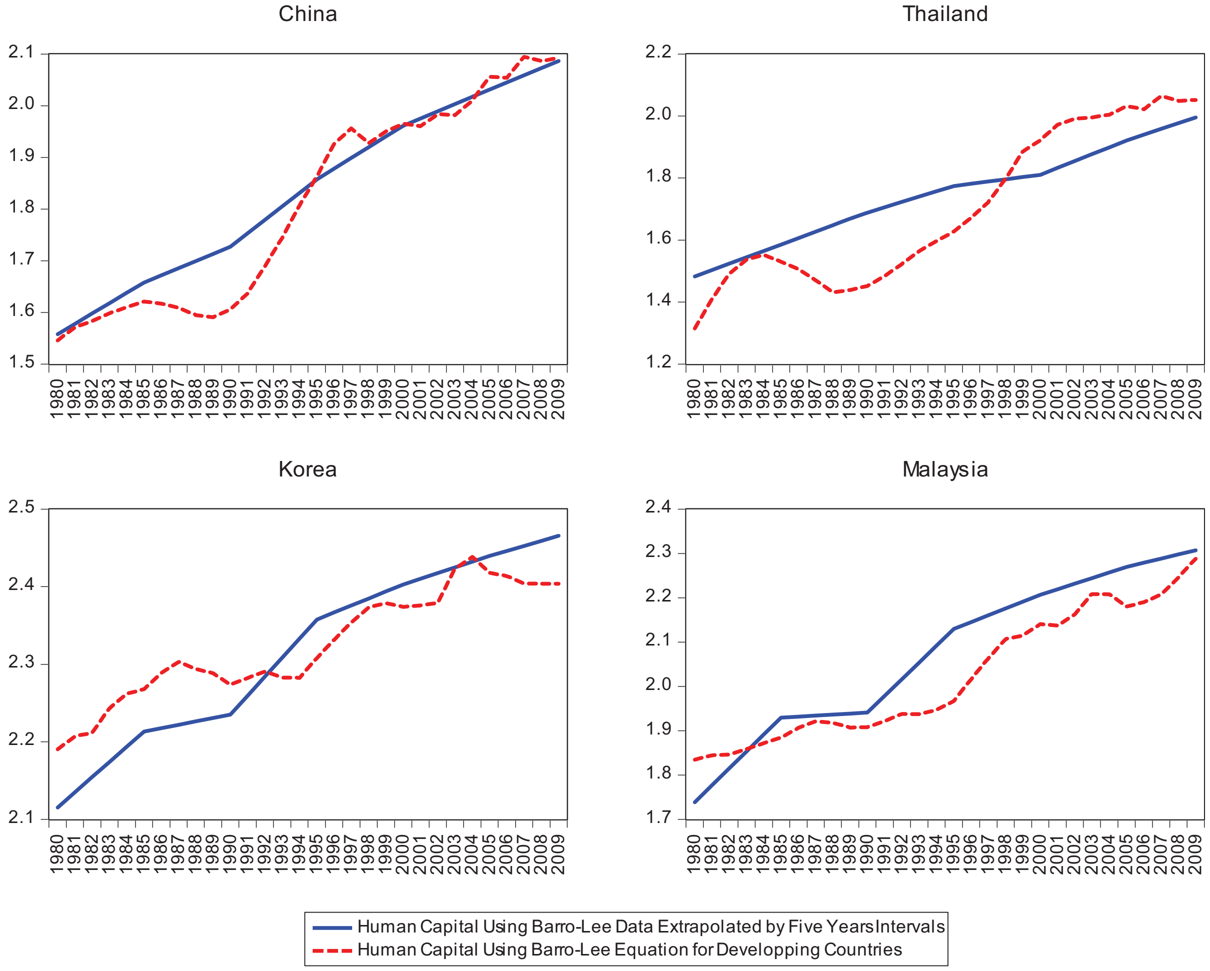

China
Thailand
Korea
Malaysia
Human Capital Using Barro-Lee Data Extrapolated by Five Years Intervals
Human Capital Using Barro-Lee Equation for Developping Countries

Figure 2: Average Estimated Elasticity of FDI for the Three Specifications by GMM

