Impacts of Foreign Direct Investment on Economic Growth: A Panel Data Study for the AMU Countries

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This paper investigates the impact of FDI on economic growth of AMU countries. We use a production function framework to estimate the impact of FDI on the economic growth of Arab Maghreb Union countries during the period from 1990 to 2006. Using panel data techniques, we control for individual heterogeneity (unobserved country-specific effects), and we also employ GMM technique to control for the possible endogeneity of FDI. We find that the magnitude of FDI effect depends on the policy regimes and local absorptive capacity of individual AMU countries. More precisely, the effect of FDI on economic growth depends on the AMU countries' technological and education level, their degree of openness of the trade and their macroeconomic stability.

JEL: C23 Models with panel data; F21 International Investment; F23 Multinational Firms

Keywords: Foreign Direct Investment; Economic growth; AMU; Panel data

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1. Introduction

Many developing countries have offered various financial and fiscal incentives to attract inflows of FDI. The reason behind these efforts is that it is believed that FDI promotes economic growth of host countries. However, the literature, both empirical and theoretical, about the impact of FDI on economic growth is less than unanimous. On the one hand, the literature has identified numerous ways in which foreign direct investment may promote growth. For instance, at a micro level, FDI can be a channel for firms of the host country to access advanced technologies (technology transfers) or advanced managerial processes (knowledge transfers) (see for instance Blomstrom et al. (2000)). Or FDI can facilitate the extraction, distribution and exports of products by improving the network of transport and communication. FDI can also beneficially affect the productive efficiency of domestic enterprises through the so-called productivity spill-overs (see Blomstrom and Kokko (1996)). FDI enables the host countries to participate in various networks such as sales and procurement networks of foreign investors. Besides these channels, at a more macro-economic level, foreign direct investment provides developing countries with the required capital and avoids the problems associated with alternative ways of raising funds in international markets and the need to cover current account deficits.
However, some contributions to the literature, inclusive of some seminal papers such as Baran, 1957; Dos Santos, 1970; Chase-Dunn, 1975, suggest that FDI may have negative impact on the growth prospects of the recipient economy if they result in a substantial reverse flows in the form of remittances of profits and dividends and/or if the multinational corporations (MNCs) obtain substantial or other concessions from the host country. The conditional-impact of FDI on economic growth literature suggests that host country characteristics could affect the potential benefits that a country may gain from FDI. The theories in this perspective suggest that the effect of FDI on growth depends on factors such as the level of education of the local workforce and the development of local financial markets, and other factors related to country-specific characteristics play an important role in allowing the positive effects of FDI to materialise (see Batten and Vinh Vo (2009) for a recent and comprehensive empirical study). Thus the stimulating effects of FDI inflows may not hold for all countries at all times.

The empirical literature, however, seems to have focused on fewer determinants at a time. Each empirical study tends to suggest one or two domestic prerequisites that are necessary for FDI to contribute to economic

growth. These findings imply that the positive growth effects of FDI materialise only if the host country satisfies certain domestic prerequisites (see also Adelman and Morris, 1967; Bhagwati, 1978; Findlay, 1978; Borensztein et al., 1998 and Bengoa and Sanchez-Robles, 2003).

This paper studies the impact of FDI on (macro-)economic growth on four AMU countries – Algeria, Libya, Morocco and Tunisia[1] - between 1990 and 2006[2]. These countries are chosen for empirical analysis because as most other developing countries, they represent an interesting case study of transition countries that have adopted policies specifically designed to attract inflows of FDI spurred on by the belief that these inflow will introduce modern technology and possibly stimulate export-led growth to help them successfully complete the transition from a command economy to a more market oriented one and to reduce their dependency upon one or few commodities. Following the conditionally impact perspective, this study hypothesises that the impact of FDI on economies of these countries is expected to be positive but conditionally dependent on some circumstances of host countries, rather than being absolutely positive or negative. This paper contributes in a novel way to the existing literature on the impact of FDI on emerging and transition countries by specifically focusing on AMU countries. Although a number of studies have already been conducted on Middle East and North Africa (MENA) countries (see for instance Jallab, et al. (2008) Al-Iriani and Al-Shamsi (2007) Sadik, and Bolbol, (2001)), this is the first attempt to investigate the growth effects of FDI specifically upon AMU countries[3]. A further contribution of this paper is that it employs different panel data techniques to avoid known estimation problems, namely, endogeneity, autocorrelation and heteroskedasticity.

This paper is structured as follows: Section 2 outlines theoretical perspectives about the impacts of FDI on economic growth of host countries and discusses the empirical studies that focus on the growth impacts of FDI in developing countries. Section 3 introduces the empirical methodology, discusses the

[1] Arab Maghreb Union (AMU) was established in 1989 and includes all five Maghreb countries (Libya, Algeria, Tunisia, Morocco and Mauritania). The main objectives of the AMU Treaty were to create an area with free circulation of people, goods, and services. Although some progress was made up to 1990, with agreements on trade and tariffs covering industrial and agricultural products, investment guarantees and prevention of double taxation, progress has halted since 1994 due to political tension among members. Mauritania was excluded due to lack of reliable data.

[2] An analysis at a micro (firm)-level was not possible due to the limited availability of data at firm-level.

[3] In a survey on studies focused upon productivity spillovers, Meyer and Sinani (2009) list 23 studies on developing countries (only one on an AMU country), 22 on transition countries (inclusive of the People's Republic of China) and 21 on developed economies. Only 13 out of 66 had been published before 2000.

econometric method and data source and description Section 4 presents the results. The final section concludes and summarises the results obtained from the empirical exercise.

2. Impacts of foreign direct investment

In neo-classical models that follow Solow (1956), the impact of FDI on the growth rate of output was expected to be, eventually, constrained by the diminishing returns of physical capital. Therefore, FDI could only be expected to exert a level effect on the output per capita, but not a rate effect. In other words, FDI could not alter the growth rate of output in the long run (Bengoa and Sanchez-Robles 2003). Therefore, within this framework, FDI could not be considered seriously as an engine of growth.

Seminal contributions by Baran, (1957), Dos Santos (1970) and Chase-Dunn, (1975) pointed out that those FDI inflows may have had negative effects on growth of the recipient economy if these inflows resulted in substantial outflows of profits and dividends and/or if the vehicles of FDI, the multinational corporations (MNCs), obtained substantial concessions from the host country. Furthermore, Lall and Streeten (1979) argued that FDI may even encourage a high degree of oligopolistic concentration, thereby restricting price competition. Kindleberger (1969), however, suggested that FDI could, in fact, increase competition. This is because foreign subsidiaries backed up by strong parent companies could compete effectively with existing local monopoly/oligopoly. Hence, by decreasing monopolistic/oligopolistic distortions, FDI could improve the allocation of resources in the host country.

