

## The Effects of External Financial Shocks on Financial Integration and Economic Growth: A VAR Approach for Maghreb Countries

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**ABSTRACT:** The main objective of this paper is to quantify the importance of external shocks in domestic and external variables fluctuations for a sample of three North African countries (Algeria, Morocco, and Tunisia) using a VAR model estimation with quarterly data during the period 1990-2010. Since the early 1990s, Maghreb countries have implemented these last year, structural liberalization policies and modernized banking and financial regulations in order to strengthen their financial systems, establish an economic union between them and improve their economic growth rates. Accompanying to these developments, the study of this relationship has been largely analyzed in the literature. In fact, several theoretical and empirical studies have been elaborated to understand the process of international banking and financial shocks and their impact on economic development of countries as well as on the ability to create economic integration between them. Results find that external shocks negatively affect economic growth of Maghreb countries and impede the implementation of financial integration project. In addition, we document the dynamic response of each studied variable to external financial stress in these economies. Our results on variance decompositions and impulse responses functions show that Maghreb countries appear especially sensitive to the trade and the financial channel.

**KEYWORDS:** Financial integration, external shocks, financial crisis, Maghreb countries, VAR approach.

### 1 INTRODUCTION

Since the 1990s, the most developing countries have embarked in a process of financial integration characterized by a reduction of impediments to cross-border financial transactions and an increased participation of foreign institutions in the domestic financial systems. In the view of some analysts (*Galindo and al. 2009; Kazi and al. 2012*), the propagation of the crisis from developed countries to emerging market economies through financial channels is proof of the need to impose limits on financial integration process. Accompanying to these developments, a growing amount of literature on this topic has emerged. In fact, several theoretical and empirical studies (*Demirgüç-Kunt and Detragiache 1998; Kaminsky and Reinhart 2000; Freixas and Holthausen 2004; Galindo and al 2009; Castiglionesi and al 2010*) have been elaborated to understand the process of international banking and financial shocks. They tackled true issue related to relationship between these shocks, on the one side, and financial integration process that are implemented by emerging and developing countries, on the other side. Their main focus is to consider that bank failures are in the center of recent economic and financial crises in emerging countries. Actually, most of the authors have come to give two explanations of banking and financial crises: on the one hand, financial liberalization make banks more vulnerable to macroeconomic shocks (*Rodrik 1998, Eichengreen 2001, Agenor 2003*) and, on the other hand, financial fragility of the banks would be exacerbated by the inadequacy of public policies and the insufficiency of supervision mechanism (*Hernández and Schmidt-Hebbel 2001, Buiter and Taci 2003, Caballero and al 2009*).

From this perspective, the effects of financial integration on financial instability in emerging and developing economies have been largely analyzed in the literature (*Hernández and Schmidt-Hebbel 2001; Ayhan Kose and al 2003; Galindo and al 2009; Albulescu 2011; Rose 2012*). In fact, it is found that financial integration amplifies the impact of international financial shocks on aggregate credit and interest rate fluctuations (*Guillaumont and Kpodar, 2004*). The existence of some imbalances in financial systems can explain the large number of financial and banking crises in both developing and industrial countries during the last decades [Chile (1981); Mexico (1995); Southeast Asia (1997); Turkey (1994); as much as in the northern European countries at the beginning of the 90s].

In this context, the main objective of this work is to examine the link between external financial shocks, financial integration and economic growth in Maghreb countries (that have implemented structural liberalization policies and modernized banking and financial regulations in order to strengthen their financial systems) by addressing the following issue: *what are the effects of international financial shocks on financial integration project and economic growth in Maghreb countries?* Our empirical investigation is based upon studies undertaken by *Khan and Senhadji 2000, Seleteng 2006, Brezigar-Masten and al 2010, Adler and Tovar 2012*, and using a VAR model estimation during the period 1990Q1-2010Q4, we find that external shocks affect negatively Maghreb countries and impede the implementation of financial integration project.

This paper is organized as follows. The first section presents a selective survey of the literature on the link between financial integration and external shocks. Thereafter, the second section outlines the benefits and costs of financial integration process the Maghreb countries. Then, section 3 highlights the characteristics of financial systems and financial integration project in Maghreb economies. Section 4 describes the data and the estimation methodology. Finally, section 5 presents the empirical results.

## **2 LITERATURE REVIEW**

Over the past two decades, there has been an increased awareness on the study of: (i) the effects that external shocks<sup>1</sup> can have on country's economic growth and financial integration process, (ii) the manner through which a fragile or irrational financial sector can be exposed to external shocks and affect the real economy of a country, and (iii) the degree according to which shocks occurring in the financial system can spread to other financial systems and destabilize the links between financial systems of different countries. In other words, increased attention has been focused recently on the growing frequency of financial shocks and the possible role that capital account liberalization might play in contributing to such phenomena. A variety of factors can lead to the emergence of a financial crisis in a specific country. In a world of growing financial globalization and more open capital accounts, events in other countries may have an impact on a country's financial integration and stability.

Since the pioneering contributions of Mundell's (1961) and McKinnon's (1963), much of the literature has focused on relationship between the countries that would impinge on the benefits of adopting a common currency and economic integration<sup>2</sup>. It is generally accepted that the correlation of shocks is the crucial criterion in a country's decision to join a commercial, financial, and currency union. *Mundell (1961)* argues that countries facing positively correlated economic shocks will be better suited for a currency union because they would allow the use of union-wide policies to correct any imbalances. In addition, the imbalances experienced by different countries during the currency and banking crises of the 1990s contributed significantly to the emergence of the idea that capital account liberalization increases the risk of financial instability [1]. In fact, the financial crisis literature tests whether financial liberalization and integration increase the risk of financial shocks. To investigate the dynamic effect of external financial shocks, several studies have used econometric models, in particular VAR models, to decompose the direct effects of external shocks on several macroeconomic variables, especially from those generated by the endogenous monetary policy response as in *Hamilton (1983)* [2]; *Bernanke et al. (1997)* [3], among others. In this context, the empirical works elaborated by *Demirgüç-Kunt et Detragiache (1998)* [4], *Kaminsky et Reinhart (1999)* [5], et *Glick et Hutchinson (1999)* [6] find that the propensity to banking and currency crises increases in the aftermath of financial liberalization. In other words, the development and widespread liberalization of financial markets in the 1980s has resulted in increasing integration. However, researches indicate that the increasing economic and financial integration can lead to a global crisis in international financial system.

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<sup>1</sup> The external shocks include the trade shocks, the financial external shocks, and the monetary external shocks.

<sup>2</sup> The potential benefits are: the degree of labor mobility; the extent of intra-trade; the symmetry of shocks across countries; and the system of risk-sharing.