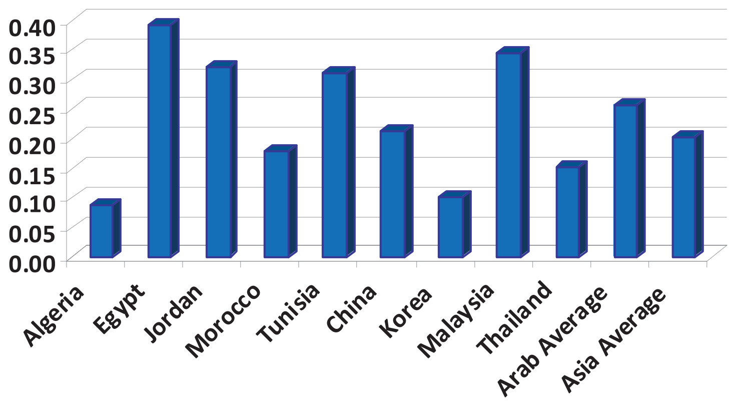


Figure 3: Average Rates of Returns

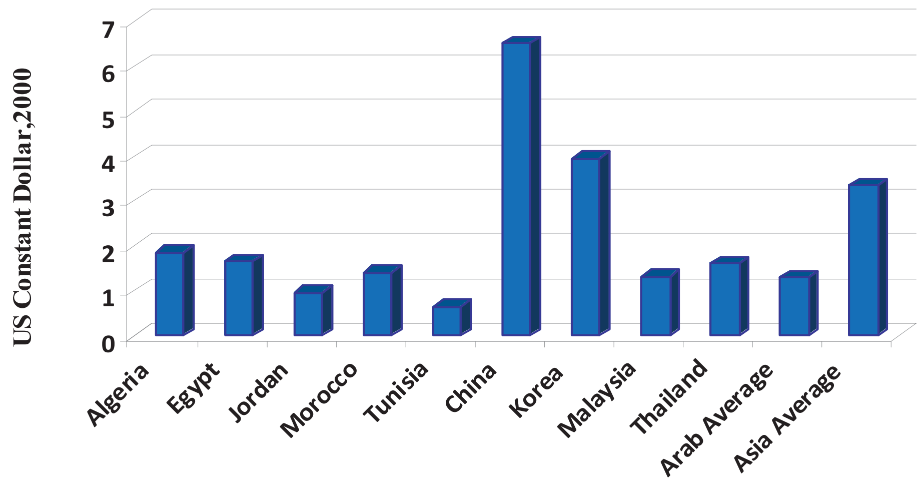


Figure 4: Human Capital

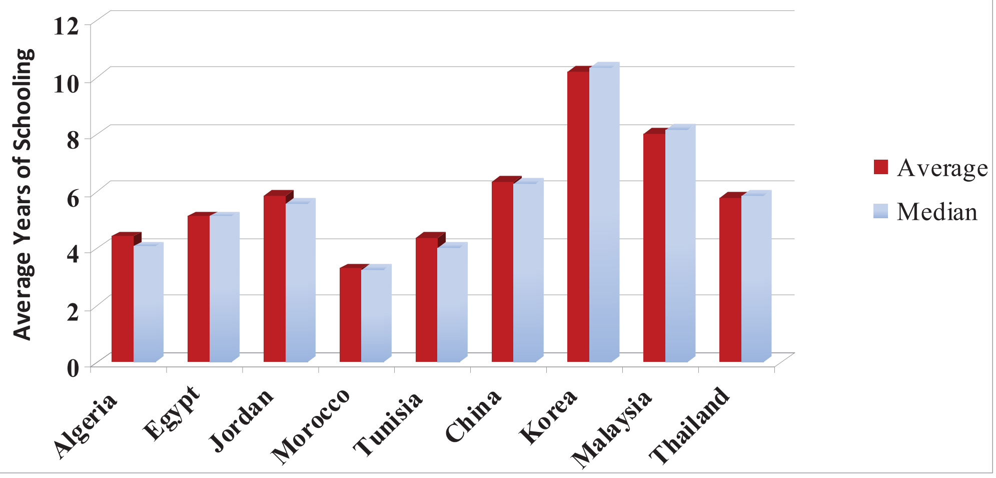
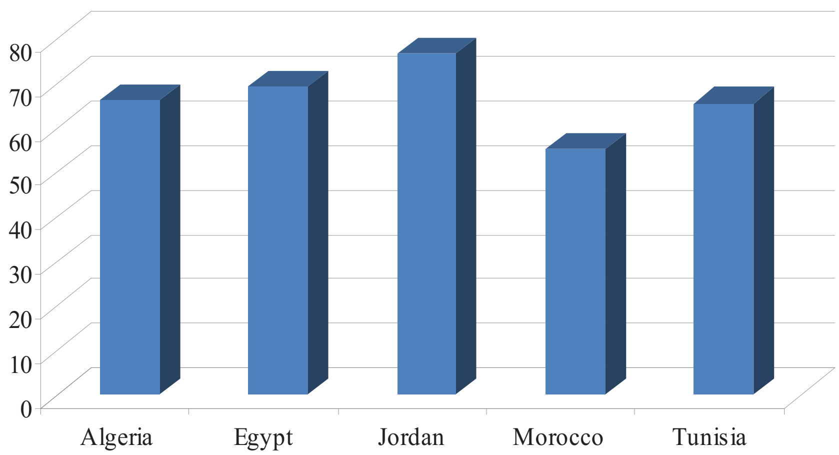