Hirschman, (1958) suggested that the major obstacle in the process of economic growth in developing countries was the lack of skills and abilities to channel savings into productive investment opportunities. He also added that foreign capital was needed not only as capital as such but also because it brought certain abilities and skills that were in particular short supply.

More recently, the new theory of economic growth suggests that FDI can affect not only the level of output per capita (as in the neo-classical models) but also its rate of (long-run) growth. The impacts of FDI on technological and organisational opportunities can be both direct and indirect. In terms of direct impacts, recent theories of FDI emphasise the importance of technology as a firm-industry or country-specific advantage that is exploited

abroad (Dunning, 1988). Thus, technical opportunity and technological learning occur directly through the transfer of new technology and organisational skills from a company's headquarter in one country to its affiliate(s) in another. In terms of indirect impacts, the presence of technologically advanced foreign firms may lead to the enhancement of the technological levels of domestic firms through 'technology spillovers' and 'increased competition'. The increased competition due to the presence of FDI forces local firms to use their resources more efficiently and/or adopt new and more efficient technology to survive (productivity spillovers). Furthermore, using international networks, host countries could not only expand exports but also import high quality parts and materials, which in turn would improve productivity in the host countries. FDI could also raise the quality of domestic human capital and improve the know-how and managerial skills of local firms (Findlay, 1978; Wang, 1990 and Borensztein et al., 1998).

From the brief review of the literature, it becomes apparent that the impact of FDI on the economy is expected to be dependant upon some characteristics of host countries, rather than being absolutely positive or negative. Adelman and Morris (1967) argued that (to benefit from FDI) governments had to maintain a certain degree of macroeconomic stability, to promote domestic and foreign competition, to help upgrade human resources and skills and foster social development.

According to Bhagwati (1978) an essential economic characteristic of host countries was the nature of their trade regime. Bhagwati (1978) provided evidence that the positive effect of FDI is larger in countries that promote outward-oriented trade policies (export promotion) relative to those that follow inward-oriented strategies (import substitution). Findlay (1978), Borensztein et al., (1998) and Bengoa and Sanchez-Robles (2003) recognise that the growth rate of developing economies is highly dependent on the extent to which these countries can adopt and implement new technologies. They also agree that the main contribution of FDI is to the technological progress of host countries. Borensztein et al. (1998) added that although FDI brought such technologies and thus could contribute to economic growth of developing countries, the effect of FDI on economic growth was dependent on the level of the existing human capital available in the host economy (the absorptive capacity). The local labour force influences the domestic rate of technical progress in a positive direction. Besides from adequate human capital, Bengoa and Sanchez-Robles (2003) argue that in order to benefit

from long-term capital flows, host countries require sufficient infrastructure, economic stability and liberalized markets.

Empirical studies analysing the growth effects of FDI in developing countries provide mixed results[4]. In particular, some studies suggest that FDI contributes to growth only if host countries meet some conditions such as human capital development and financial market development. The effects of FDI on growth are significantly positive for large groups of developing countries in studies of Blomstrom et al. (1994) and Balasubramanyam et al, (1999). These studies also find FDI to have higher effects on growth than domestic investment. Impacts of FDI stock on growth, however, seem to be ineffective, in 58 developing countries (Dutt, 1997) and in Arab countries (Sadik and Bolbol, 2001). A more recent study by Trevino and Upadhyaya (2003) using pooled time series data from five developing Asian countries finds that FDI positively contributes to economic growth and in open economies, the impact of FDI on economic growth is more effective than that of foreign aid. Similarly, Rabindra et al. (2007) examine the impact of foreign aid and foreign direct investment in East European Countries, using a fixed-effects estimator and pooled annual time series data from 1993 to 2002. They suggest that inflows of foreign direct investment are a significant factor that positively affects economic growth in these countries. Bende-Nabende et al. (2002) found that direct long-term impact of FDI on output is significant and positive for comparatively economically less advanced Philippines and Thailand, but negative in the more economically advanced Japan and Taiwan. In the context of the People's Republic of China, two recent studies by Yao and Wei (2007) and Ran et al. (2007) conclude that the effect of FDI upon the Chinese economy is positive, but that there are significant differences across industries and more importantly across the different provinces of the PRC. Darrat et al. (2005) examine the effectiveness of foreign direct investment on growth in Central and Eastern Europe (CEE) and the Middle East and North Africa (MENA) regions finding that FDI affects growth positively only in the European Union accession countries of the CEE region, while the effect of FDI on growth in MENA is either insignificant or negative. The authors suggest that it might be that FDI has negative impacts on economic growth in Middle East and North Africa countries but positive impacts in Central and Eastern Europe because FDI flows more rapidly to the transitional Eastern European countries and the transition economies are

[4] In this paper we focus our attention mainly on developing and emerging countries. There is, however, a very rich literature focusing on developed countries (see for example: Haskel, et al. (2002); Gorg and Strobl (2002); Alfaro and Rodriguez-Clare (2003) and Durham, (2004)).

endowed with a well-developed source of human capital, while the MENA countries do not have skilled labour forces that may have contributed to the positive effect of FDI inflows on economic growth. They also conclude that the magnitude of the FDI effect depends on host country conditions.

There are also some individual country studies that use time-series analysis. These studies are not as popular as cross-country sectional or panel data studies, because most of data availability, especially in developing countries, goes back only to the 1960s or 1970s, leading to a very limited number of observations. Studies on the impacts of FDI on the economic growth of most developing countries seem to agree that FDI promotes economic growth, mainly through technology transfer and spillover. Blin and Ouattara, (2003) addresses the important question of whether foreign direct investment enhances economic growth in Mauritius using time series data for the period of 1975-2001. Their answer is affirmative: foreign presence seems to have a significant positive impact on the rates of growth of local productivity. FDI is also found to play a fundamental role in provincial economic growth in China (Berthelemy and Demurger, 2000 and Zhang, 2001).
Borensztein et al. (1998) argue that even though FDI is positively correlated with economic growth, host countries require minimum human capital in order to benefit from long-term FDI inflows. They find a strong positive interaction between FDI and the level of educational attainment. Similar findings have been observed in the study of Bengoa and Sanchez-Robles (2003). The results of this study concluded that the positive growth effects of FDI were dependent on the level of human capital available in the host economy, economic stability and liberalised markets. While Blomstrom et al. (1994) using cross-country data from 78 developing countries find no evidence that education is critical, they argue that lower income developing countries do not gain substantial growth benefits from FDI, whereas higher income developing countries do. In turn, Alfaro et al. (2004) find that FDI promoted economic growth in economies with sufficiently developed financial markets, while Balasubramanyam et al. (1996), using cross-country data for a sample of 46 developing countries, found that trade openness is crucial for obtaining the growth effects of FDI. They argue that more open countries are likely to both attract a higher volume of FDI and stimulate more efficient utilisation of it than closed countries. A similar conclusion was found by Batten and Vinh Vo (2009) for a sample of 79 countries. Oliva and Rivera-Batiz (2002) suggest that the concepts of growth policies and foreign investment promotion should be expanded to include the quality of government. They find evidence that, institutions, as expressed by the quality

of the democratic regime and the rule of law, matter in making FDI favourable for growth. They conclude that institution quality is of substantial importance in attracting FDI and in creating a favourable environment for FDI to contribute to growth. Kohpaiboon (2002); Bengoa and Sanchez-Robles (2003) and Farrokh, (2007) argue that FDI contributes to growth by enhancing economic efficiency and that this effect is larger in economies that promote outward-oriented trade policies relative to those that pursue inward-oriented strategies.

