
The Impact of Foreign Direct Investment on Economic Growth in an Era of Globalization: A VAR Analysis for North African Countries

ZENASNI Soumia¹ and BENHABIB Abderrezak²

Tlemcen School of Economics, Algeria

Abstract:

The purpose of this work is to empirically examine the effects of foreign direct investment (FDI) and on economic growth of North African economies in the era of globalization. The study of this relationship has largely been analyzed in the literature. Our empirical investigation uses VAR model approach with quarterly data during the period 1980-2010. Results suggest that FDI plays a positive role in boosting the economic growth of North African countries. They also emphasize that these countries has been relatively successful over the last decade in attracting FDI inflows that have not shown a significant performance. In the other hand, impulse response functions indicate that the existence of external financial shocks can be followed by depreciation in domestic and external variables as well as in FDI flows and real GDP fluctuations. Consequently, this can be harmful to the economic activity; that's why North African countries should reinforce their economies through the establishment a monetary, commercial, and financial union between them as well as the adoption of a common currency and the creation of a free trade area.

Keywords: FDI, economic growth, globalization, North African countries, VAR approach.

JEL Codes: F21, F43, F65, G01, C3.

Introduction

Increased globalization over the last two decades has led to strong growth in international business activity and foreign direct investment (FDI). Since the early 1990s, FDI became the largest single source of external finance for developing countries. This important source of private external financing has grown at a phenomenal rate, and the world market for it has become more competitive. Globalization covers a wide array of economic activities, including international trade, international migration, and international investment. An accurate assessment of whether globalization is good for economic growth requires that we examine the growth effects of all of the components of globalization. Indeed, the rapid growth of FDI and its overall magnitude had aroused many studies relating on the determinants, the transmission channels and the effects of FDI on economic growth in developed and developing countries. Like other developing economies, North African countries have developed in recent times, an economic policy aimed at promoting the development of its economy through FDI. However, the flows of these attracted investments remain relatively low and their impact on growth is ambiguous.

Along with the rapid growth of FDI flows, abundant theoretical and empirical literature has developed in recent years to determine the theoretical advantages of these flows on the economy of each country (*Bornschiefer and al 1978; Borensztein and al 1992; De Gregorio 1993; Borensztein and al 1998; Choe 2003;*

¹ ZENASNI Soumia, PhD, Economics and Finance, Tlemcen School of Economics, Algeria.

E-mail : soumia_zenasni1@yahoo.fr

² BENHABIB Abderrezak, Professor of Economics and Management, Director of Tlemcen School of Economics, Algeria.

E-mail : abenhajib1@yahoo.fr

Their results are mixed; some of them have shown that there is no positive relationship between foreign direct investment and economic growth (*Bornschier and al 1978; Alfaro and al 2002; Carkovic and Levine 2002; Effendi and al 2003; Massoud 2008*). While other studies have found that FDI positively and significantly affect the long-term economic growth (*Fry 1993; De Mello 1999; Bengoa and al 2003; Basu and al 2007; Türkcan and al 2008; Agrawal and Khan 2011; Adeniyi and al 2012*). Moreover, the ongoing debate about the benefits and costs of globalization has prompted a resurgence of interest in analyzing the relationship between macroeconomic variables and economic growth. That's why it is necessary to take into consideration the existence of some disturbances, crises, or shocks which can adversely affect the link between FDI and economic growth. In this study, we examine the potential effects of external financial crisis over this link using vector autoregressive (VAR) approach.

The objective of this work is to investigate the effects of FDI on economic growth of the North African economies in the era of globalization by addressing the following issue: *taking into consideration the likely impact of external financial shocks, what are the potential effects of foreign direct investment on the North African economic growth?* Using a VAR model estimation for the three North African countries (Algeria, Tunisia, and Morocco) during the period 1980Q1-2010Q4, we find that, under particular economic and financial conditions (such as the adoption of an export promotion trade regime, restoring international competitiveness and diversification of exports), Results suggest that FDI plays a positive role in boosting the economic growth of North African countries. They also emphasize that these countries has been relatively successful over the last decade in attracting FDI inflows that have not shown a significant performance.

This paper is organized as follows. The first section presents a selective survey of the literature on the link between FDI and economic growth. Thereafter, the second section highlights the characteristics of economic growth and FDI in North Africa. Section 3 describes the data and the estimation methods. Finally, section 4 presents the empirical results.

1. Literature review

In the economic literature, there is a large body of studies on the impact of foreign direct investment (FDI) on economic growth. This literature explores various aspects of the spillover effects of FDI such as (i) technology transfer (ii) introduction of new processes (iii) productivity gains and (iv) opening of new market opportunities. FDI is usually viewed as a channel through which technology is able to spread from developed to developing countries. According to *Chen (1992)*, the positive developmental role of FDI in general is well documented. He argues that FDI produces a positive effect on growth in host countries.

Moreover, *Blomström and Kokko (1997)* reveal that economic theory provides two approaches to studying the effects of FDI on host countries. One is rooted in the standard theory of international trade and dates back to MacDougall (1960). This is a partial equilibrium comparative-static approach intended to

ZENASNI Soumia & BENHABIB Abderrezak

examine how marginal increments in investment from abroad are distributed. The main prediction of this model is that inflows of foreign capital -whether in the form of FDI or portfolio capital- will raise the marginal product of labor and reduce the marginal product of capital in the host country. The other approach departs from the theory of industrial organization, and was pioneered by Hymer (1960)¹. This approach suggests that to be able to invest in production in foreign markets, a firm must possess some asset (for example, product and process technology or management and marketing skills) that can be used profitably in the foreign affiliate. Firms investing abroad therefore represent a distinctive kind of enterprise. In their study, *Blomström and Kokko (1997)* suggest that foreign direct investment may promote economic development by helping to improve productivity growth and exports.

In a research focusing on China, *Dess (1998)* finds that the FDI affects Chinese growth through the diffusion of ideas. Indeed, FDI presents a significant positive effect on Chinese long-term growth through its influence on technical change. Although some empirical literature suggests a positive correlation between FDI and growth, several others posit that no such linkage exists. In their study elaborated on the benefits of FDI for domestic firms, *Aitken and Harrison (1999)* show that the net effect of FDI on firm level productivity is negligible. *Bosworth and al. (1999)* used panel regression techniques to evaluate the impact of capital inflows on investment on a group of 58 developing countries for the period 1978-95. They found that FDI flows have a positive (and almost one for one) impact on investment, whereas portfolio flows have no discernible effect. Additionally, *Ogutucu (2002)* argues that the foreign direct investment is a major catalyst for the development and the integration of developing countries in the global economy.