Furthermore, the focus on external shocks of emerging countries is understandable given their structural characteristics, particularly their trade and financial openness and their rising effort in coordination and policy harmonization on a regional scale. Indeed, investigating the responses to these shocks can give an additional indication on the homogeneity degree between the area's countries and on the convergence process of their policies. In the literature, several methods have been used in order to assess the relationship between external shocks, financial instability, capital account openness, and monetary and financial integration. Some papers have used the structural vector autoregression (VAR) models to identify the nature and the impact of external shocks on emerging and developing economies. *Ng T., (2002)* analyses three shocks in a tridimensional VAR for five Southeast Asian countries over the period 1970-1995. The identified shocks are the following: external, domestic (supply-related) and domestic (demand-related) shocks. The external shock is considered as a simultaneous combination of supply and demand external shocks. The results of this study show a strong correlation of responses to these shocks - including the external one suggesting that these countries are suitable for a monetary union [7].

In addition, the study of *Illing M. (2003)* provides four case studies of episodes often thought of as periods of financial stress or crisis [the stock market crash of October 1987, the near-collapse of Long-Term Capital Management in 1998, the failures of the Canadian Commercial Bank (CCB) and Northland Bank in 1985, and the Bank of New York's 1985 computer problem]. In this study, Illing provides concrete illustrations and interesting examples of the variety of shocks that can trigger episodes of stress in the financial system. These include external shocks, operational problems, and, in the case of the stock market crash, a shift in expectations. The case studies also illustrate the kinds of contagion mechanisms that can turn isolated events into more widespread stress on the financial system. For example, the potential wealth effects associated with a stock market crash can affect consumption and investment expenditures, and the informational contagion that occurred with the failures of CCB and Northland Bank led to a number of other small banks being shut out of wholesale markets [8]. On the other side, *Aghion, Bacchetta, and Banerjee (2004)* have studied the role of financial factors as a source of instability in small open economies. To do this, they use a tradeable good produced with internationally mobile capital and a country specific factor; this model examines also the effects of financial liberalization on the stability of the macroeconomy, and assesses the macroeconomic effects of specific shocks to the financial sectors (such as over lending by banks leading to bank failures). Results show that temporary external shocks will have large and persistent effects in the sense that these economies can exhibit stable limit cycles. They show also that, in the case of small open economies, full financial liberalization (i.e., opening the domestic market to foreign capital flows) may actually destabilize the economy, inducing chronic phases of growth with capital inflows followed by collapse with capital flows [9]. This can negatively affect and hamper any economic, financial, or monetary integration projects among States. So, economies at an intermediate stage of financial development should consider carefully how they liberalize their capital account.

Similar to *Ng T., (2002)* study's, *Huang and Guo (2006)* have studied the case of East Asian economies, over the period 1970-2002, to estimate a multivariate structural VAR including a global external shock modeled as a global supply shock. These authors find that external disturbances are not only significant, but they are also positively correlated among East Asian countries suggesting their symmetric nature [10]. Moreover, there is strong evidence that the world economies have become more integrated globally over the last thirty years [11]. Actually, financial integration<sup>3</sup> has been the subject of much debate, particularly following the different shocks and crises in emerging markets in the late 1990s. Much of the debate has focused on identifying the advantages and disadvantages of the capital account liberalization policies. In fact, the severe financial crises that hit emerging countries led to a rethinking of financial integration strategies. The global financial crisis of 2007, which began with financial market problems in the United States, raised similar questions about desired integration levels in a context of repeated international financial instability; this crisis is often seen as related to the global imbalances these last years.

In reality, although capital account liberalization seems to have brought several benefits to those who have applied these policies, as evidenced by large expansionary cycles during the mid-2000s, it has not been without costs. However, the recent study elaborated by *Rancière, Tornell and Westermann (2008)* suggests that the benefits of liberalization policies seem to outweigh the costs considering countries that have experienced occasional financial crises have, on average, grown faster than countries with stable financial conditions, which suggests the existence of a positive effect of economic and financial integration with systemic risk to economic growth [12]. The study of *Edwards S. (2009)* investigates the way in which the interaction between trade and financial openness affect the probability of external crises; in other words, this study

<sup>3</sup> The most important aspect of this financial integration is that global economies show co-movements in most of the economic variables (such as inflation, unemployment, GDP growth).

examines whether an increase in the degree of financial openness affects the likelihood that a country experiences an external crisis. Using a large cross country data set (several advanced and developing countries over the period 1970-2004) and panel probit analysis, the estimation results indicate that relaxing capital controls increases the likelihood of a country experiencing a sudden stop<sup>4</sup>. Moreover, the results suggest that financial liberalization strategies increase the degree of vulnerability to external crises [13]. This is particularly the case if this strategy is pursued with pegged exchange rates and if it results in large current account imbalances.

Overall, financial integration allows banks in different countries to smooth local liquidity shocks by borrowing on the international interbank market. In the view of some economists (*Galindo and al 2009*), the propagation of the crisis from developed countries to emerging and developing market economies through financial channels is proof of the need to impose limits to financial integration [14]. In this perspective, *Ersel H. (2010)* affirms that an external financial shock, such as the 2007, not only affects the financial sector of a country but can easily spread to the real sector as well [15]. Indeed, the financial crisis of 2007 led to a sharp decline in the international financial flows, which inevitably, affected the behavior of the financial institutions as well as the levels of economic growth in developing economies; these countries have become more vulnerable to external financial shocks. Moreover, emerging market economies continue to be vulnerable to large global financial shocks, as made evident by the behavior of capital flows in and out of these economies during periods of global financial stress. On the one hand, a country's *degree of financial integration* with the rest of the world is likely to influence its vulnerability to external financial shocks. On the other hand, a country's *strength of economic fundamentals* is also likely to buffer or amplify the impact of external shocks. Strong fundamentals can prevent capital outflows in the first place (as investors would be less concerned about credit worthiness) but can also play a role in allowing the economy to adjust more easily to a given shock (for example, by providing more room to undertake countercyclical policies -e.g. lowering interest rates-, letting the exchange rate depreciate or using fiscal policy to stabilize domestic demand).

In the other hand, *Dincer, Kandil, and Trabelsi (2011)* have focused, in their work, on the Turkish experience of capital account liberalization and its effect on domestic macroeconomic variables (real interest rates, real effective exchange rates, real GDP, the inflation rate and crises dummies), using quarterly data in a multivariate autoregressive vector (VAR) model during the period 1989-2009. The proposed methodology analyzes the dynamics of the interaction between capital flows and macroeconomic performance and provides the necessary evidence to study the macroeconomic effects of capital account liberalization. Estimation results find that the effects of capital flows on the economy are significantly different before and after the crisis in 2001. Indeed, the evidence supports significant effects of freeing financial flows on macroeconomic performance especially during the pre-crisis period. However, after the financial crisis of 2001, the Turkish economic growth has declined significantly [16]. Thus domestic and external financial shocks affect negatively capital account liberalization and the domestic macroeconomic variables. Furthermore, the study of *Allegret and Benkhodja (2011)* investigates the dynamic effect of four external shocks (oil price shock, USD/EUR exchange rate shock, international inflation shock and international interest rate shock) on an oil exporting economy. The authors examine also the appropriate monetary policy strategy for Algerian economy, given its structural characteristics and the pattern of the external shocks. Using the Bayesian approach, a DSGE (Dynamic, Stochastic, General equilibrium) model based on the features of the Algerian economy, over the period 1990Q1-2010Q4, the main findings of this study confirm that Algeria is especially sensitive to real shocks. Thus, external shocks in both oil and non-oil sectors are the predominant source of macroeconomic fluctuations [17].