The empirical evidence on whether FDI generates positive effects on domestic investment is ambiguous, with some evidence that the effect for developing countries is more consistently pessimistic than the effect for developed countries[5]. For instance, Fry (1993) finds a negative relationship between FDI and domestic investment in India after controlling for country specific effects. Fedderke and Romm, (2006) find complementarity between foreign and domestic capital in the long run, while there was evidence of crowding-out of domestic investment from foreign direct investment in the short run. However, Wang (2008) using panel data analysis for a sample of 50 developing and developed countries, found that the contemporaneous impact of FDI upon domestic investment is negative (crowding-out effect) in the case of developed countries, while it is neutral in the case of developing countries. But the cumulative effect becomes positive for developing countries, while remains neutral for developed countries.
Most studies investigating the effect of FDI on the productivity of domestic firms suggest that the expected impact of the entry of foreign firms on the productivity of domestic firms is ambiguous, as opposing effects are possible. Aitken and Harrison (1999) found no evidence that foreign presence accelerated productivity growth in domestic firms and added that increases in foreign ownership negatively affect the productivity of wholly domestically owned firms in the same industry in Venezuela over the 1976-1989 periods. Similar conclusions is reached by Sasidharan (2006), in a study of the spillover effects from the entry of foreign firms using firm level data of Indian manufacturing industries for the period 1994-2002. Haddad and Harrison (1993) also find no positive effect of FDI on the rate of economic growth in developing countries, namely in Morocco. They argue that this lack of spillover could be due to the technology gap between domestic and foreign-owned firms.

[5] For example; Haskel et al. (2002) and Liu et al. (2000) suggest that there are spillover effects from foreign to domestic firms in a panel data set of firms in the UK; Gorg and Strobl (2002) find that foreign presence reduces exit and encourages entry by domestic-owned firms in the high-tech sector in Ireland.

However, study by Sjoholm (1999a) reports that inter-industry spillovers from FDI are found at national level in Indonesia where local establishments in industries with a large foreign presence have shown high productivity growth. The findings from Liu (2002) seem to suggest that the positive spillover effects of FDI to local firms are channelled through backward linkages, i.e. firms that become local suppliers of foreign firms could benefit from spillovers. One explanation for the lack of evidence on externalities is that multinationals will seek to minimise technology leakage to competitors while improving the productivity of their suppliers by transferring knowledge to them (Alfaro and Rodriguez-Clare, 2004). Thus, if FDI were to generate spillovers, they are more likely to be vertical in nature than horizontal.

3. Methods of empirical analysis and the data

As mentioned above, FDI can help the process of accumulating capital and bringing advanced technology, advanced managerial and labour skills to developing countries, which impact positively on the economy. The channels of transmission are externalities, learning by watching and spill-over effects associated with FDI. The model which has been used to test the effect of FDI on economic growth, is derived, in conventional manner, from a Cobb-Douglas type production function in which foreign capital is introduced as an input in addition to labour and domestic capital. In the usual notation the production function can be written as follows:

$$Y_{it} = A_{it}\ K^{\alpha 1}{}_{it}\ F^{\alpha 2}{}_{it}\ L^{\alpha 3}{}_{it}\ H^{\alpha 4}{}_{it}\ U_{it} \qquad (1)$$

Where *i* denote the countries, *t* the year, *Y* total output, *A* total factor productivity (TFP), *K* domestic capital stock, *F* foreign capital stock, *L* labour input, *H* human skills capital stock and U an error term.

It is possible to transform equation (1) in linear form by taking the natural logarithmic on both sides. The respective coefficients would then represent the output elasticity with respect to each dependent variable, yield the following expression describing the determinants of output:

$$y_{it} = \alpha_0 + \alpha_1 k_{it} + \alpha_2 f_{it} + \alpha_3 l_{it} + \alpha_4 h_{it} + u_{it} \qquad (2)$$

where small case letters denote that the variables are in natural logarithmic terms and the parameters α_1, α_2, α_3 and α_4 are output elasticities of domestic capital foreign capital, labour and human skills respectively. The dependent

variable, the output level of the country, has been measured by Real Gross Domestic Product.

In view of the well known problems associated with the measurement of capital stock especially in the context of developing countries, the study follows the established practice of numerous previous studies, that *k* and *f* are proxied by the flow of domestic investment (I_d) and flow of foreign direct investment (FDI) respectively (Agrawal, 2000; Blin and Ouattara, 2003 and Darrat et al. 2005). Accordingly, replacing the domestic and foreign capital investment inputs by domestic investment and foreign direct investment yields the following growth equation:

$$y_{it} = \alpha_0 + \alpha_1 I_{d\,it} + \alpha_2 FDI_{it} + \alpha_3 l_{it} + \alpha_4 h_{it} + u_{it} \qquad (3)$$

The model also introduces a group of control variables as additional factors input into the production function, while *X* is a vector containing the log of the "traditional" growth determinants suggested by a large number of empirical studies such as government consumption, openness and inflation (e.g. Alfaro et al. 2004; Bengoa and Sanchez-Robles 2003; Oliva and Rivera-Batiz, 2002 and Borensztein et al. 1998). In panel data analysis the existence of unobservable country-specific growth determinants are to be taken into account. As argued earlier, FDI seems to affect mostly investment efficiency and since this effect is conditioned by the degree of inflation, openness, education and technological gap, (conditional impact see Adelman and Morris, 1967; Findlay, 1978; Borensztein et al., 1998; Bengoa and Sanchez-Robles, 2003), these relationships can be modelled by introducing in the model further variables capturing the interaction between FDI and those variables. This procedure follows directly Jallab et al. (2008) and Li and Liu (2005).