Using cointegration technique and the error correction model to examine the link between FDI and economic growth in India, *Chakraborty and Basu (2002)* suggest that FDI does not cause India's GDP. In the same perspective, *Alfaro (2003)* has made a sectorial panel OLS analysis, using cross-country data over the period 1981-1999. *Alfaro* affirms that, although it may seem natural to argue that FDI can convey great advantages to host countries, the benefits of FDI vary greatly across sectors by examining the effect of foreign direct investment on growth in the primary, manufacturing, and services sectors. The main results indicate that FDI in the primary sector tend to have a negative effect on growth, while investment in manufacturing a positive one, and the effect of investment on growth in service sector is ambiguous.

Furthermore, *Kohpaiboon (2003)* has studied the Thailand's case (over the period 1970-1999) to examining the causal link between FDI and economic growth. By introducing an export variable in the growth-FDI equation, he finds that the growth impact of FDI tends to be greater under an export promotion trade regime compared to an import-substitution regime. These results have been affirmed by *Balamurali and Bogahawatte (2004)* in a study elaborated for the case of Sri Lanka. The authors emphasize that a better trade policy reforms (promotion of foreign direct investment and domestic investment) and restoring international

¹ Other important contributions have made by *Buckley and Casson (1976)*, *Caves (1971)*, *Dunning (1973)*, *Kindleberger (1969)*, and *Vernon (1966)*.

competitiveness to expand and diversify the country's exports have the potential of accelerating economic growth in the future. Moreover, according to *Kose and al. (2005)* indicate that there are various direct and indirect theoretical channels through which increased financial flows can enhance growth. The direct channels include augmentation of domestic savings, reduction in the cost of capital through better global allocation of risk, development of the financial sector, and transfer of technological knowledge. The main indirect channels are associated with promotion of specialization and inducement for better economic policies.

Baharumshah and Thanoon (2006) used a dynamic panel model to examine the link between FDI and growth in East Asian economies. They demonstrated that FDI positively contributes in the process of growth in studied countries. In other words, this study has argued that countries that are successful in attracting FDI can grow faster than those that deter FDI. Based on a number of determinants of the linkage between FDI and economic growth (such as human capital, learning by doing, exports, macroeconomic stability, level of financial development, public investment and other determinants), *Neuhaus (2006)* shows that there are three main channels through which FDI can influence the technological change, improve the capital stocks and generate economic growth: (a) direct transmission (through "Greenfield Investments"); (b) indirect transmission (through "Ownership Participation") and (c) second-round transmission (through "Technology Spillover").

In turn, the study of *Alfaro et al. (2006)* found that increased levels of FDI, regardless of the reason of the increase, generate three times more additional growth in financially well-developed countries than in financially poorly-developed countries. Based on the Generalized Least Squares models, the study of *Bhandari et al. (2007)* illustrate that an increase in the stock of domestic capital and inflow of foreign direct investment are main factors that positively affect economic growth in East European countries. Besides, *Won et al. (2008)* focused their analysis on the case of Asian newly industrializing economies. Using the panel vector autoregressive models, results show that the openness of the economy, measured by exports and FDI inflows, is the most common economic factor attributed to the rapid growth of the Asian newly industrializing economies.

In addition, *Anwar and Nguyen (2010)* examine the link between FDI and economic growth in Vietnam over the period 1996-2005. Using a simultaneous equations model, their results suggest that the impact of foreign direct investment on growth in Vietnam will be larger if more resources are invested in education, financial market development and in reducing the technology gap between the foreign and local firms. *Tiwari and Mutascu (2010)* have conducted an empirical analysis to examine the effects of FDI on economic growth for 23 Asian countries over the period 1986-2008. Results show that FDI and exports enhance the economic growth of Asian countries.

Agrawal and Khan (2011) investigated the impact of FDI on economic growth in five Asian countries (China, Japan, India, South Korea, and Indonesia) over the period 1993-2009. This study confirms that FDI

promotes economic growth and further provides an estimate that one dollar of FDI adds about 7 dollars to the GDP of each of the five countries. Moreover, *Adeniyi and al (2012)* examines the causal link between FDI and economic growth with financial development in some small open developing economies. Using a trivariate framework which applies Granger causality tests in a vector error correction (VEC) over the period 1970-2005, results suggest that the extent of financial sophistication matters for the benefits of foreign direct investment on economic growth in studied economies.

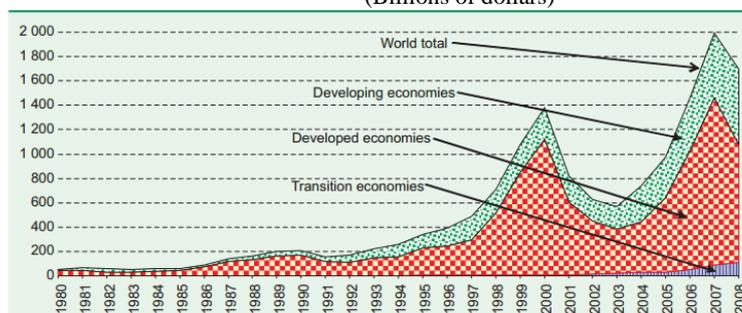
Finally, we can observe that several studies have examined this relationship in particular in the case of developing countries. The major part of them stress that FDI, adjusted to other determinants, have a significant positive effect on economic growth.

2. Overview of FDI flows in developing countries

FDI flows to developing countries' sectors increased rapidly in the late 1980s and early 1990s. Attracting FDI has been one of the key policy goals of developing countries and today everybody agrees that FDI has been an important vehicle to accelerate enterprise modernization and restructuring by introducing new technologies, management techniques and marketing practices. Contrary to other capital flows, FDI is less volatile and does not show a pro-cyclical behavior. It has therefore become the "favorite capital inflows" for developing countries. The FDI increased rapidly during the late 1980s and the 1990s in almost every region of the world revitalizing the long and contentious debate about the costs and benefits of FDI inflows. On one hand, many authors would argue that, given appropriate policies and a basic level of development, FDI can play a key role in the process of creating a better economic environment. On the other hand potential drawbacks do exist, including a deterioration of the balance of payments as profits are repatriated and negative impacts on competition in national markets.

According to the *UNCTAD World Investment Report (2009)*, turmoil in the financial markets and the worldwide economic downturn progressively affected global FDI in 2008 and in the first half of 2009. After uninterrupted growth in FDI activity in the period 2003-2007, global FDI inflows fell by 14% in 2008 to 1,697 billion \$, from a record high of 1,979 billion \$ in 2007 (figure 1). While the 2008 level was the second highest in history, in late 2008 and the first few months of 2009, significant declines were recorded in all three components of FDI inflows: equity investments, other capital (mainly intercompany loans). Such a decline was caused mainly by the financial crisis that developed countries have experienced following the collapse of Lehman Brothers (one of the largest financial institutions in the United States).

Figure 1: FDI inflows, global and by groups of economies, 1980-2008
(Billions of dollars)



Source: UNCTAD (2009), "World Investment Report 2009: Transnational Corporations, Agricultural Production and Development", *United Nations Conference on Trade and Development*, New York and Geneva, p 4.