In the same perspective, *Adler and Tovar (2012)*, asserted in their study -relating to the identification of the economic impact of global financial shocks on emerging market economies- that, in emerging Europe, the financial integration process has moved in the direction of making the region more vulnerable to global external financial shocks [18]. From these results, we can say that these shocks are harmful for any financial and economic integration project among countries. This process can play an important role to propagate the shocks to other countries [19]; it is considered as a channel through which external financial shocks lead to decline financial and intermediation costs and to negatively affect financial markets. Indeed, the crisis demonstrated that a highly integrated and developed financial system does not always and necessarily strengthen financial stability. In turn, the study of *Allegret and al. (2012)* examines the effect and the relative importance of external shocks in domestic fluctuations of East Asian countries and check if these shocks lead to asymmetric or symmetric reactions

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<sup>4</sup> The author has defined a "sudden stop" episode as an abrupt and major reduction in net capital inflows to a country that had been receiving large volumes of foreign capital.

between the considered economies. The authors estimate a structural VAR model<sup>5</sup> with block exogeneity (SVARX model) over the period 1990-2010. Result estimation shows the existence of a rising impact of external shocks on domestic variables since 1990s in East Asian countries. Moreover, responses of domestic variables to external monetary and financial shocks are less symmetric, thus justifying the reinforcement of monetary and financial cooperation between the area's countries [20].

### 3 BENEFITS AND COSTS OF FINANCIAL INTEGRATION IN MAGHREB COUNTRIES

In the real world, a duality of benefits and risks is inescapable because of the existence of asymmetric information and imperfect contract enforcement problems [21]. The analysis of the "costs-benefits" of financial integration is highly conditional on the nature and credibility of the exchange rate regime. The sequencing and coordination of capital account liberalization, the macroeconomic stabilization and the structural reforms, aimed at strengthening the domestic financial sector, are the key elements of this analysis [22]. At the theoretical level, there are two contrasting views of financial integration effects. In one view, this later strengthens financial development and contributes to higher long-run growth. In another view, capital account liberalization induces excessive risk-taking, increases macroeconomic volatility, and leads to more frequent crises.

#### 3.1 POTENTIAL BENEFITS

According to the analytical arguments pertaining to capital account openness and financial integration, there are a number of benefits of financial integration process [23]: the benefits of international risk sharing for consumption smoothing; the positive impact of capital flows on domestic investment and growth; the enhancement of the macroeconomic discipline<sup>6</sup>; and the increased efficiency as well as the greater stability of the domestic financial system associated with foreign bank penetration<sup>7</sup>.

For the case of Maghreb countries, greater financial integration and regional trade will have positive repercussions for each country. It would allow them to create a large regional market and attract more foreign investment. In addition, it is mainly the new complementary economic structures which can multiply the possibilities of exchange whose would benefit all Maghreb countries. All these developments are conditioned by the establishment of common rules in the banking and fiscal fields and the liberalization of capital movements. At the same time, given the need to create a regional economic grouping as well as a profitable regional cooperation, it becomes increasingly imperative for the Maghreb countries to coordinate their economic, institutional and legal reforms. The concretization of financial integration among them might mean some "4.6 billion \$" as an annual gain [24].

Furthermore, the financial openness process and the concretization of financial integration project in the Maghreb countries, as for other African countries, can yield benefits via three channels. First, it provides a powerful incentive for domestic financial reforms. Second, it increases the efficiency and profitability of the financial institutions by increasing their scale of operations. Third, it ensures the growth of indigenous financial institutions into regional and global players by increasing their competitiveness in the area of globalization [25]. Indeed, *Hufbauer and Claire (2008)* estimated some of the gains of the Arab Maghreb Union (AMU) by comparing selected indicators of economic performance between 1989 -the year of the AMU's inception- and 2007. Their findings include: (i) a reduction in inflation rates, except in Libya; (ii) a 30 percent increase in real per-capita GDP; (iii) an increase in the share of total merchandise in GDP from 41.7 percent in 1989 to 72.5 percent in 2007; and (iv) an increase in inward FDI stock as a share of GDP by more than 100 percent between 1990 and 2006 [26].

<sup>5</sup> As an alternative to VAR approach, many researchers (*Jensen and Johnson 1995; Thorbecke 1997; Bomfim 2003; Bernanke and Kuttner 2005; Dedola and Lippi 2005...*) have performed event studies, which allows for analysis, comparatively at higher frequency than VAR literature which is normally based on quarterly and monthly data... For more information, see: *Kazi I., A., Wagan H., and Akbar F. (2012)*.

<sup>6</sup> The free movements of capital flows across borders may induce countries to follow more disciplined macroeconomic policies and thus reduce the frequency of policy mistakes... See *Obstfeld (1998)*.

<sup>7</sup> In this concept, *Caprio and Honohan (1999)* have argued that foreign bank penetration may: (i) improve the quality and availability of financial services in domestic market, by increasing the degree of bank competition; (ii) serve to stimulate the development of the domestic bank supervisory and legal framework; (iii) enhance a country's access to international capital; and (iv) contribute to the stability of the domestic financial system.

### **3.2 POTENTIAL COSTS**

However, the experience of the past two decades has led economists and policymakers to recognize that, in addition to the potential benefits discussed above, open financial markets may also generate significant costs. Such potential costs include [27]: the high degree of capital flows concentration and the lack of access to financing for small countries; the inadequate domestic allocation of these flows, which may hamper their growth effects and exacerbate preexisting domestic distortions; the loss of macroeconomic stability; the pro-cyclical nature of short-term capital flows and the risk of abrupt reversals; the high degree of volatility of capital flows, which relates in part to herding and contagion effects; and risks associated with foreign bank penetration.

In general, both domestic and external financial liberalization policies in several advanced and emerging countries has increased their vulnerability to financial shocks; these policies appear to have been associated with costly financial shocks, as documented by *Williamson and Mahar (1998)*, [28]. This association may be somewhat deceptive, given that financial crises are complex events with multiple causes and have occurred in more, as well as in less, liberalized financial systems. Still, there have been enough cases where financial liberalization, including capital account liberalization, has played a significant role in crises to raise serious questions about whether and under what conditions such liberalization will be beneficial rather than harmful [29]. Although misaligned fundamentals of some sort played a role in all of the above crises, they have called attention to the inherent instability of financial markets and the risks that cross-border financial transactions can pose for countries with relatively fragile financial systems and weak regulatory and supervision structures.

The financial integration between the Maghreb countries -in the financial, commercial and economic terms- is seen as a crucial factor for stimulating economic growth. However, the cost of non concretization of the Maghreb union may be unsustainable for these economies. In fact, the trade in each Maghreb country with the European Union represent between 60 and 70 percent of their trade rate, while the trade among the Maghreb countries represent only 2.5 percent. Therefore, the non-Maghreb is expensive for these countries [30]. Losses due to the lack of integration can reach more than 10 billion \$ per year for the entire region [31]. Moreover, the weakness of exchanges between the Maghreb countries hinders their economic growth rates due in particular to the rigidity of their economic structures, customs barriers and low levels of investment.