The following equation in panel data framework is used to assess the effect of FDI on economic growth:

$$y_{it} = \alpha_0 + \alpha_1 I_{d\,it} + \alpha_2 FDI_{it} + \alpha_3 l_{it} + \alpha_4 h_{it} + \beta_1 X_{it} + \beta_2 Z_{it} + \eta_i + u_{it} \qquad (4)$$

Where η_i is a country-specific effect represented by country dummies. And *Z* includes the interaction term variables. All variables are expressed in units of US dollars at 1990 prices to remove the inflation effect.

However, there might still be the possibility of endogeneity of the regressors in the sense that that Gross Domestic Product (GDP) may affect the level of foreign investment. To provide evidence for this endogeneity, the

Hausmann (1976) will be performed and if endogeneity is found to be a problem, TSLS and GMM methods will be used.

Moreover there might still be some effect of lagged GDP and other inputs effect on aggregate output as well. Therefore, following Islam, (1995), Caselli, et al. (1996) and Durlauf, et al. (2004) the study adds up a time dimension to the cross-section growth equation and thus we add the lagged value of GDP to incorporate some dynamics into our model. Equation (4) above is the n rewritten as:

$$y_{it} = \alpha_0 + \gamma y_{it-1} + \alpha_1 I_{d\,it} + \alpha_2 FDI_{it} + \alpha_3 l_{it} + \alpha_4 h_{it} + \beta X_{it} + \beta_2 Z_{it} + \eta_i + u_{it} \quad (5)$$

Since FDI may establish backward and forward linkages with domestic industries, FDI can either complement or displace domestic investment. That means the impact of FDI is different from that of domestic investment due to the possibility of FDI to crowd-in domestic investment through creating complementary industries (vertical linkages) (Kugler, 2001), or progress their productivity through knowledge spillovers or its capability to replace domestic investments (Alfaro and Rodriguez-Clare, 2004; Gorg and Strobl, 2002). It can also crowd out domestic investment, however, by technological superiority, better management and more efficient production process, (Javorcik, 2004). According to the conditional perspective, the relationship between FDI and domestic investment relies, among other things, on the degree of complementarity and substitution between domestic investment and FDI, domestic regulatory environment and so forth (Oliva and Rivera-Batiz, 2002).

Following previous studies (e.g. Kumar and Prakash, 2002 and Sahoo, 2006) this study examines the impact of FDI on domestic investment in the framework of a simple dynamic model in which the present values of domestic investment are made a function of past value of itself (dependent variable) as well as present and lagged values of FDI and economic growth variable.

The following equation is used to assess the effect of FDI on domestic investment:

$$I_{dit} = \alpha_0 + \alpha_1 I_{dit-1} + \alpha_2 I_{dit-2} + \alpha_3 FDI_{it} + \alpha_4 FDI_{it-1} + \alpha_5 y_{it} + \eta_i + u_{it} \quad (6)$$

Where I_d and FDI are the domestic investment and foreign direct investment, and y is GDP, η is the country effect and is assumed to be time invariant. u is the classical disturbance term. All variables are expressed in logarithm and monetary units are in US dollars at 1990 prices. The inclusion of current and past values of FDI in the domestic investment equation helps to capture the possibly dynamic nature of effect of FDI on domestic investment. As argued earlier, the study has assumed that the current effect of FDI on domestic investment may be negative as it decreases the market proportion of domestic investors. However, in the past period, FDI could have a positive effect on domestic investment as it increases the demand for local inputs through linkages with local suppliers.

This paper employs different panel data procedures to analyse the role of FDI in the economies of Arab Maghreb Union countries. These countries have different history of FDI, policy regimes and growth patterns between 1990 and 2006. To control for these differences (unobserved country-specific effects), this paper uses Two-stage Least Square Dummy Variables[6]. This technique not only controls for individual heterogeneity but also controls for the endogeneity of FDI (there are two-ways relationships between FDI and economic growth: FDI could stimulate economic growth and/or high economic growth could induce more FDI). We have identified two candidates for instruments – the real bilateral exchange rate[7] and FDI lagged once. To account for endogeneity we apply two methods, namely, instrumental variable (IV) estimation method designed by Anderson and Hsiao (1982)[8] and GMM estimators designed by Arellano and Bond (1991).

To test whether the variables were stationary the IM, Pesaran and Shin (IPS)[9] test for unit roots in the panel data was used. The results are presented in Appendix Table (A). These results show that the null hypothesis is not rejected for all the series tested in levels, although they are stationary after taking the first difference.

Data are based on a panel of four Arab Maghreb Union countries (AMU) for the period 1990 - 2006. Appendix Table (B) describes the variables and

[6] This procedure is the same as the usual procedure for 2SLS, except that the instrument variables include not only exogenous variables but also dummies variables.
[7] Measured in units of US Dollars per domestic currency.
[8] This procedure uses first difference equation to get rid of the country-specific effect.
[9] LLC and IPS are two favourable tests for panel data unit roots, both of tests are based on the ADF prescription. However, LLC hypothesises homogeneity in the dynamics of the autoregressive coefficients for all cross-sectional. In contrast, the IPS is more general in the sense that it allows for heterogeneity in these dynamics. Therefore, it is described as a “Heterogeneous Panel Unit Root Test”.

their sources. Data are drawn from the World Development Indicators (World Bank, 2007), Arab Investment Guarantee Corporation (2007), Key Indicators of Maghreb Countries (Arabic Monetary Fund (AMF), various issues), while the indicators of Libyan human capital are obtained from Libyan General Authority for Information. The paper chooses real GDP growth (y) to represent economic growth. The rate of growth is calculated as the first difference, i.e. $log\ y_{it} - log\ y_{it-1}$. The variable foreign direct investment equals to growth rate of real FDI stock. Domestic Investment (I_d) is obtained by subtracting FDI from gross fixed capital formulation (GFCF). It should be noted that domestic investment includes both private and government investment. It was not always possible to distinguish between the two, therefore it was decided to include domestic investment and not include government investment (as a control variable). The impact on economic growth of FDI differs depending on host country characteristics (conditional impact), including macroeconomic stability (inflation will be used as a proxy for macroeconomic stability), the extent of trade openness (measured by the sum of exports and imports as a percentage of GDP) and the level of technological gap.

The technology gap may heavily influence the existence of positive spillover effects of FDI. For instance if the gap is too large, foreign firms may simply crowd out domestic enterprises. The interaction of FDI with technology gap should help examine the absorptive capacity of foreign technology through FDI.

However, it is difficult to measure technological gap of individual countries, especially for developing countries. There are two approaches to the measurement of technology gap of a country: the indicators approach and the productivity approach. The indicators approach includes the Technology Achievement Index developed by the United Nations Development Program, the ArCo index (Archibugi and Coco 2003) and the Science & Technology Indicator developed by the OECD. Unfortunately, there are no time-series indicators of technology gap for Arab Maghreb Union countries from any of the mentioned sources.