Moreover, the pattern of FDI flows has varied by groups of economies. FDI inflows and outflows of developed countries plunged in 2008, with inflows declining by 29%, to 962 billion \$, and outflows by 17%, to 1,507 billion \$ (*UNCTAD World Investment Report, 2009*). In contrast, developing and transition economies saw FDI inflows rise in 2008 to record levels for both, with their shares in global FDI inflows growing significantly between 2003 and 2007. The decline in FDI flows in 2008-2009 in developing countries reflects the impact of the financial crisis of 2007. However, most developing countries are disappointed about the continuing high levels of protection and subsidies for agricultural goods, mainly in developed countries. These measures hamper developing-country exports of agricultural products, and undermine the effective use of their comparative advantages.

3. Characteristics of economic growth and FDI in North Africa

In recent years, foreign direct investment is considered as a key factor towards progress in North African countries. This type of external funding has shown an increasing trend over time which can reflect, partly, the large-scale privatization programs that were implemented by these economies in recent years (*Reggad 2008*). The sustained efforts at policy reforms in North African countries (including privatizations by host countries, and intensified search for natural-resource), drove FDI inflows to the North African sub-region to \$24 billion, although this was slightly lower than in 2007. In North Africa, there was an increase in FDI inflows, which was driven by investments in their oil and gas industries (in Algeria), and the agriculture, manufacturing and tourism (in Morocco and Tunisia), in addition to privatizations of public companies engaged in the oil industry (*UNCTAD World Investment Report, 2009*).

Table 1 provides some basic data on three North African countries as well as some statistics that are particularly relevant in the context of our research.

Table 1: Overview of AMU countries in 2008

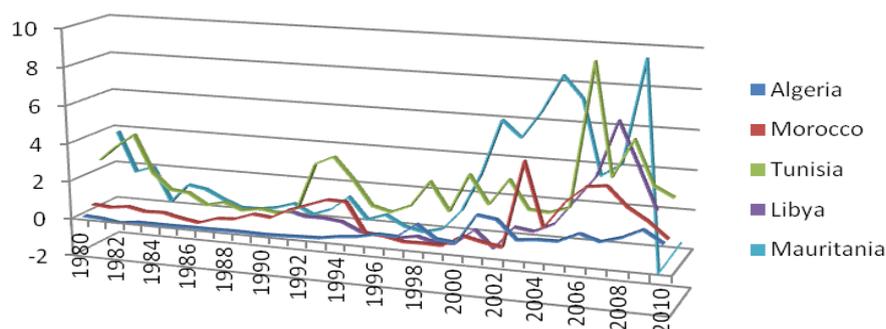
Country	Pop'n M	GDP US \$ m	GDP per capita US \$	FDI inflow US \$ m	FDI stock US \$ m	OPEC Y/N	WTO Yr joined
Algeria	34.4	166,545	4,845	2,646	14,458	Yes	No
Morocco	32.1	88,883	2,769	2,388	41,001	No	1995
Tunisia	10.3	40,309	3,903	2,761	29,083	No	1995

Source: Rogmans T. J. (2011), "The determinants of Foreign Direct Investment in the Middle East North Africa Region", PhD thesis, Supervised by Prof. Dr. Ebber H.A., Nyenrode Business University, November, p 61.

From the table it can be seen that the region's top economy in terms of overall GDP is Algeria, the member of OPEC (Organization of the Petroleum Exporting Countries). In addition, WTO membership is important for countries in the sense that member states commit to a rules based framework for international trade and investment. In terms of Foreign Direct Investment, as per 2008, the three North African countries (Algeria, Morocco, and Tunisia) account between 2 and 3 US million \$ of the FDI inflows; table shows also that Morocco is the most important country in the region in terms of FDI stock with 41 US million \$. It is true that a substantial increase was recorded in these countries, but it is still insufficient on a global scale (*Reggad 2008*).

The achievements of North African countries in attracting FDI are still low compared to their potentiality and their performance¹ (see figure 2). This lower rate is mainly related to some economic obstacles. Comparing FDI between the five North African countries (Algeria, Morocco, Tunisia, Libya, and Mauritania), we can observe that Algerian economy has the most lower rate in attracting FDI; this situation is caused by the period of significant crisis that faced the country in the 1990s, as well as some other economic and financial barriers.

Figure 2: FDI, a comparison among five North African countries (net inflows, % of GDP)



Source : The African Development Indicators, World Bank, 2012.

¹ In the case of Algeria for example, 97.5% of Algerian economic returns are generated by the oil; so there are great potentialities and opportunities (in the entire region) to attract more foreign investments.

4. Empirical analysis

4.1 Methodology and data

4.1.1 Descriptive data

To examine the effects of foreign direct investment and economic growth in the three Maghreb countries (Algeria, Tunisia, and Morocco), we use data from 1990 to 2010. The data utilized for the analysis have been collected from a various international databases: the World Development Indicators (WDI), the CNUCED, the UNCTAD stat, the SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012, the Chinn-Ito index (2010)¹, and the World Economic Outlook Database (IMF), 2012. The exact source for each variable is presented in appendix (table A-1).

4.1.2 Estimation methodology

We use the recent developments in time series econometrics to analyze and determine causal relationships between FDI and economic growth in three North African countries during the period 1980-2010. We first examine long-run equilibrium (cointegration) relationship among variables. Then, we use the econometrics of panel data; we estimate a dynamic panel system GMM estimator proposed by *Blundell and Bond (1998)* and tested by *Berthelemy and Demurger (2000)*, *Carkovic and Levine (2002)*, *Basu and Guariglia (2007)*, *Tiwari and Mutascu (2010)*, *Agrawal and Khan (2011)*. This approach will be applied using three different econometric methods with fixed effects, Ordinary Least Squares method (OLS), Two Stages Least Squares method (TSLS), and Generalized Method of Moments (GMM).

Moreover, in the empirical literature, several studies make it very clear that the relationship between FDI and economic growth is complex, given that the world has known these last two decades the economic and financial globalization phenomenon increasingly expanding. To test this relationship, they applied constant parameters VAR and factor augmented VAR approaches (*Choe 2003; Balamurali and Bogahawatte 2004; Hansen and Rand 2006; Won et al. 2008*). In other words, it is necessary to take into consideration the existence of some disturbances, crises, or shocks which can adversely affect the link between FDI and economic growth. In this study, we examine the potential effects of external financial crisis over this link using vector autoregressive (VAR) approach.