## **4 OVERVIEW OF FINANCIAL SYSTEMS AND FINANCIAL INTEGRATION PROJECT IN MAGHREB COUNTRIES**

The financial sector plays a crucial role in the process of capital accumulation and productivity growth. In recent years, Maghreb countries are well aware of the importance of modernizing their financial sectors and have been implementing reforms, with encouraging results. These countries have established a council to coordinate and harmonize their development plans as well as interregional trade. The five Maghreb countries (Algeria, Libya, Mauritania, Morocco, and Tunisia) signed a treaty in 1988 with the objective of safeguarding the region's economic interests, fostering and promoting economic cooperation, and intensifying mutual commercial exchanges as a precursor for integration and the creation of a North African Common Market [32]. The main characteristics of the financial systems in these countries include the following [33]: (a) bank dominance and heavy public sector presence in most countries; (b) limited financial sector openness; (c) public banks burdened with inefficiencies and a high level of nonperforming loans; (d) shortcomings in the legal, regulatory, and supervisory frameworks; and (e) a largely cash-based payment systems that is being modernized.

As shown in figure 1, the aggregate of growth performance conceals important differences between the five countries, reflecting not only differences in initial economic, social, and political conditions but also differences in pace and strength of economic reform [34]. Thus, countries that have implemented deeper and broader structural reforms have reaped the highest growth dividend.

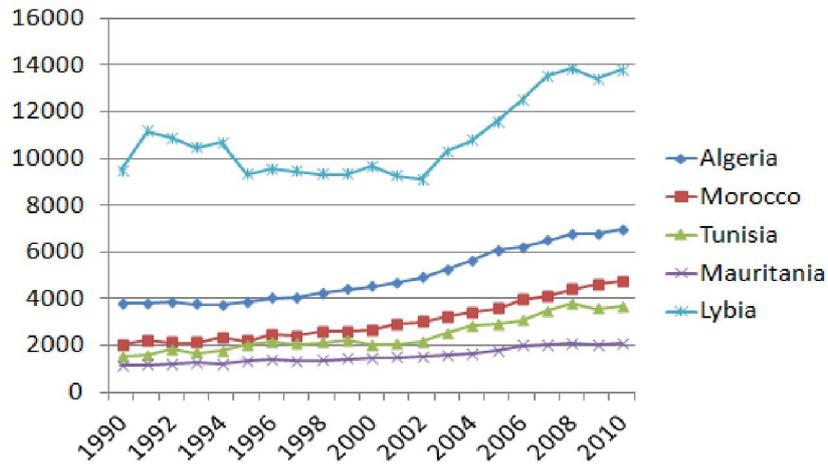


Fig. 1. GDP per capita in PPP terms (Intra-Maghreb Comparison)

Source : The International Monetary Fund, World Economic Outlook Database, April 2011.

In addition, in terms of international comparison, figure 2 shows that the growth dividend has been relatively modest: growth in GDP per capita in purchasing power parity (PPP) terms in the North African countries has accelerated somewhat during the past decade but it has been weaker than in some other developing and emerging market economies (ex: Latin American economies). So, despite the establishment of the Arab Maghreb Union over two decades ago, the bulk of the Maghreb’s trade is with Europe. The level of intra-Maghreb trade is lower than that of many of the world’s trading blocs. In 2007, intra-Maghreb trade represented less than 2 percent of the subregion’s combined gross domestic product (GDP) and less than 3 percent of the subregion’s total trade [35]. Some of the reasons for this low performance include high barriers to trade, lack of production base diversification, and political considerations.

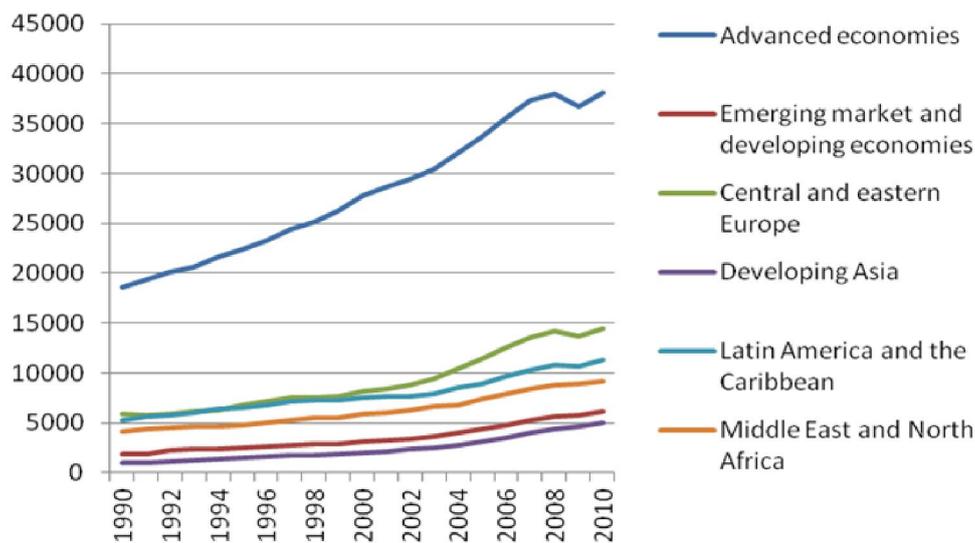
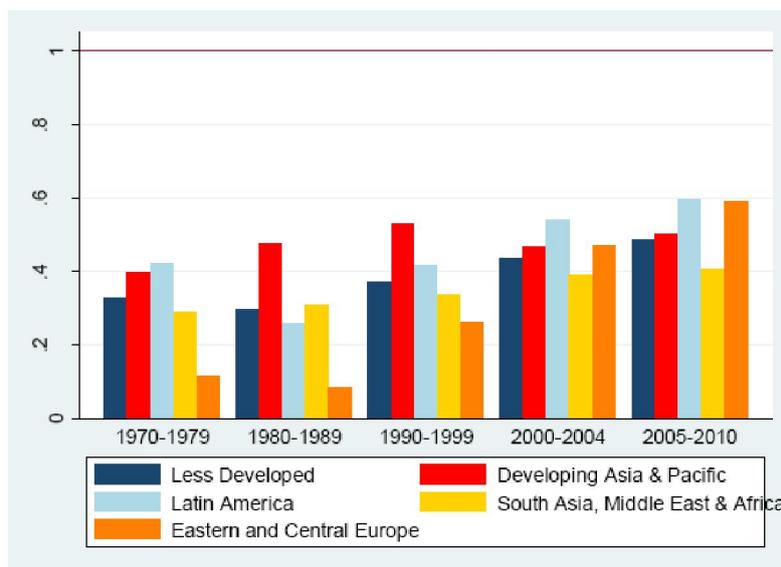


Fig. 2. GDP per capita in PPP terms (International Comparison)

Source : The International Monetary Fund, World Economic Outlook Database, October 2012.