Therefore, this paper uses the productivity approach previously used by Li and Liu (2005) to measure the technology gap as:

$$GAP_{it} = (y\ max_{\ t} - y_{it}) / y_{it}$$

Where: real GDP per capita of the United States is used as y max t, while y_{it} is the real GDP per capita of each AMU country. However, it must be said that for oil-exporting countries, this measure of the technological gap may

not truly reflect their technological abilities, since their GDP per capita is "artificially" boosted by high exports of oil.

Nonetheless, we decided to calculate the variable for each country and use it in the empirical work, although any conclusion derived from the results should be clearly interpreted as tentative.

According to endogenous growth theory, human capital (a combination of labour manpower (labour force) and labour skills) has been recognised as an essential determinant of economic growth. The majority of studies have measured labour power by the absolute or growth in the number of workers. In this paper, labour force has been constructed by using the growth in the number of workers.

However, the measurement of labour skills has been a challenge. Previous papers have used literacy rates, gross enrolment rates or other measures of educational achievements as a proxy for human skill stock. Unfortunately, due to generally limited availability of data, many studies (including this one) will use secondary school-enrolment rate data, which are relatively more complete than other labour skill data, (Borensztein et al., 1998; Bengoa and Sanchez-Robles, 2003). Finally a negative impact is expected for the variable government consumption (as already mentioned government investment is included in domestic investment) because as recent studies by Borensztein et al., (1998) and Campos and Kinoshita, (2002), have shown that government expenditure in general, government consumption in particular is usually financed by increasing taxes; which could lead distortions in the economy and increase input costs. Thus, a negative impact of government expenditures on economic growth is expected. However, government consumption by increasing total domestic demand may have an indirect growth effect by encouraging private investment by firms that may expect an n increase in both sales and profits. This leads to a positive effect on expected output growth. Appendix Table (C) presents the descriptive statistics for the principal variables.

4. The results

This section presents the estimation results for the four AMU countries during 1990-2006 based on the model specification in equations 4, 5 and 6. The study uses simultaneous-equation regression for Two Stage Least Square Dummy Variable (LSDV) regression (4). Table (1) reports the estimation results. As the study showed earlier, the simultaneity problem arises because there is simultaneity between economic growth and FDI. The Hausman simultaneity (1976) test is implemented to examine this simultaneity.

Findings of the Hausman simultaneity test indicate that we do not reject the hypothesis that simultaneity is present in all specifications[10].

In table 1, column 1 reports the results from the estimation of the Cobb-Douglas function augmented by the FDI; column 2 reports the results of the Cobb-Douglas function plus the control variables, while columns 3 reports the results of the models after the interaction terms between FDI and each control variable is introduced. Table 1 also reports the results from the diagnostic tests (the White and ARCH tests for heteroscedasticity and the Breusch- Godfrey test for autocorrelation of the error terms). The study applied the White and the Breusch- Godfrey tests for heteroscedasticity and autocorrelation of the error term. These tests suggest that indeed there are heteroscedasticity and serial correlation problems. The corresponding F-statistic is highly significant in all specifications. That means the equation's coefficients are biased and t-tests, F-tests and confident intervals are inconsistent and should not be interpreted. These tests are important because if the heteroscedasticity or autocorrelation problem exists the method provides inconsistent and inefficient estimators. Moreover, a dynamic panel estimation is then required in equations (5, 6). It is well known that 2LSDV (Two-stage Least Square Dummy Variables) estimates are biased and inconsistent when lagged dependent variables are included in the regression equation (see, e.g. Kiviet, 1995). To cure both econometric problems, the study applies two methods, namely Instrumental Variable (IV, Anderson and Hsiao, 1982) and the first step GMM estimator (Arellano and Bond, 1991).

[10] To apply Hausmann (1976) test for simultaneity (see Gujarati (2003)), it needs to find a set of instrumental variables that are correlated with the variable FDI but not with the error term of GDP equation. The choice of the appropriate instrument is a crucial step. As we mentioned above, we take the FDI_{t-1} and Exchange rate as instruments. To carry out the Hausman test, we run two OLS regressions. In the first regression, we regressed the variable (log) FDI on all exogenous variables and instruments and retrieve the residuals:

$$DLFDI_{it} = f\ (DLFDI_{it-1}\ ,\ DLRex_{it}\ ,\ DLI_{it}\ ,\ DLL_{it}\ ,\ DLH_{it}\ ,\ DLX_{it}\ ,\ DLZ_{it})$$

Then in the second regression, we re-estimate the production function including the residuals from the first regression as additional regressors. If the OLS estimates are consistent, then the coefficient on the first stage residuals should not be significantly different from zero. As can bee seen from the results at the 1% level of significance, the coefficient of residual is statistically significant and therefore, at this level there is simultaneity problem. (all t-values of coefficient of residual and their probabilities are listed in table 1 in the paper).

Table 1 Impact of FDI on economic growth of Maghreb Union Countries 1990-2006. Dependent variable: growth of Real GDP

Independent Variables	Two-stage Least Square Dummy Variables (2LSDV)		
	1	2	3
Constant	-0.088 (-0.981)	-0.154 (-1.294)	**0.072** **(2.421) ****
ΔLn (FDI)	**0.801** **(3.556) *****	**1.067** **(2.856) *****	**1.438** **(4.859) *****
Δln (Domestic investment)	**0.361** **(3.971) *****	**0.349** **(3.126) *****	0.092 (1.103)
ΔIn (Labour Force)	1.663 (0.908)	1.644 (0.749)	0.284 (1.036)
ΔIn(Education)	0.074 (0.483)	0.125 (0.937)	
ΔLn (Government consumption)		0.018 (0362)	
ΔLn Inflation		**0.723** **(1.866) ****	
ΔLn Openness		**-0.297** **(-1.825) ***	
ΔLn (FDI x Inflation)			**-0.409** **(-2.002) ****
ΔLn (FDI x Openness)			**-0.189** **(-1.973) ****
ΔLn (FDI x Education)			-0.189 (-1.349)
ΔLn (FDI x Gap)			**-0.671** **(-5.501) *****
Dummy-Tunisia	-0.041 (-0.395)	-0.065 (-1.078)	-0.019 (-0.561)
Dummy-Algeria	-0.036 (-0.652)	-0.021 (-0.329)	0.002 (0.058)
Dummy-Morocco	0.031 (0.588)	0.058 (0.869)	-0.028 (-0.8)
t-value (Hausman simultaneity test (1976))	-3.84***	-4.05***	-6.07***
F-statistic	11.11***	8.221***	28.31***
X^2 (Redundant fixed effect test)	2.498	3.178	1.915
F White (no cross-terms)	3.775***	5.706***	1.30
F (ARCH)	6.49***	6.88***	4.37**
F (B.G(LM))	3.91***	9.438***	4.81***

Note: - absolute value of t-statistics in parentheses; *, **, ***: statistically significant at 10, 5 and 1% respectively.