The VAR is a technique that enables one to perform variance decomposition and examine the symmetry in each country's response to macroeconomic fluctuations; in other words, it allows us to observe how an unexpected change in one variable affects other variables in the model. The regression estimation using the VAR technique requires for testing the stationarity of the variables as well as the cointegration relationships. In fact, *Maddala and Kim (1998)* indicate that in the cases where the variables are neither stationary nor

¹ The Chinn-Ito index (*KAOPEN*) is an index measuring a country's degree of capital account openness. This index is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

cointegrated, the VAR model must be estimated using the first differences. However, if there are r cointegration relationships, the model must be estimated with r stationary combinations and $(n-r)$ variables of first differences (Benhabib et al. 2010). Before implementing the VAR model, it is necessary to check whether the variables are stationary. We employ the ADF test (Dickey and Fuller, 1981) and the PP test (Phillips and Perron 1988). The PP test corrects, in a non-parametric way, the possible presence of autocorrelation in the standard ADF test. Then, we use the Johansen Cointegration test to examine the long-run equilibrium relationship among variables.

4.2 Regression specification

From the examination of theoretical and empirical literature review, aimed to study the effect of FDI on economic growth, we specify the model of our study. Based on two endogenous variables (namely Y_{1t} and Y_{2t}) and multivariate exogenous variables (control variables), the basic VAR model has the following general equation:

$$Y_{1t} = \alpha_1 + \sum_{j=1}^k \beta_{1j} Y_{1t-j} + \sum_{j=1}^k \delta_{1j} Y_{2t-j} + \sum_{k=1}^k \gamma_{1k} X_k + \mu_{1t} \dots \dots \dots (1)$$

$$Y_{2t} = \alpha_2 + \sum_{j=1}^k \beta_{2j} Y_{1t-j} + \sum_{j=1}^k \delta_{2j} Y_{2t-j} + \sum_{k=1}^k \gamma_{2k} X_k + \mu_{2t} \dots \dots \dots (2)$$

where $Y_{t-j} = (Y_1, Y_2)_{t-j}$ is the j^{th} lagged variable of $(Y_1, Y_2)_t$ and X_k is the k^{th} exogenous variable, and it is assumed that each of the error terms does not have serial correlations or autocorrelations. In general, these assumptions could be accepted because the model has been using the lagged dependent variables.

The econometric model of this work is based upon studies undertaken by Alfaro (2003), Balamurali and Boghawatte (2004), Anwar and Nguyen (2010). It is as follows:

$$GDP_{i,t} = \alpha_1 + \beta_1 GDP_{i,t-1} + \lambda_1 FDI_{i,t-1} + \delta_1 DINV_{i,t} + \phi_1 TOPEN_{i,t} + \chi_1 DShochs_{i,t} + \gamma_1 CONTROLS_{i,t} + \mu_{1i,t} \dots (1')$$

$$FDI_{i,t} = \alpha_2 + \beta_2 FDI_{i,t-1} + \lambda_2 GDP_{i,t-1} + \delta_2 DINV_{i,t} + \phi_2 TOPEN_{i,t} + \chi_2 DShochs_{i,t} + \gamma_2 CONTROLS_{i,t} + \mu_{2i,t} \dots (2')$$

where $GDP_{i,t}$ is a variable representing the logarithmic of growth in real GDP per capita for countries. $FDI_{i,t}$ represents foreign direct investment, it measures the inflows of capital accruing to country i in year t . $DINV_{i,t}$ is the nationally owned investments defined as gross fixed capital formation. $Topen_{i,t}$ represents the trade openness measured by the sum of imports and exports in percentage of GDP. $Dshochs_{i,t}$ is a dummy variable of external shocks taking a value of one if country i experiences a financial disturbances in period t and zero otherwise. $CONTROLS_{i,t}$ is a vector of control variable of the determinants of FDI and growth (country fundamentals and other determinants on FDI); it contains $FDev_{i,t}$ is a measure of the development of domestic financial systems; it is calculated by the money supply as a share of per capita GDP; $Inf_{i,t}$ variable measures the inflation rate in the three North African countries and represents the annual rate of change of the Consumer Price Index; $ExRate_{i,t}$ denotes the real exchange rate variable calculated from nominal exchange rates and CPIs¹; $Kaopen_{i,t}$ variable that measures the extent of openness in capital account transactions. $\mu_{i,t}$ is the error term.

¹ This study uses the real exchange rate as an indicator of macroeconomic stability in AMU countries.

5. Estimation Results

5.1 Stationarity and Cointegration tests results

5.1.1 Stationarity test results

Before testing the long-run relationship among variables, it is necessary to check whether studied series are stationary. We employ the ADF test (*Dickey and Fuller, 1981*) and the PP test (*Phillips and Perron, 1988*). The PP test corrects, in a non-parametric way, the possible presence of autocorrelation in the standard ADF test. Then, we use the Johansen Cointegration test to examine the long-run equilibrium relationship among variables.

Table 2 provides the results of the Augmented-Dickey-Fuller (ADF) and Phillips-Perron (PP) tests of the variables. The results of the unit root tests conducted on the exogenous and endogenous variables reveal that, in the 1st differences, the natural logs of real per capita growth, foreign direct investment, gross domestic investment, trade openness, financial development, inflation, nominal effective exchange rate, and capital account transactions all are stationary. Given these test results, we can conclude that these time series are integrated of order one, or $I(1)$.

Table 2: Unit Root Test Results

Variables in 1 st Differences	Algeria		Morocco		Tunisia	
	ADF Test	PP Test	ADF Test	PP Test	ADF Test	PP Test
GROWTH	- 3.926*** (0.0055)	- 4.132*** (0.0033)	- 4.599*** (0.0010)	- 6.299*** (0.0001)	- 5.035*** (0.0003)	- 5.022*** (0.0003)
FDI	- 3.473** (0.0209)	- 7.274*** (0.0001)	- 4.612*** (0.0010)	- 9.722*** (0.0000)	- 6.715*** (0.0001)	- 6.644*** (0.0001)
DINV	- 4.837*** (0.0005)	- 4.826*** (0.0006)	- 4.768*** (0.0006)	- 4.769*** (0.0006)	- 3.371** (0.0209)	- 3.486** (0.0158)
TOpen	- 3.196** (0.0317)	- 3.606** (0.0119)	- 7.619*** (0.0000)	- 8.027*** (0.0000)	- 4.536*** (0.0012)	- 4.966*** (0.0004)
FDev	- 4.382*** (0.0018)	- 4.373*** (0.0018)	- 4.875*** (0.0005)	- 5.724*** (0.0001)	- 4.726*** (0.0008)	-10.365*** (0.0000)
Inf	- 5.991*** (0.0001)	- 5.981*** (0.0001)	- 3.105** (0.0409)	- 6.857*** (0.0001)	- 2.672* (0.0839)	- 3.944*** (0.0028)
ExRate	- 4.827*** (0.0006)	- 4.817*** (0.0006)	- 3.645** (0.0111)	- 6.666*** (0.0001)	- 4.812*** (0.0007)	- 4.839*** (0.0007)
Kaopen	- 5.385*** (0.0001)	- 5.385*** (0.0001)	- 5.228*** (0.0002)	- 6.354*** (0.0001)	- 5.196*** (0.0002)	- 5.196*** (0.0002)

***: variable stationary at significant levels at 1%, 5%, and 10% (-3.679, -2.967, -2.622 respectively).

Values between brackets are probabilities.