Moreover, figure 3 presents the evolution of the financial openness index by regions. As the chart clearly shows, the Africa index of capital account openness has been increasing since the 1990s, but it has been weaker than in some other emerging market economies.



Note: The maximal value of *KAOPEN* is indexed as 1.00.

Fig. 3. Financial openness in developing countries: a comparison

Source : Ito and Chinn (2012), [36]

Financial integration is essential for the region's development, both in terms of trade and internal cooperation, and for the Maghreb's relations with its external partners, notably the European Union [37]. The Arab Maghreb Union (AMU) was founded on February 1989, when the five member states (Algeria, Libya, Morocco, Mauritania, and Tunisia) signed the constituting treaty. This treaty has the following objectives [38]: (i) progressive implementation of free movement of capital, services, goods and persons between member states; (ii) adoption of a common policy in economic, industrial, financial, agricultural, and commercial terms; (iii) establishment of a free trade area with the dismantling of all trade tariff and non tariff barriers among member countries; (iv) creation of a unified custom space with the adoption of a common external tariff with other countries; and (v) strengthening the economic partnership in the Maghreb. Indeed, to strengthen monetary and financial linkages between the five member states, several multilateral trade and financial agreements have been signed on issues relative mainly to regional trade and tariffs, investment guarantees, tax provisions, interbank relationships, and financial settlements (see appendix, figure A-1). Also, Maghreb region needs to develop a strong institutional framework and make additional progress on trade liberalization and facilitation to foster integration.

Finally, we can say that the economic reforms that have been undertaken in all Maghreb countries over the past two decades have generally achieved macroeconomic stability and contributed to raising growth in some countries. Despite these developments, financial sectors of these countries still need further modernization and regional and global integration. Some of the necessary reforms would also facilitate financial integration in the region [39]: (i) strengthen the soundness of the banking systems in all the five countries, (ii) increase competition in the banking systems, (iii) deepen the financial markets, (iv) strengthen financial sector oversight, and (v) upgrade financial sector infrastructure.

The remainder of the paper is organized as follows. Section 4 shows the empirical analysis on the effects of external shocks on financial integration project in Maghreb countries. The first part of this section describes the data and the econometric methodology; while the second part presents the model of this study. Section 5 gives the empirical results.

## 5 EMPIRICAL INVESTIGATION

### 5.1 METHODOLOGY AND DATA

#### 5.1.1 DESCRIPTIVE DATA

To examine the effects of external shocks on financial integration project in the Maghreb countries (Algeria, Tunisia, and Morocco), we use a quarterly data<sup>8</sup> from the period 1990Q1-2010Q4. The data utilized for the analysis have been collected from a various international databases: the World Development Indicators (World Bank), Lane and Milesi-Ferretti (2007) database, the CNUCED, the UNCTAD stat, the SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012, the Chinn-Ito index (2010)<sup>9</sup>, and the World Economic Outlook Database (IMF), 2012. The exact source for each variable is presented in Appendix (table A-1).

Data unavailability is the main concern in carrying out the research of this nature in most developing countries. The Maghreb countries are therefore not an exception. The annual time series in these countries is not long enough to carry out a robust and sensible econometric analysis. The data for most of the variables listed below is on annual basis. Consequently, in order to have a longer time series data, Eviews software was used in order to carry out a cubic interpolation of the quarterly time series. However, the methodological technicalities and underpinnings behind this technique adopted are beyond the scope of this paper.

#### 5.1.2 ESTIMATION METHODOLOGY

Most of the studies mentioned in the literature review applied constant parameters VAR and factor augmented VAR approaches. One of the first empirical papers dealing with the issue of macroeconomic disturbances through econometric estimations is done by *Bayoumi and Eichengreen (1992)*, [40]. In that seminal paper, they apply a variant of the VAR model to assess the nature of macroeconomic disturbances among different groups of countries. This model is estimated for decomposing permanent and temporary shocks of variables.

The VAR is a technique that enables one to perform variance decomposition and examine the symmetry in each country's response to external shocks; in other words, it allows us to observe how an unexpected change (shock) 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 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 [41]. Before implementing the VAR model, it is necessary to check whether the variables are stationary. We employ the ADF test [42] and the PP test [43]. 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.

### 5.2 REGRESSION SPECIFICATION

From the examination of theoretical and empirical literature review, aimed to study the effect of external financial shocks on financial integration and growth, we specify the model of our study. Based on two endogenous variables (namely  $Y_1$  and  $Y_2$ ) and multivariate exogenous variables (control variables), the basic VAR model has the following general equation:

<sup>8</sup> The data was converted from annual to quarterly time-series by applying cubic interpolation technique embedded in Eviews econometric software.

<sup>9</sup> 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.

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

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

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<sup>10</sup> of this study is based upon studies undertaken by *Khan and Senhadji 2000, Seleteng 2006, Brezigar-Masten and al 2010, Adler and Tovar 2012*, it is as follow:

$$FI_{it} = \alpha_1 + \beta_1 FI_{it-1} + \lambda_1 GDP_{it-1} + \delta_1 FDev_{it} + \gamma_1 Dshocks_{it} + \phi_1 FDev_{it} \times Dshocks_{it} + \theta_1 X_{it} + \mu_{1it} \dots (1')$$

$$GDP_{it} = \alpha_2 + \beta_2 GDP_{it-1} + \lambda_2 FI_{it-1} + \delta_2 FDev_{it} + \gamma_2 Dshocks_{it} + \phi_2 FDev_{it} \times Dshocks_{it} + \theta_2 X_{it} + \mu_{2it} \dots (2')$$

Where  $FI_{i,t}$  denotes financial integration measured by the sum of net foreign assets<sup>11</sup> and external liabilities<sup>12</sup> as a percentage of GDP as indicated in *Lane and Milesi-Ferretti (2007)*, [44].  $GDP_{it}$  variable represents the logarithmic of growth in real GDP per capita for countries.  $FDev_{it}$  is a measure of the development of domestic financial systems; it is calculated by the money supply as a share of per capita GDP.  $Dshocks_{it}$  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.  $X_{i,t}$  is a vector of control variable (country fundamentals and other variables); it contains  $FDI_{i,t}$  that represents Foreign Direct Investment,  $TO_{i,t}$  variable which represents the Trade Openness measured by imports and exports in percentage of GDP,  $ExRate_{i,t}$  denotes the exchange rate variable calculated from nominal exchange rates and CPIs,  $Inf_{i,t}$  that represents the annual rate of change of the Consumer Price Index,  $Kaopen_{i,t}$  variable that measures the extent of openness in capital account transactions.  $\mu_{i,t}$  is the error term.

## 6 EMPIRICAL RESULTS

### 6.1 STATIONARITY AND COINTEGRATION TESTS RESULTS

#### 6.1.1 STATIONARITY TEST RESULTS

Table 1 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 the financial integration variable, the natural logs of real per capita growth, foreign direct investment, inflation,  $Dshocks$ , trade openness, nominal effective exchange rate, and kaopen are not all stationary in the same order (in the 1<sup>st</sup> differences).