Figure 5: Quality of Human Capital Relative to Korea's Korea=100)



[i] For example see Balasubramanyam *et al.* (1996) and Kawai (1994) on trade-FDI-growth, Carkovic and Levine (2002) found the effect of FDI on growth is not robust in the presence of openness of trade. Levine (2002) had an interaction term of per capita income and FDI and reports no growth effect. Alfaro *et al.* (2007) argue that FDI has significant growth effect in countries with relatively more developed financial markets. See also Aitken and Harrison (1999), Haddad and Harrison (1993), and Mansfield and Romeo (1980). The main problem in this literature apparently is an estimation problem pointed out by Carkovic and Levine (2002) and that is not taking into account simultaneity bias, country-specific effects, and the use of lagged dependent variables in growth regression. Razzak (2009) provides micro-level evidence for trade-growth relationship in the Arab countries.

[ii] The theory of FDI is part of the theory of internalization developed by Coase (1937). It is thoroughly discussed in Hymer (1976), Buckly and Gasson (1976), Dunning (1977), and Rugman (1975). FDI by multinational companies cannot be explained by neoclassical trade theory. Market friction and imperfections inhibit private international investments. The theory of internalization explains that the motivations and reasons for foreign production and sales by multinational companies (FDI) are associated with these market imperfections. Free trade does not give rise to such companies. For example, when a country imposes tariffs on imports, profit-maximizing foreign exporters are better off if they establish production and sales in that country to avoid the tariffs. The same is true in the case of knowledge, which is transferred within the internal market between the multinational company and its subsidiary because of the absence of such market and competitive prices. Rugman (1980) provides a number of examples. Internalization theory seems to suggest that FDI and free trade cannot be positively associated, but rather the opposite is true, which contradicts the story told in Jones and Romer (2010).

[iii] The concept of thick-modeling was first introduced by Clive Granger (2004).

[iv] In a related literature, Bosworth *et al.* (2007) and Hung and Mascaro (2005) test and explain the issue of high return on U.S. FDI abroad. They found that American firms operating outside the U.S. appear to earn a persistently higher return than that earned by foreign firms in the U.S. McGrattan and Prescott (2008) also study the differential returns on investments of foreign subsidiaries of the U.S. multinational companies and U.S. subsidiaries of foreign multinationals. They argued that measurement errors might explain some of the reported variations, mostly unmeasured intangible capitals.

[v] The production function would have an extra term $e^{\lambda t}$, where λ is the rate of disembodied technical change. If the data have unit roots this linear time trend would be a misspecification issue. If, however, we find the data to be trended but the trend is not stochastic we would have to have this linear trend term back in the specification. It is, however, extremely difficult to discern one from the other.

[vi] FDI inflows are uneven in the five Arab countries. In some years these flows were near zero, which makes ΔK_f very small, thus $\Delta Y / \Delta K_f$ becomes a very large and nonsensical number. The stock of FDI, instead, do not exhibit this problem. Thus we will use the stock of FDI instead.

[vii] It would be important to include a measure of the quality of human capital too. Measurement of quality is tricky. There are some data, but the time series are short. Future research must take this variable into account.

[viii] The Jorgenson and Fraumeni (1992) method constructs a stock of human capital, which is based on lifetime earnings.

[ix] Jallab *et al.* (2008) is the only paper we are aware of on the issue of FDI and growth in the Arab countries using a proper estimation technique.

[x] We use a variety of common test statistics such as the Dickey-Fuller (1979), the ADF test, Said and Dickey (1984), Phillips and Perron (1988), and Elliot (1999). We also use different specifications (with and without

trend), and test the lag structure using various testing criteria. We also tested the panel of the five countries for a unit root using a variety of common tests such as Levin *et al.* (2002), Breitung (2000), Im *et al.* (2003), Hadri (2000), Sarno and Taylor (1998) and Taylor and Sarno (1998).