5.1.2 Cointegration test results

Table 3 presents the results of the Johansen cointegration test. It shows the existence of a cointegration relationship between the variables in all countries (Algeria, Morocco, and Tunisia).

Table 3: The Johansen Cointegration test results

Hypotheses of cointegration equation	Algeria		Morocco		Tunisia	
	Trace Test	Max. Eigen Test	Trace Test	Max. Eigen Test	Trace Test	Max. Eigen Test
None	49.013* (0.0387)	28.365* (0.0397)	47.153 (0.0581)	31.928* (0.0129)	45.461 (0.0825)	28.548* (0.0375)
At most 1	20.648 (0.3799)	12.614 (0.4883)	15.224 (0.7654)	10.929 (0.6543)	16.912 (0.6465)	11.219 (0.6254)
At most 2	8.034 (0.4618)	6.427 (0.5590)	4.924 (0.8783)	4.284 (0.8282)	5.693 (0.7314)	5.688 (0.6534)
At most 3	1.606 (0.2050)	1.606 (0.2050)	0.010 (0.9186)	0.010 (0.9186)	0.004 (0.9465)	0.004 (0.9465)

* denotes rejection of the hypothesis at the 0.05 level.
Values between brackets are probabilities.

This table shows that, in Morocco and Tunisia, there is one cointegration equation at the 0.05 level based on the maximum eigenvalue test. In the case of Algeria, there is one cointegration equation at the 0.05 level based on the trace test, as well as the maximum eigenvalue test. Moreover, the stationarity and the cointegration test results will allow us to better specify the dynamic panel GMM estimator.

On the other hand, cointegration tests of the four variables for each country give us the results interpreted in the following equations:

$$\text{Algeria: } \text{GROWTH} = 0.288 \text{ FDI} + 9.086 \text{ DINV} - 2.635 \text{ TOPEN} - 0.311 \text{ CONTROLS}$$

$$(0.069) \quad (1.260) \quad (0.204) \quad (0.084)$$

$$\text{Morocco: } \text{GROWTH} = 0.069 \text{ FDI} + 1.046 \text{ DINV} - 2.047 \text{ TOPEN} + 0.119 \text{ CONTROLS}$$

$$(0.019) \quad (0.235) \quad (0.363) \quad (0.026)$$

$$\text{Tunisia: } \text{GROWTH} = 0.381 \text{ FDI} + 2.402 \text{ DINV} - 1.175 \text{ TOPEN} + 0.163 \text{ CONTROLS}$$

$$(0.051) \quad (0.775) \quad (0.330)$$

From the regression results, we find that foreign direct investment (FDI) is an important factor contributing to stimulate the economic growth of North Africa. However, its effect is relatively small; this can be justified by the many obstacles to attracting foreign investment projects. Moreover, the results show that the trade openness variable affects negatively and significantly the economic growth in the three countries, which means that the import and export policies in North Africa are not significant. In addition, the control variables (trade openness, financial development, exchange rate, etc.) have a positive impact on Moroccan and Tunisian economic growth; this is due to the implementation in recent years by the economic authorities of reforms in different economic and financial sectors. Nevertheless, the impact is negative for the Algerian growth rates, which means that the macroeconomic policy reforms are not significant.

5.2 Dynamic panel GMM test results

The empirical analysis using the dynamic panel GMM method gives the results reported in Tables 4, 5 and 6.

Table 4: FDI and economic growth, Least Squares method (LS)

Variables	Algeria	Morocco	Tunisia
FDI	1.716 (0.067)	3.017** (0.027)	6.062*** (0.066)
DINV	19.130*** (0.110)	17.457*** (0.103)	11.569*** (0.134)
TOPEN	- 3.997*** (0.139)	- 1.519 (0.662)	- 2.846* (0.081)
CONTROLS	0.994 (0.038)	2.782* (0.035)	0.271 (0.077)

Dependant variable: growth rate of real per capita GDP. (***), (**) and (*) indicate statistical significance at the 1%, 5% and 10% level, respectively. Values between brackets are Standard Error.

Table 5: FDI and economic growth, Two-Stage Least Squares method (TSLS)

Variables	Algeria	Morocco	Tunisia
FDI	1.599 (0.111)	1.625 (0.049)	3.375** (0.119)
DINV	6.799*** (0.368)	4.427*** (0.296)	3.241** (0.387)
TOPEN	- 1.120 (0.621)	0.404 (0.321)	- 3.181** (0.419)
CONTROLS	- 0.753 (0.136)	2.262 (0.113)	0.635 (0.326)

Dependant variable: growth rate of real per capita GDP. (***), (**) and (*) indicate statistical significance at the 1%, 5% and 10% level, respectively. Values between brackets are Standard Error.

Table 6: FDI and economic growth, Generalized Method of Moments (GMM)

Variables	Algeria	Morocco	Tunisia
FDI	1.031 (0.172)	2.181 (0.038)	3.428** (0.114)
DINV	4.990*** (0.500)	9.833*** (0.158)	6.358*** (0.241)
TOPEN	- 0.577 (0.206)	- 0.220 (0.423)	- 1.866 (0.163)
CONTROLS	- 0.526 (0.191)	2.566 (0.066)	0.260 (0.242)

Dependant variable: growth rate of real per capita GDP. (***), (**) and (*) indicate statistical significance at the 1%, 5% and 10% level, respectively. Values between brackets are Standard Error.

Interestingly, the effect of foreign direct investment (FDI) is positive and statistically significant at the 99% level of confidence in the three countries and in all specifications (LS, TSLS, and GMM), suggesting that FDI is beneficial for economic growth in the three studied countries. Nevertheless, its effect is relatively small; this can be justified by the existence of many obstacles to attracting foreign investment projects. In addition, the effect of domestic investment is positive and statistically significant at the significance level of

99% in the three countries and in all specifications (LS, TSLS, and GMM); this can confirm that this type of investment is an important determinant which can foster the economic growth of North African countries.

Besides, the estimation shows that the effect of trade openness is negative and statistically significant at the 95% significance level in all specifications (OLS, TSLS and GMM), which suggests the weakness of the reforms undertaken by the North African economic authorities in terms of openness and financial and trade liberalization. In other words, this effect is mainly due to the existence of several barriers and obstacles to freedom of trade between each country and the outside. We can check also the observation that the macroeconomic fundamentals as well as other internal and external variables have, in sum, a positive impact in Moroccan and Tunisian economic growth; however, it negatively affects growth in Algeria, that's indicate that Moroccan and Tunisian economy have a better macroeconomic stability.