<sup>10</sup> The variables were transformed into logarithm form due to the following advantages as suggested by *Seleteng (2006)*: (i) the log transformation provide the best fit. That is to say, the log transformation also, to some extent, smoothes time trend in the dataset; (ii) the log transformation can be justified by the fact that its implications are more plausible than those of a linear model.

<sup>11</sup> Net Foreign Assets (NFA) = Total Assets - Total Liabilities

<sup>12</sup> External liabilities are measured by the sum of portfolio liabilities and FDI liabilities as a share of total liabilities.

Table 1. Unit Root Test Results

Variables in 1 <sup>st</sup> Differences	Algeria		Morocco		Tunisia	
	ADF Test	PP Test	ADF Test	PP Test	ADF Test	PP Test
Y <sub>1</sub>	- 1.506 (0.5247)	- 3.086** (0.0317)	- 1.841 (0.3582)	- 3.727*** (0.0054)	- 1.279 (0.9984)	- 1.046 (0.7329)
Y <sub>2</sub>	- 1.668 (0.4428)	- 3.129** (0.0283)	- 2.887* (0.0513)	- 3.141** (0.0275)	- 3.345** (0.0161)	- 3.707*** (0.0057)
FDev	- 1.677 (0.4383)	- 2.211 (0.0229)	- 2.699* (0.0788)	- 3.429** (0.0096)	- 1.883 (0.3382)	- 2.426 (0.0128)
Dshocks	- 2.664* (0.0851)	- 3.733*** (0.0053)	- 2.664* (0.0851)	- 3.733*** (0.0053)	- 3.416** (0.0132)	- 3.733*** (0.0053)
FDI	- 2.543 (0.1119)	- 3.281** (0.0200)	- 2.486 (0.1231)	- 5.005*** (0.0001)	- 2.786* (0.0651)	- 4.201*** (0.0012)
TO	- 3.463** (0.0116)	- 3.708*** (0.0057)	- 1.833 (0.3618)	- 4.126*** (0.0015)	- 2.672* (0.0839)	- 3.944*** (0.0028)
Inf	- 1.176 (0.6783)	- 3.057** (0.0345)	- 1.326 (0.6094)	- 2.535 (0.0057)	- 2.924** (0.0472)	- 4.459*** (0.0005)
ExRate	- 1.653** (0.4505)	- 4.311*** (0.0008)	- 1.995 (0.2881)	- 2.956** (0.0436)	- 2.106 (0.2427)	- 3.403** (0.0137)
Kaopen	- 1.677 (0.2698)	- 2.034 (0.0016)	- 1.820 (0.0041)	- 2.425 (0.0073)	- 1.316 (0.0174)	- 2.623* (0.0073)

Y<sub>1</sub>: represents Financial Integration variable, Y<sub>2</sub>: Gross Domestic Product, FDev: Financial Development measured by M2 to per capita GDP, Dshocks: Dummy variable of external shocks, FDI: Foreign Direct Investment, TO: Trade Openness, Inf: Inflation in percent change, ExRate: the variable of Exchange Rate, Kaopen: the variable measures the extent of openness in capital account transactions.

\*\*\*: variable stationary at significant levels at 1%, 5%, and 10% (-3.520, -2.900, -2.587 respectively).

Values between brackets are probabilities.

### 6.1.2 COINTEGRATION TEST RESULTS

Table 2 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).

This table shows that, in Algeria and Morocco, there is one cointegration equation at the 0.05 level based on the trace test, as well as the maximum eigenvalue test. However, in the case of Tunisia, the Trace test indicates 4 cointegrating equations at the 0.05 level and indicates two cointegrating relations in the Max-eigenvalue test at the 0.05 level.

Table 2. 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	76.946* (0.0062)	39.781* (0.0088)	82.297* (0.0036)	38.305* (0.0138)	174.535* (0.0001)	79.607* (0.0001)
At most 1	40.164 (0.2167)	21.522 (0.2459)	43.991 (0.1101)	18.515 (0.4529)	94.928* (0.0002)	61.205* (0.0001)
At most 2	18.642 (0.5188)	15.049 (0.2855)	25.476 (0.1451)	15.380 (0.2631)	33.722 (0.5171)	15.424 (0.7140)
At most 3	3.592 (0.9336)	2.933 (0.9511)	10.096 (0.2734)	9.895 (0.2189)	5.395 (0.7655)	4.779 (0.7694)
At most 4	0.659 (0.4168)	0.659 (0.4168)	0.200 (0.6539)	0.200 (0.6539)	0.616 (0.4325)	0.616 (0.4325)

\* denotes rejection of the hypothesis at the 0.05 level.

Values between brackets are probabilities.

Moreover, the stationarity test as well as the cointegration test results will allow us to better specify the VAR model which will be used for the estimation of the response functions of Financial Integration, real GDP, and financial system development to the external shocks (figure A-2 in appendix presents the correlations between each studied variable).

After testing the stationarity of variables using the unit root test and the cointegration approach presented in tables 1 and 2 above, this study also involves the use of impulse response functions and forecast error variance decomposition to assess the response of macroeconomic variables to an external financial shock and the proportion of the variations in the variables attributable to this shock respectively. The analysis that follows is hence preoccupied with these issues together with the standard sensitivity checks typical in most VAR based enquiries.

## **6.2 THE IMPORTANCE OF EXTERNAL SHOCKS IN THE VARIANCE OF DOMESTIC VARIABLES**

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, and B-4) for the all period sample (1970Q1-2010Q4).

Table B-1 presents the variance decomposition of the forecast error of financial integration variable. The external shocks affect the financial integration in Maghreb countries, at short-run horizon (1-4 periods), by at least 0.5 percent (2.24 percent in Algeria and 1.31 percent 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 20 percent of the variance in all countries. In addition, at short-run horizon, external shocks explain at least 1.88 percent of the real GDP variances in the case of Algeria, 0.2 percent for the GDP variances of Morocco, and 0.08 percent in Tunisia (Table B-2). Thus, Algeria is especially sensitive to these shocks. Indeed, external shocks tend to be increasingly 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 financial development variable due to external shocks over the period 1990q1-2010q4. Results suggest that when the country's financial system is more open (or deeper), external shocks have a significant influence on the activities of these systems at long-run horizon. As indicated in table B-4, external shocks exert a stronger influence, at long-run horizon, on *fundamentals* of all studied countries 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.

## **6.3 RESULTS OF IMPULSE RESPONSE FUNCTIONS**

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 [45]: 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, these shocks may lead to negative response of economic activity in the long-run. Thus, the financial integration project among Maghreb countries is impeded in the long-run as a result of external shocks. However, in the short-run, shocks effects on financial integration appear negative in the three countries; this can be justified by the fact that responses to shocks in these countries are relatively slow.

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.