To avoid the so-called dummy variable trap, the coefficient of constant represents the intercept of Libya, while the variables Dummy-Tunisia, Dummy-Algeria and Dummy-Morocco represent the intercepts of Tunisia, Algeria and Morocco.

As reported in Table 1, the variable FDI is always positive and significant (at 1% level of significance) irrespective of the specification of the model. Also domestic investment appears to have a positive and significant impact, although the effect disappears once the interaction terms are also included. The variables capturing the effect of human capital (labour force and education) are both positive but not significant. This may be due more to the limitations of the variables used than to the fact that human capital does not

play a role upon economic growth. Among the control variables (column 2) government consumption is not significant, while surprisingly for both inflation and trade openness, the coefficients are significant, but have signs not in line with expectations. Column 3 reports the results of the model with the interaction terms. To avoid the problem of multicollinearity we had to drop the variables Inflation, openness and education from the previous specification. The negative impact of trade openness appears to be confirmed even in conjunction with the variable FDI, while the variable Education is still insignificant (but now with a negative sign). Interestingly, the interaction between FDI and inflation has now a negative sign, suggesting that FDI could be more effective if inflation was lower. Finally, the interaction between FDI and technological gap suggests that the higher the gap, the less effective FDI could be. To provide further support to these results, in Table 2 are reported the results for the models, after introducing a dynamic effect through the lagged value of GDP as required in equations (5, 6). However, 2LSDV (Two-stage Least Square Dummy Variables) estimates are biased and inconsistent when lagged dependent variables are included in the regression equation (see, e.g. Kiviet, 1995). Therefore, the study applies the first step GMM estimator (Arellano and Bond, 1991)[11].

As in the case of Table 1, in table 2, column 1 reports the results from the estimation of the Cobb-Douglas function augmented by the FDI; column 2 reports the results of the Cobb-Douglas function plus the control variables, while columns 3 reports the results of the models after the interaction terms between FDI and each control variable are introduced. In the last column the interaction terms between FDI and the variable GAP is dropped to remove the problem with (2nd order) serial correlation encountered in specification 3 and the failure of the Sargan for over-identification test in column 3. Table 2 also reports the results from the serial correlation first- and second-order tests and the Sargan for over-identification.

As can be seen from tables 2 the first step GMM estimator has been shown to result in more reliable inferences. Also the GMM method allows correcting for heteroscedasticity problem and autocorrelation of the error term. Since both problems seem to be important, the study adopts the approach proposed by Arellano and Bond (1991) as preferred estimation strategy. Although General Method of Moments (GMM) estimation technique is designed for panels with N >T or, at any rate, with a large N, this method has been shown

[11] Since the number of cross sections is four, two-step GMM technique does not allow using more than four instruments to favour identification of our estimates that will yield inconsistent results.

to produce more efficient and consistent estimators compared with other procedures[12].

Table 2 gives the output of the first-step GMM estimator using the moment conditions on the first-differenced equation (5). Independent variables have been instrumented in "differences" with lagged three periods for y_{it-1} and one and two lagged periods for the other independent variables. Sargan/Hansen test does not reject the validity of these of instruments in all columns except column (3). Test for first-order serial correlation rejects the null of no first-order serial correlation but it does not reject the null that there is no second-order serial correlation for all specifications[13].

The results are quite consistent. FDI is again strongly significant (and positive). Apart from one specification (column 3), also domestic investment is significant and positive. The labour force appears to play an important (and positive) role. Finally, the interaction terms behave in a manner consistent to previous findings (negative and significant impact of inflation, trade openness and technological gap).

[12] These findings are in line with the findings of Al-Iriani and Al-Shamsi, (2007) who applied the GMM procedure as outlined in Arellano and Bond (1991) to the balanced panel of the six GCC countries data with 35 annual observations for each country and Sahoo, (2006) who used same technique to examine the dynamic impact of FDI on domestic investment for four South Asian countries over the period 1970-2003.

[13] Actually, the first difference of error term (uit -uit-1) is mathematically related to (uit-1 -uit-2) via the shared term uit-1. So, it is expected a first-order serial correlation in differences. This is not informative for the Arellano-Bond autocorrelation test.

Table 2 Impact of FDI on economic growth of Maghreb Union Countries 1990-2006 Dependent variable: growth of Real GDP

Independent variables	First-step GMM			
	1	**2**	**3**	**4**
ln(GDPt-1)	**0.329 (4.301) *** **	**0.210 (2.408) *** **	0.0035 (1.48)	**0.177 (2.175)** **
ln (FDI)	**0.212 (5.617) *** **	**0.179 (4.544) *** **	**0.974 (18.60)*** **	**0.580 (3.386)*** **
ln (Domestic investment)	**0.304 (5.491) *** **	**0.271 (4.367) *** **	-0.014 (0.725)	**0.289 (5.628)*** **
In (Labour Force)	0.031 (0.203)	**0.423 (2.342) ** **	**1.245 (17.11)*** **	0.01 (0.10)
In (Education)	-0.010 (-0.103)	-0.072 (-0.992)		
Ln (G consumption)		**0.099 (2.873) *** **	**0.028 (3.02)*** **	**0.067 (2.11)** **
Inflation		-0.065 (-0.938)		
Openness		-0.107 (-1.095)		
ln (FDI x Inflation)			**-0.082 (-3.599)*** **	**-0.572 (-1.818)* **
ln (FDI x Openness)			**-0.089 (-2.77)*** **	**-0.189 (-1.627)* **
ln (FDI x Education)			**0.037 (1.73)* **	-0.004 (-0.057)
ln (FDI x Gap)			**-0.803 (-24.38)*** **	
Number of observations	65	63	59	59
Number of countries	4	4	4	4
Serial Correlation test: first- order	(2.026) **	(1.859) *	(3.140) ***	(0.171)
Serial Correlation test: second- order	(0.420)	(0.797)	(-0.344)	(1.415)
Sargan/Hansen test of over-identification restriction: p-value	(65.27) (0.080)	(62.12) (0.130)	(94.47) (0.000)	(58.07) (0.135)

Note: - absolute value of t-statistics in parentheses; *, **, ***: statistically significant at 10, 5 and 1%.