In sum, results show that Foreign Direct Investment (FDI) is an important factor which contributes to increase economic growth of AMU countries. Finally, we can assert that these countries should adopt some economic and financial conditions (such as, adopting a better trade policy reforms¹, restoring international competitiveness, and diversifying the country's exports), to significantly improve their financial and economic situations.

After testing the stationarity and the cointegration of the variables, and after estimating our model within dynamic panel system GMM estimator, this study involves also the use of impulse response functions and forecast error variance decomposition to assess the response of the tested macroeconomic variables to an external financial shock and the proportion of the variations in the variables attributable to this shock. The analysis that follows is hence preoccupied with these issues together with the standard sensitivity checks typical in most VAR based enquiries.

5.3 The importance of external shocks in the between FDI and growth

In order to determine the ability of external shocks (and their relative importance) to explain the variables fluctuations at different horizons, we perform a standard variance decomposition exercise for the variables contained in the VAR model. Results of this decomposition are reported in appendix (tables B-1, B-2, B-3, B-4 and B-5) for the all period sample (1980Q1-2010Q4).

Table B-1 presents the variance decomposition of the forecast error of foreign direct investment variable. The external shocks affect the FDI in Maghreb countries, at short-run horizon (1-4 periods), by 0.02 percent in Algeria, 0.31 percent in Morocco, and 0.51 in Tunisia. At the long-run horizon (16-20 periods), the variance decomposition test suggests a strong increase in the impact of external shocks. In fact, we note that these shocks explain more than 14 percent of the variance in all countries. In addition, at short-run horizon, an external financial shock explains 0.68 percent of the real GDP variances in the case of Algeria, 0.07 percent for the GDP variances of Morocco, and 0.08 percent in Tunisia (Table B-2). Thus, Algeria is especially

¹ Such as the promotion of the foreign direct investment as well as the domestic investment.

sensitive to these shocks. Indeed, external shocks tend to be persistent at long-run horizon, especially for the case of Algeria and Tunisia. Such evolutions are linked to the increase in oil exports in Algeria and the increase in the openness degree in Tunisia these last years.

Moreover, table B-3 presents the fraction of the variance of the domestic investment variable due to an external shock over the period 1980q1-2010q4. Results suggest that when the country's policy supports the creation of enterprises, external shocks have a significant influence on the activities of these enterprises at long-run horizon. Table B-4 shows the potential impact of an external financial shock on trade openness. This effect of trade openness is negative confirming the existence of several obstacles to freedom of trade between each country and the outside. As indicated in table B-5, external shocks exert a stronger influence, at long-run horizon, on *fundamentals* of all studied countries, especially in Tunisia, than on GDP and other variables. From this perspective, the high impact of external shocks on *fundamentals* largely reflects the rising trend in the trade openness of each Maghreb country with the Europeans countries.

5.4 Results of Impulse Response Functions (the impact of external shocks on studied variables)

Dynamic responses of each studied variable to the external shocks are depicted in appendix C for the all-period sample. Tracing out the time paths of the effects of financial shocks on the set of domestic variables, impulse responses allow us to analyze not only the contemporaneous reaction to a specific shock but also the speed of adjustment of the economy. External shocks negatively affect the macroeconomic variables of developing countries that have become more vulnerable to these shocks. Many channels explain such vulnerability (*Allegret and Benkhodja 2011*): first of all, these countries remain dependent from economic activity in industrialized countries (*the trade channel*) and from international capital markets -including international banking activity to finance their investment (*the financial channel*). In addition, domestic prices in emerging and developing countries remain influenced by exchange rates fluctuations (*the pass-through channel*).

These channels suggest an expected negative response of GDP in the aftermath of an external shock. Our results also suggest that these shocks negatively affect the real GDP (particularly in the case of Algeria and Morocco; in Tunisia, the effect is relatively stable). This negative effect is due to the fact that the growth of the Maghreb economies is strongly linked to the outside through, in large part, oil exports of Algeria and manufacturing exports of Morocco and Tunisia. As expected, in all studied countries, in terms of foreign direct investment policies, these shocks may lead to negative response of economic activity in the long-run, especially in the case of Tunisia.

On the other hand, the responses of financial development indicators to an external financial shock are either insignificant from a statistical standpoint in the three studied countries. This may be the consequence of poor financial openness policies applied by these countries since the 90s. In fact, this finding is accentuated in the long-run period. Moreover, it is important to stress that responses of the most of studied variables are

similar across our studied countries both in terms of contemporaneous and persistence reactions. We expect a negative response of domestic GDP to an external shock. Indeed, the high trade openness degree of Maghreb countries with European and other advanced countries makes them very sensitive to the trade channel. These results confirm the decreasing direct influence of the external shocks on fundamentals (inflation and exchange rate) in the North African countries. Finally, we can say that the negative effects of external shocks are followed by depreciation in domestic variables as well as in real GDP fluctuations. Consequently, this can be harmful to the economic activity and to the possibility of establishing a monetary, commercial, and financial union between the Maghreb countries.

Conclusion and Policy Recommendations

After reviewing the theoretical and the empirical literature over the link between foreign direct investment and economic growth taking into consideration the influence of external financial disturbance, this study examines empirically this relationship for the case of three North African countries using the dynamic panel system GMM estimator proposed by *Blundell and Bond (1998)* and the VAR approach over the period 1980-2010. This study emphasizes that FDI plays a positive role in boosting the economic growth of Maghreb countries. It also emphasizes that these countries has been relatively successful over the last decade in attracting FDI inflows that have not shown a significant performance. In the other hand, impulse response functions indicate that the existence of external financial shocks can be followed by depreciation in domestic variables as well as in FDI flows and real GDP fluctuations. Consequently, this can be harmful to the economic activity; that's why the North African countries should reinforce their economies through the establishment a monetary, commercial, and financial union between them as well as the adoption of a common currency and the creation of a free trade area.

We can assert that FDI inflow could bring important benefits to North Africa in the form of capital inflows, technology spillovers, human capital formation, international trade integration, job creation, the enhancement of enterprise development. However, government policies are needed to enhance benefits and minimize negative effects on the local community. The role of political stability as a key factor in attracting and maintaining investors cannot be overemphasized, and maximizing a country's potential for attracting FDI inflows need to include policies improving the legal framework, adequate infrastructure, good governance, an effective judicial system and respect for the rule of law among others.

Finally, we can say that, although, the economy of each North African country has achieved, these recent years, significant steps leading them to achieving higher level of economic and financial developments, it remains nevertheless that these countries should firstly elaborate structural economic policies especially on the commercial, banking and financial plans, secondly improve the investment climate, and thirdly, create the conditions for an attractive and sound economic environment for foreign investments. Besides, these some obstacles should be removed in order to facilitate free movements of capital that may lead to the

establishment of a common currency and a free trade area. This can allow them to increase the degree of financial integration, improve economic growth rates in each country, and, thereby, make them less vulnerable to different external shocks.