**Table 3. Summary Results of Recent Empirical Studies on External Shocks and Financial Integration**

Studies	Countries	Period	Methods	Main results
Aghion and al. (2004)	Small open economies	/	Dynamic open economy model	The temporary external shocks will have large and persistent effects on countries' fundamentals in the sense that these economies can exhibit stable limit cycles.
Blecker (2008)	Mexico	1979-2007	DOLS Approach <sup>13</sup>	After three decades of liberalization policies, Mexico has become chronically dependent on external forces as the motor of its expansion and remains highly vulnerable to adverse external shocks [44].
Edwards (2009)	Six regions in the World <sup>14</sup>	1970-2004	Panel Probit Analysis	Financial integration strategies increase the degree of vulnerability to external crises.
Brezigar Masten, and al. (2008)	31 European Countries	1996-2004	GMM	Financial integration stimulates a steadier provision of finance through domestic financial markets also in crisis times.
Dincer, Kandil, and Trabelsi (2011)	Turkey	1989-2009 (Quarterly)	Multivariate VAR model	Domestic and external financial shocks affect negatively capital account liberalization and the domestic macroeconomic variables in Turkey.
Allegret and Benkhodja (2011)	Algeria	1990-2010 (Quarterly)	DSGE model <sup>15</sup>	Algeria is especially sensitive to real shocks; and external shocks in both oil and non-oil sectors are the predominant source of macroeconomic fluctuations.
Adler and Tovar (2012)	40 EME <sup>16</sup> and 9 small advanced economies	1990-2012	Cross-sectional Multivariate Estimation	In emerging Europe, the financial integration process has moved in the direction of making the region more vulnerable to global external financial shocks.
Kazi, Wagan, and Akbar (2012)	14 major OECD countries	1981-2010 (Quarterly)	Augmented VAR Approach	Financial integration can play an important role to propagate the shocks to other countries.
Allegret, and al. (2012)	9 East Asian countries	1990-2010 (Quarterly)	SVARX model <sup>17</sup>	Result shows the existence of a rising impact of external shocks on domestic variables since 1990s in East Asian countries.

Source: Elaborated by the authors.

<sup>13</sup> DOLS Approach: Dynamic Ordinary Least Squares Approach

<sup>14</sup> Regions are: Industrial Countries, Latin American and Caribbean, Asia, Africa, Middle East, Eastern Europe.

<sup>15</sup> DSGE model: Dynamic, Stochastic, General equilibrium model.

<sup>16</sup> EME: Emerging Market Economies.

<sup>17</sup> SVARX model: Structural VAR Model with Block Exogeneity.

## 7 CONCLUSION AND POLICY RECOMMENDATIONS

Developing economies continue to be vulnerable to large external financial shocks, as made evident by the behavior of capital flows in and out of these economies during periods of global financial stress. However, and despite its increasing degree of financial integration, such vulnerability appears to have declined over time for some emerging regions, reflecting to a large extent marked improvements in fundamentals. In fact, countries that have made improvements to the external sustainability (current account and external debt) and have applied a more flexible exchange rate have mitigated the impact of external financial shocks, especially in highly integrated economies financially. Overall, these results support the notion that financially integrated emerging economies with strong fundamentals (especially exchange rate flexibility) are better equipped to cope with external shocks, while financially integrated countries with weak fundamentals may be more affected by external shocks.

In this paper we tried to test the effects of external financial shocks on financial integration and macroeconomic variables using a VAR framework with quarterly data covering the period 1990Q1-2010Q4. The aim of this paper is to quantify the importance of external shocks in domestic and external variables fluctuations for a sample of three North African countries (Algeria, Morocco, and Tunisia). We document in addition the dynamic response of each studied variable to external financial stress in these economies. Our results on variance decompositions and impulse responses functions show that Maghreb countries appear especially sensitive to the trade and the financial channel. Moreover, responses of domestic variables to external monetary and financial shocks are more symmetric, thus justifying the non reinforcement of monetary and financial cooperation between the area's countries. Thus, external shocks affect negatively Maghreb countries and impede the implementation of financial integration project.

Finally, we can say that although the economy of each Maghreb country has achieved, these recent years, significant steps leading them to achieve higher level of economic and financial developments, it remains nevertheless that these countries should elaborate structural economic policies especially on the commercial, banking and financial plans. They must also remove all obstacles to free movements of capital, then create a common currency and establish a free trade area. This can allow these countries to increase the degree of financial integration between them, improve economic growth rates in each country, and, thereby, make them less vulnerable to different external shocks.