Most variables have statistically significant coefficients with the expected signs. Results from table 2 suggest that past value of GDP of the countries contributes positively towards the present value of GDP confirming the existence of dynamism and endogeineity in the modelling framework. This is consistent with recent studies from Choe (2003) and Al-Iriani and Al-Shamsi (2007). Interestingly the positive and significant coefficient of FDI from the table suggests that FDI has positive impact on economic growth for four AMU countries. This result is consistent with findings in several other MENA countries, for instance, study by Al-Iriani and Al-Shamsi (2007) who have found bi-directional causality between FDI and GDP for six countries comprising the Gulf Corporation Council (GCC). However, these results are not consistent with the findings of Sadik, and Bolbol, (2001) that foreign investment in the Arab countries (Morocco, Saudi Arabia, Tunisia and Egypt) has a negative impact on economic growth. The estimations suggest that growth of human capital has not contributed to the growth of AMU countries, whereas domestic investment and government expenditure have contributed in significant measure.

The literature and empirical studies (conditional perspective) suggest that the impact of FDI on economic growth varies across countries depending upon some determinants of host countries. This study estimated whether the impact of FDI on economic growth of AMU countries depended on host country polices (trade regime and macroeconomic stability) and the local absorptive capacity (human capital level and technology gap between domestic and foreign enterprises). The results show that the estimated coefficient of FDI is positive and significant implying that inflows of FDI into AMU countries actually increase technical efficiencies in these countries. In contrast, the negative and significant estimate associated with the FDI-Open interaction term indicates that in AMU countries the efficiency-enhancing impact of FDI reduces with increased openness. These counter-intuitive findings are, however, in line with the findings of Farrokh, (2007) who suggests that the negative sign of the interaction term between FDI and openness in developing countries may be explained in terms of lack of an efficient infrastructure to facilitate the diffusion of technological and managerial know-how associated with the inflow of FDI to the economy. Moreover, like most other developing countries and the majority of Arab states, the AMU countries have seen several decades of import substitution policies[14]. The import substitution regime, as it is mentioned in previous

[14] Tariff was the major instrument used to influence the Maghreb countries development path. The role of tariff to promote domestic industry effectively began in 1980s by imposing escalation tariff structure

literature and empirical studies (e.g. Bhagwati, 1978; Kohpaiboon, 2002 and Bengoa and Sanchez- Robles, 2003), is unlikely to provide an economic environment conducive to favourable spillover from foreign firms. Furthermore, the protection stemming from this policy is likely to restrict domestic competition, which is the essential determinant that promotes firms to update new technologies in both production and management to enhance productivity. Moreover, because of highly protected domestic markets, which were created by the import substitution policy, FDI becomes a best channel for foreign companies to keep their market share and to gain extra profits.

The important finding of this study is the strong negative and significant coefficient of FDI-inflation interaction term. Thus, the positive annual percentage change of consumer prices in AMU countries would have a negative impact of FDI on economic growth. This finding is consisted with the finding of Jallab, et al. (2008) who found that the direction of the link FDI and growth depends on the threshold of the annual percentage change of consumer price in MENA countries. Thus, it can be concluded that the effect of FDI on economic growth depends on the threshold of the annual percentage change of consumer prices.

The study also estimates whether the impact of FDI on economic growth depends on labour skills (i.e. education). The coefficient of the interaction term of FDI and Education is negative and not significant in column 4, but it is positive and significant in column 3. These results appear to suggest that economic growth cannot be stimulated by simply attracting FDI but also by simultaneously increasing the level of education of the economically active population. These results are in line with the results of Borensztein et al. (1998) and Bengoa and Sanchez-Robles (2003) who find that in countries with low levels of education the impact of FDI on growth is negative, though sometimes insignificant. But in countries with high levels of education, FDI has a strong and positive growth effect. The rationale is that only countries with sufficiently high levels of human capital can exploit the technological spillovers associated with FDI.

In column 3, the technology gap enters the equation and results in a significantly negative coefficient, which implies that the technological level of the AMU countries might be too low to adopt the advanced technologies brought in by foreign investors. Therefore, despite increasing FDI flows into

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where tariff rate ascended from raw materials to finished products. Protection is thus significantly higher in the Maghreb counties than in competing countries from enjoying greater gains from enlarged trade and making them generally less attractive to outward-oriented foreign investment by multinational firms (for more details see Hufbauer and Brunel, 2008).

these countries, their spillover impacts on domestic production are negative. This result confirms earlier studies such as Haddad and Harrison (1993); Sjoholm, (1999b) and Thuy, (2007) that the impact of FDI on economic growth is associated with the technology gap between home and host country. Overall, the panel data findings indicated the fact that FDI has a positive impact upon growth but this impact conditionally depends on some circumstances of host countries.

Finally, the dynamic impact of FDI on domestic investment for the four AMU countries during 1990-2006 is estimated using dynamic panel data analysis first-step GMM developed by Arellano and Bond (1991). The findings of equation (6) are reported in table 3. The estimation results are significant in terms of all diagnostic statistics. The Sargan/Hansen test does not reject the null hypothesis that over-identifying restrictions are valid. That means the instrumental variables are uncorrelated to some set of residuals. Further, it is not possible to reject the null hypothesis of no second-order autocorrelation, which implies that the obtained estimates are consistent (except column 1).

It can be seen from table 3 that the lagged value of domestic investment of the countries contributes positively towards the current value of domestic investment in specifications 1 and 2 confirming the existence of dynamism and endogeineity in the modelling framework. However, in specification 3, the two lagged value of domestic investment have a positive but insignificant coefficient, implying that they do not contribute significantly to domestic investment, once the effect of GDP and FDI is taken into account.

Table 3 Impact of FDI on domestic investment of Maghreb Union Countries 1990-2006 Dependent Variable: Real of Domestic Investment (I_d)

Independent variables	First-step GMM		
	1	2	3
Ln (Domestic investment$_{t-1}$)	**0.325 (2.409) *****	**0.154 (1.625) ***	0.118 (1.052)
Ln (Domestic investment$_{t-2}$)	0.012 (0.103)		0.034 (0.372)
Ln (FDI)	**-0.238 (-1.813) ****	**-0.355 (-3.369) *****	**-0.367 (-3.443) *****
Ln (FDI $_{t-1}$)	**0.392 (2.247) ****	**0.271 (1.981)****	**0.297 (2.149) ****
In (GDP)		**0.717 (5.093) *****	**0.703 (4.939) *****
Number of observations	64	64	64
Number of countries	4	4	4
Serial Correlation test: first-order	4.365 (0.00)	3.383 (0.00)	3.240 (0.00)
Serial Correlation test: second-order	-2.081 (0.04)	-1.204 (0.23)	-1.219 (0.23)
Sargan/Hansen test of over-identification restriction: p-value	46.11(0.55)	50.45 (0.50)	56.88 (0.25)

Note: - absolute value of t-statistics in parentheses; *, **, ***: statistically significant at 10, 5 and 1%.