REFERENCES

- Adeniyi O., Omisakin O., Egwaikhide F. O., and Oyinlola A. (2012), "Foreign Direct Investment, Economic Growth and Financial Sector Development in Small Open Developing Economies", *Economic Analysis & Policy*, Vol. 42, No. 1, March, pp. 105-127.
- Agrawal G., and Khan M. A. (2011), "Impact of FDI on GDP Growth: A Panel Data Study", *European Journal of Scientific Research*, Vol. 57, No. 2, pp. 257-264.
- Anwar S., and Nguyen L. (2010), "Foreign direct investment and economic growth in Vietnam", *Asia Pacific Business Review*, Vol. 16, No. 1-2, January-April, pp. 183-202.
- Aitken B. J., and Harrison A. E. (1999), "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *The American Economic Review*, Vol. 89, No. 3, June, pp. 605-618.
- Alfaro L. (2003), "Foreign Direct Investment and Growth: Does the Sector Matter?", *Working Paper*, Harvard Business School, April.
- Alfaro L., Chanda A., Kalemli-Ozcan S., and Sayek S. (2006), "How Does Foreign Direct Investment Promote Economic Growth? Exploring the Effects of Financial Markets on Linkages", *NBER Working Paper*, No. 12522, September.
- Anwar S., and Nguyen L. (2010), "Foreign direct investment and economic growth in Vietnam", *Asia Pacific Business Review*, Vol. 16, No. 1-2, January-April, pp. 183-202.
- Baharumshah A., and Thanoon M. (2006), "Foreign capital flows and economic growth in East Asian countries", *China Economic Review*, Vol. 17, Issue 1, January, pp. 70-83.
- Balamurali N., and Bogahawatte C. (2004), "Foreign Direct Investment and Economic Growth in Sri Lanka", *Sri Lankan Journal of Agricultural Economics*, Vol. 6, No. 1, pp. 37-50.
- Benachenhou A. (2008), "Pour une meilleure croissance", Alpha Design, Juin.
- Benhabib A., Benamar A., and Maliki S. (2010), "The Optimal Currency Area and the GCC (Gulf Council Countries): Is there a feasibility?", Presented at the Second Research Conference on Empirical Issues in International Trade and Finance, Indian Institute of Foreign Trade, New Delhi, 16th and 17th December.
- Bhandari R., Dhakal D., Pradhan G., and Upadhyaya K. (2007), "Foreign Aid, FDI and Economic Growth in East European Countries", *Economics Bulletin*, Vol. 6, No. 13, April, pp. 1-9.
- Blomström M. and Kokko A. (1997), "How Foreign Investment Affects Host Countries", *Policy Working Paper Series*, No. 1745, March, 44 pages.
- Blundell R., and Bond S. (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, No. 87, pp. 115-143.
- Bosworth B. P., Collins S. M., and Reinhart C. M. (1999), "Capital Flows to Developing Economies: Implications for Saving and Investment", *Brookings Papers on Economic Activity*, Vol. 1999, No. 1, pp. 143-180.
- Chakraborty C., and Basu P. (2002), "Foreign direct investment and growth in India: A cointegration approach", *Applied Economics*, Vol. 34, Issue 9, pp. 1061-1073.
- Chen, E. K.Y. (1992), "Changing Pattern of Financial Flows in the Asia-Pacific Region and Policy Responses", *Asian Development Review*, Vol. 10, No. 2, pp. 46-85.
- Dess, S. (1998), "Foreign Direct Investment in China: Determinants and Effects", *Economics of Planning*, Vol. 31, No. 2, pp. 175-194.
- Dickey D. A., and Fuller W. A., (1981), "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica*, Vol. 49, No. 4, July, pp. 1057-1072.
- Kohpaiboon A. (2003), "Foreign Trade Regime and FDI-Growth Nexus: A Case Study of Thailand", *Journal of Development Studies*, Vol. 40, No. 2, pp. 55-69.
- Kose A. P., Prasad E. S., and Terrones M. E. (2005), "Growth and Volatility in an Era of Globalization", *IMF Staff Papers*, Vol. 52, Special Issue.
- Neuhause M. (2006), "The impact of FDI on economic growth: an analysis for the transition countries of Central and Eastern Europe", Ed. Physica Verlag Heidelberg, Germany.

ZENASNI Soumia & BENHABIB Abderrezak

- Ogutcu M. (2002), "Foreign Direct Investment and Regional Development: Sharing experiences from Brazil, China, Russia and Turkey", OECD Working Paper, No 38.
- Phillips P. C. B., and Perron P., (1988), "Testing for a Unit Root in Time Series Regression", *Biometrika*, Vol. 75, No. 2, June, pp. 335-346.
- Reggad S. (2008), "Foreign Direct Investment: The Growth Engine to Algeria", *Korea Review of International Studies*, Vol. 11, No. 1, pp. 79-98.
- Rogmans T. J. (2011), "The determinants of Foreign Direct Investment in the Middle East North Africa Region", PhD thesis, Supervised by Prof. Dr. Ebber H.A., Nyenrode Business University, November.
- Tiwari A. and Mutascu M. (2010), "Economic growth and FDI in ASIA: A panel data approach", *MPRA Working Paper*, No. 28172, December.
- UNCTAD (2009), "World Investment Report 2009: Transnational Corporations, Agricultural Production and Development", *United Nations Conference on Trade and Development*, New York and Geneva.
- Won Y., Hsiao F., and Yang D. (2008), "FDI Inflows, Exports and Economic Growth in First and Second Generation ANIEs: Panel Data Causality Analyses", *KIEP Working Paper*, No. 08-02, April, pp. 11-86.

Appendix**Table A-1: Overview of studies on the impact of FDI on economic growth**