[xi] We use panel cointegration tests, the Johansen-Fisher test found in Maddala and Wu (1999), Kao (1999) residual test, and Pedroni (1999, 2004) residual test. The latter includes a number of tests, which allow for heterogeneous slope coefficients to vary across the panel (the panel v-test, panel ρ test, panel Phillips-Perron test, panel ADF test, group ρ test, group Phillips-Perron test and group ADF test). The null hypothesis is that the residuals are I(1) – no cointegration – and the alternative hypothesis is that the residuals are I(0). For the first 4 tests, the assumption is that under the alternative hypothesis, the residuals have a common AR coefficient. In the remaining 3 tests, the assumption is that the residuals under the alternative hypothesis have an individual AR coefficients. Kao (1999) test is similar to Pedroni's test in principle, i.e., a residual-based test, but there are cross-section specific intercepts and homogenous coefficients in the first-stage regressors. The null hypothesis is that the residuals are I(1). The Maddal and Wu (1999) Johansen test is similar to Johansen's time series tests, i.e., a maximum eigenvalue test.

[xii] Only the Pedroni (2004) test(s) for the Asian panel has high the P-values.

[xiii] We regress each of the three explanatory variables on a constant and the set of instruments, retrieve the residuals and then estimate the equations with the residuals as additional regressors. We test the hypothesis that the set of the coefficients of the residuals are zero using both F and Chi-squared.

[xiv] The GMM estimator minimizes $S(\beta) = (\sum_{i=1}^{N} Z'\varepsilon_i(\beta))'W(\sum_{i=1}^{N} Z'\varepsilon_i(\beta)) = g(\beta)'Wg(\beta)$ with respect to the coefficients matrix β for a chosen pxp weighting matrix W, where $\varepsilon_i(\beta) = (Y_i - f(X_{it}, \beta))$; $g(\beta) = \sum_{i=1}^{N} g_i(\beta) = \sum_{i=1}^{N} Z'\varepsilon_i(\beta)$ and Z is a $T_i xp$ matrix of instruments.

[xv] We do not use dynamic GMM (Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998)) because we are (1) interested in the long run point elasticity to compute the rate of returns, and (2) because we have a short panel, i.e., N is small.

[xvi] We also allowed the share of human capital ρ to vary across countries, but we do not report the results to save space. The results are available upon request. We found that the coefficient estimate to be insignificant for Algeria. We also found the coefficient estimate to be negative for Jordan and Morocco. A number of papers on growth-FDI seem to report negative coefficients for FDI or human capital in similar specifications (see for example, Kottaridi and Stengos (2010) and Varum *et al.*(2011) And Borensztein and J-W Lee (1998)). Finally we found the coefficient to be positive, sizable, and significant for Egypt and Tunisia.

[xvii] Independent calculations of the ratios of gross operating surplus to GDP from National Income Accounts also reveal similarly high values. These estimates are between 0.35 and 0.78 depending on the specification.

[xviii] We re-estimated the regressions (GMM) and fixed the coefficient γ for all Arab countries. The estimated elasticity is an average across all Arab countries is 0.22 percent.

[xix] This coefficient measures the distance from a constant returns to scale. There are different interpretations to this negative value. One is that the production function exhibits a decreasing return-to-scale. This suggests that the Arab markets are small, thus doubling output is costly and requires more than doubling inputs. It could also mean that output in the Arab markets is consistently priced below marginal cost. Basu and Fernald (1997) suggest that this interpretation and decreasing returns to scale sounds illogical for a profit maximizing firm. However, there is evidence that the majority of firms in the Arab countries are small in size with negative value added, hence non-profitable firms, Alkawaz (2006). Of course a positive value means that the function exhibits an increasing returns to scale.

[xx] Quantile regressions failed to produce any sensible results for Asia., which may indicate that distributional nonlinearity is insignificant.

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xxi A measure of cognitive skills as a proxy for the quality of human capital is found in Trends in International Math and Science (TIMMS), which is an international students assessment survey, reports country scores for students in 4th and 8th grades in more than 80 countries, every four years. In the first survey in 1995 the scores for Algeria, Egypt, Jordan, Morocco and Tunisia were 394.15, 420.40, 439, 372.36, and 439 respectively. In the last published survey in 2007 these scores declined in all countries except Jordan, 381.75, 399.5, 454.5, 319, and 377 respectively. While in Korea's score increased from 568 in 1995 to 575 in 2007. Both Thailand and Malaysia's scores declined from 505.5 and 462 in 1995 to 472.5 and 456 in 2007 respectively.

xxii Razzak (2010) estimated a CES production function using cross sectional data of thousands of observations for firms in Egypt, Lebanon, Morocco and Turkey.