These findings confirm earlier studies such as Kumar and Prakash, (2002) and Sahoo, (2006). From the dynamic panel data estimation of model (6 column 3) the following interpretation can be provided. FDI, both in the present period and lagged once has a significant effect on domestic investment in the present period. However, the coefficients of the FDI current year and FDI lagged one year have different impacts on economic growth. The coefficient of FDI of the current period has a negative effect on domestic investment while the lagged FDI has positive effect. The pattern observed tends to corroborate the hypothesis of this study (and the findings by Wang (2008)) that the current effect of FDI on domestic investment may be negative as it decreases the market proportion of domestic investors. However, over a longer period, FDI could have a positive effect on domestic investment as it increases the demand for local inputs through linkages with local suppliers. It can be concluded that the impact of FDI on domestic

investment is of a dynamic nature and the nature of effects over times may differ[15].

5. Conclusion

This paper has empirically assessed the impact of foreign direct investment on economic growth, taking account of the macroeconomic environment (degree of trade openness, human capital capacity, macroeconomic stability and technology gap) in the context of the AMU countries during period 1990-2006.

The results indicate that there exists a relationship between economic growth and FDI, in the sense that inflows of FDI are an important determinant of growth of GDP. The estimations also suggest that, on its own, the growth in human capital has not translated into higher economic growth, whereas domestic investment and government spending have contributed to it in significant measure.

The most important findings of this paper are certainly that the positive impact of FDI on the economy depends on its interaction with trade openness, macroeconomic stability (i.e. low inflation), education level and the technology gap. It can be concluded that policies aimed at providing incentives to foreign investors with a view to attracting foreign capital needs to be complemented by other policies to generate economic growth in AMU countries. In other words, the AMU countries would do better by concentrating on human capital, developing domestic firms, creating a stable macroeconomic framework and conditions conducive to productive investments to start up the process of development.

This paper also analysed the effect of FDI inflows on domestic investment. The findings of these estimations corroborate the study hypotheses that FDI inflows affect domestic investments in a dynamic manner with a negative (contemporaneous) impact and a subsequent positive effect. It can be concluded that the negative impact of FDI inflows on domestic investment in the current period attributes to that FDI decreases the market proportion of domestic investors. However, the positive effect of FDI in lagged period

[15] As can be seen from results in table 3 the impacts of FDI on domestic invest in the long-run (no time) are slightly negative for AMU countries over period 1990-2006.

attributes to that FDI increases the demand for local inputs through linkages with local suppliers.

In conclusion, it is obvious that the impacts of FDI on economic growth and domestic investments lay virtually on the type or efficiency of FDI. Some kinds of FDI tend to be more positive developmental externalities than others. In that context AMU countries should pay attention to the efficiency of FDI inflows besides attracting greater amounts of FDI. Moreover, the results of the impact of foreign direct investment on economic growth, taking account of macroeconomic environments have shown that AMU countries policies (monetary and trade policies) have an important bearing on the quality of FDI inflows received (rent seeking and profit-seeking).

Since our results indicate that the positive impact of FDI on economic growth of AMU depends on local absorptive capacity, further research about the relationship between FDI and economic growth in the context of the AMU countries could be enriched substantially by studies at micro-level, by investigating the impact of FDI inflows on economic growth through their impact on domestic firms' operations.

Appendix Table A

Stationarity test results

Variable Name	Using Heterogeneous Panel Unit Root Test (IPS)		Variable Name	Using Heterogeneous Panel Unit Root Test (IPS)	
	Level	1st Difference		Level	1st Difference
Log real GDP	2.166	-4.340***	log of the real government consumption	-0.521	-4.180***
Log of real stock of FDI	2.037	-3.753***	Log Open	-1.443*	-3.825***
Log of real of domestic investment	1.619	-1.961**	Log Gap	-0.399	-2.789***
Log of Human skill	0.353	-3.836***	Log Inflation	-0.313	-2.579***
Log of labour force	0.284	-4.245***	Log of real exchange	-0.562	-2.626***

Note: *** significant at 1%, ** significant at 5%, * significant at 10%.

Appendix Table B

Variables and definition and sources

Variable	Definition	Source
GDP	Real Gross Domestic Product at constant 1990 US dollars prices	Arabic Monetary Fund (AMF) (various issues)
FDI	Real annual FDI stock at constant 1990 US dollars prices	Arab Investment Guarantee Corporation (2007)
I_d	Domestic Investment measured as real annual GFCF at constant 1990 US dollars prices subtracted from FDI inflows	GFCF were obtained from (Arabic Monetary Fund (AMF), various issues)
EDU	Human skills measured as total number of students in secondary school (thousands of students)	World Development Indicators (World Bank, 2007) except data of Libya were obtained from Libyan General Authority for Information (various issues)
FORCE	Labour force measured as absolute number of labours (thousands of people)	World Development Indicators (World Bank, 2007) except data of Libya were obtained from Libyan General Authority for Information (various issues)
GCONS	Real Government consumptions at constant 1990 US dollars prices	Arabic Monetary Fund (AMF) (various issues)
EXCH*	Real Exchange rate = ln(domestic consumer prices index / USA prices index / domestic currency per [$])	AMU domestic currency: Arabic Monetary Fund (AMF) (various issues). USA prices index: World Development Indicators (World Bank, 2007)
OPEN	Sum of exports and imports as a share of real GDP	Arabic Monetary Fund (AMF) (various issues)
GAP	Deference of GDP per capita (USA) and GDP per capita (country) as share of GDP per capita (country)	AMU GDP per capita data were obtained from Arabic Monetary Fund (AMF) (various issues) and USA GDP per capita were obtained from World Development Indicators (World Bank, 2007)
INF	Inflation measured as the annual percentage change of consumer prices	Arabic Monetary Fund (AMF) (various issues)

(*) this variable is used as instrument in Two-stage Least Square Dummy Variables (2LSDV) method.

Appendix Table C

Statistical Description of Data

Series	No. of Obs.	Mean	Std. Deviation	Minimum	Maximum
Δln(GDP)	64	0.031201	0.135263	-0.402853	0.273781
Δln(FDIStock)	64	0.091390	0.182787	-0.360160	0.701790
Δln(Rexch)	64	0.100291	0.189952	-0.146912	0.920096
Δln(OPEN)	64	0.019228	0.140506	-0.437154	0.509099
Δln(G-Cons)	64	0.015645	0.437218	-2.146778	2.442800
Δln(GAP)	64	0.005836	0.149029	-0.246457	0.498398
Δln(INF)	64	0.058298	0.085085	-0.100083	0.275356
Δln(D-Inves)	64	0.003774	0.191609	-0.616441	0.433424
Δln(Forc)	64	0.034616	0.011551	-0.000287	0.079674
Δln(Edue)	64	0.024155	0.171159	-0.736733	0.434305

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