Studies	Countries	Period	Estimation Methods	Main results
Bornschieer, Chase-Dunn and Rubinson (1978)	76 less developed countries	1960-1975	OLS	FDI has negative impact on economic growth in developing countries. Also, this impact increases when income level increases.
Fry (1993)	16 developing countries	1975-1991	OLS	In 11 developing countries, FDI negatively affects growth. But in Pacific Basin countries FDI affects positively growth.
Borensztein, Gregorio and Lee (1998)	69 developing Countries	1979-1989	Seemingly Unrelated Regressions Technique	FDI is an important tool for technology transfer. Also, it makes more contributions to economic growth than domestic investment.
Aitken et Harrison (1999)	Venezuela	1975-1989	Panel Data	The net effect of FDI on firm level productivity is negligible.
Berthelemy and Demurger (2000)	24 Chinese Provinces	1985-1996	GMM	FDI plays an important role in the economic growth of Chinese provinces.
Duttaray (2001)	66 developing Countries	1970-1996	Granger Causality Test	FDI positively affects growth in less than 50% of selected countries.
Carkovic and Levine (2002)	72 developed and developing Countries	1960-1995	GMM	The exogenous component of FDI does not exert a robust, independent influence on growth.
Mencinger (2003)	8 EU countries	1994-2001	Granger Causality Test	FDI affects economic growth but economic growth doesn't affect FDI.
Bengoa and Sanchez-Roblesp (2003)	18 Latin American countries	1970-1999	Hausman Test ; OLS	Foreign direct investment is positively correlated with economic growth in the host countries.
Balamurali and Bogahawatte (2004)	Sri Lanka	1977-2003	VAR model	The promotion of foreign direct investment can accelerate the long-run economic growth.
Hansen and Rand (2006)	31 developing countries	1970-2000	Panel VAR Model	FDI has an impact on GDP via knowledge transfers and adoption of new technology.
Basu and Guariglia (2007)	119 developing Countries	1970-1999	GMM	FDI enhances economic growth in developing countries.
Massoud (2008)	Egypt	1974-2005	Two Stage Least Squares	The main argument of the paper is that FDI is not an aggregate phenomenon. FDI has an ambiguous effect on growth.
Tiwari and Mutascu (2010)	23 developing Asian countries	1986-2008	Dynamic Panel Model ; OLS	Both foreign direct investment and exports enhance growth process in Asian countries.
Agrawal and Khan (2011)	5 Asian economies	1993-2009	Panel data Regression	FDI promotes economic growth and further provides an estimate that one dollar of FDI adds

				about 7 dollars to the GDP of each of the five countries.
Adeniyi and al (2012)	5 Small Developing African Countries	1970-2005	Vector Error Correction (VEC) model	The extent of financial sophistication matters for the benefits of foreign direct investment on economic growth in small open developing countries.

Table A-2: Definition and sources of variables

Variable	Definition	Source
GDP growth	This variable represents the growth of the real per capita gross domestic product.	• IFS; • SESRIC Database.
FDI	Direct Foreign Investment flow as % of GDP. This variable measures the inflows of capital in countries. It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital.	• CNUCED • UNCTADstat
DINV	It is the nationally owned investments defined as "gross fixed capital formation".	African Development Indicators, World Bank.
TOPEN	Trade Openness (Export and import volume of goods and services) as a share of GDP. This variable measure the openness degree of domestic banking and financial system.	• The SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012.
DShocks	Dshochs is a dummy variable of external shocks taking on a value of one if country i experiences a financial disturbances in period t and zero otherwise.	/
FDev	Financial Development measured by money and quasi money (M2) as share of GDP: comprises the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This variable measures financial market development.	• International Financial Statistics (IFS). • The SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012.
Inf	This variable measures the inflation rate in the three Maghreb Countries. It represents the annual rate of change of the Consumer Price Index.	• International Monetary Fund, World Economic Outlook Database, April 2012.
ExRate	Exrate denotes the exchange rate variable; it is calculated from nominal exchange rates and CPIs.	• IFS, Global Insight, Oxford Economic Forecasting and ERS Baseline Regional Aggregations.
Kaopen	This variable measures the extent of openness in capital account transactions.	• The Chinn-Ito index (2010 Update Version).

Appendix B: Variance Decomposition

Table B-1: the fraction of the variance of the FDI due to external shocks, 1990Q1-2010Q4

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.02	0.31	0.51
	16-20	17.40	14.07	18.62

Notes: "1-4" stands for the average between 1 quarter after a shock and 4 quarters after a shock. "16-20" stands for the average between 16 quarters after a shock and 20 quarters after a shock.

Table B-2: the fraction of the variance of the GDP due to external shocks, 1980Q1-2010Q4

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.68	0.07	0.08
	16-20	2.37	1.89	4.04

Notes: "1-4" stands for the average between 1 quarter after a shock and 4 quarters after a shock. "16-20" stands for the average between 16 quarters after a shock and 20 quarters after a shock.

Table B-3: the fraction of the variance of the *DINV* due to external shocks, 1980Q1-2010Q4

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.20	0.05	0.005
	16-20	25.08	1.39	0.13

Notes: "1-4" stands for the average between 1 quarter after a shock and 4 quarters after a shock. "16-20" stands for the average between 16 quarters after a shock and 20 quarters after a shock.

Table B-4: the fraction of the variance of the *TOPEN* due to external shocks, 1980Q1-2010Q4

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.06	0.45	0.41
	16-20	2.06	10.28	7.36

Notes: "1-4" stands for the average between 1 quarter after a shock and 4 quarters after a shock. "16-20" stands for the average between 16 quarters after a shock and 20 quarters after a shock.

Table B-5: the fraction of the variance of the *Fundamentals* due to external shocks, 1980Q1-2010Q4

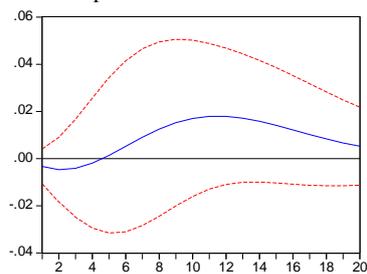
Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.01	0.23	0.03
	16-20	13.17	8.12	6.51

Notes: "1-4" stands for the average between 1 quarter after a shock and 4 quarters after a shock. "16-20" stands for the average between 16 quarters after a shock and 20 quarters after a shock.

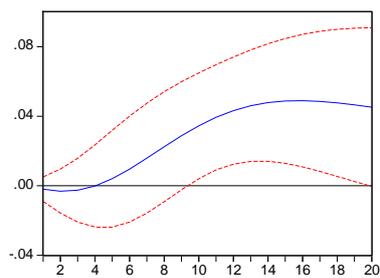
Appendix C: Impulse Response Functions to an External Shock, 1980Q1-2010Q4

ALGERIA

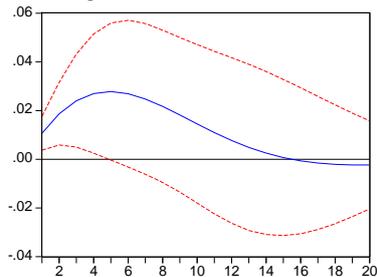
Responses of FDI to shocks



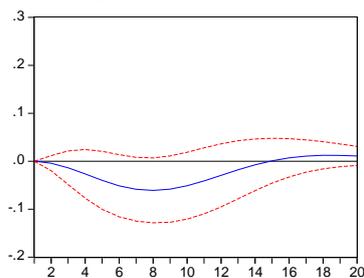
Responses of GDP to shocks



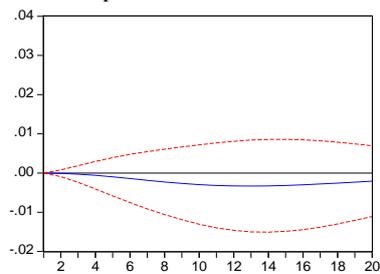
Responses of DINV to shocks

**MOROCCO**

Responses of FDI to shocks



Responses of GDP to shocks



Responses of DINV to shocks