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APPENDIX

APPENDIX A

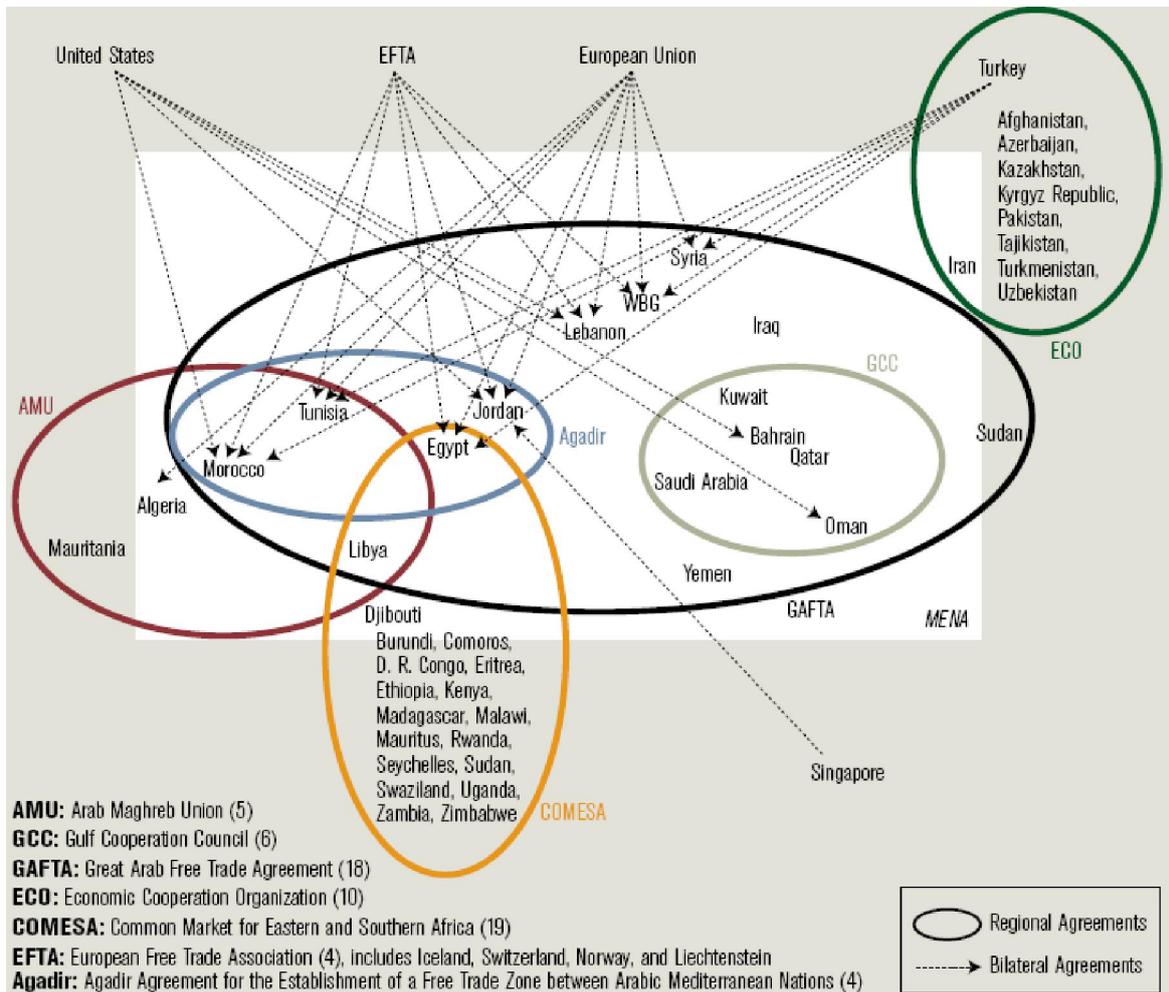


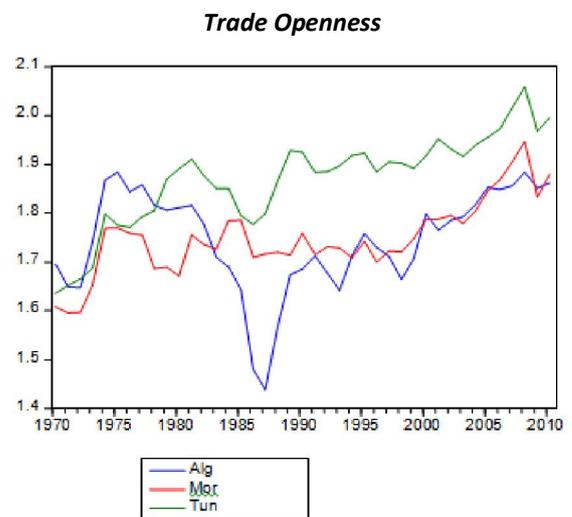
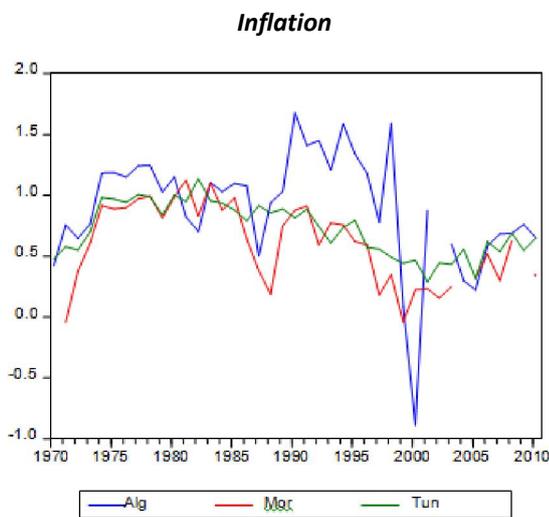
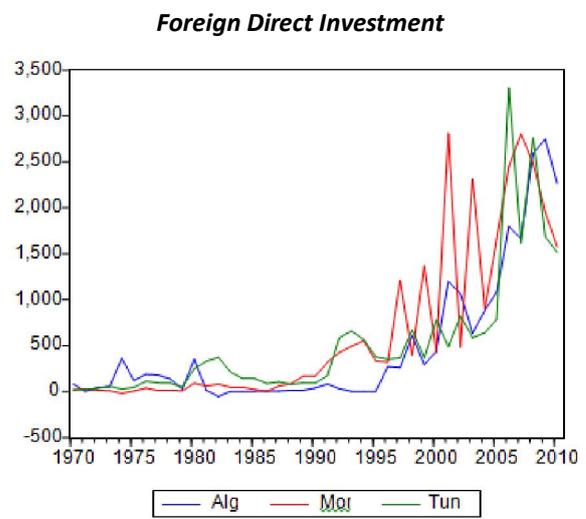
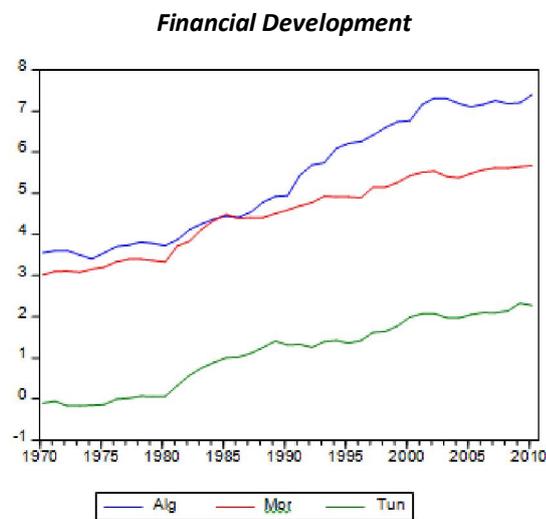
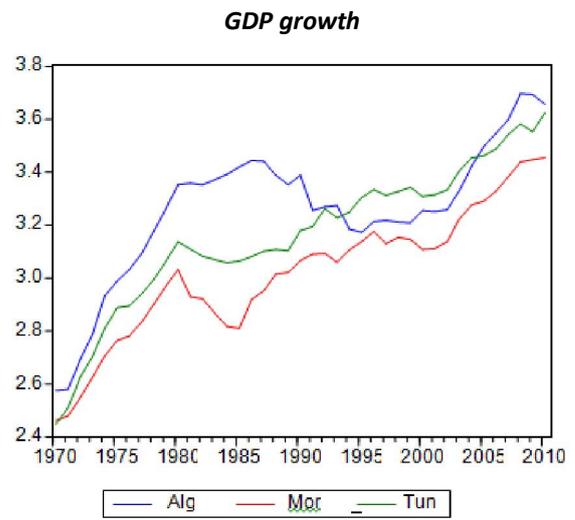
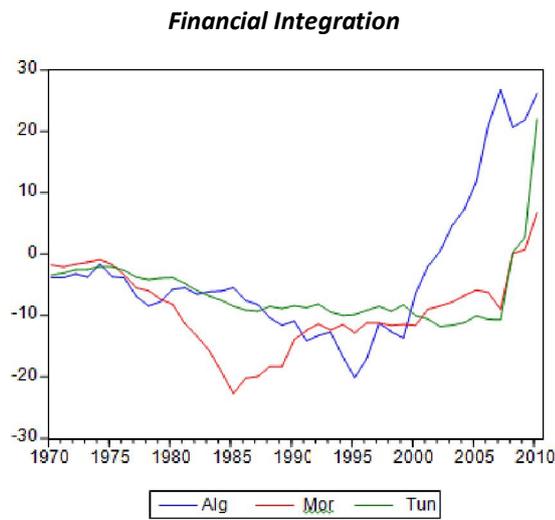
Fig A-1. The network of Trade Agreements across world regions

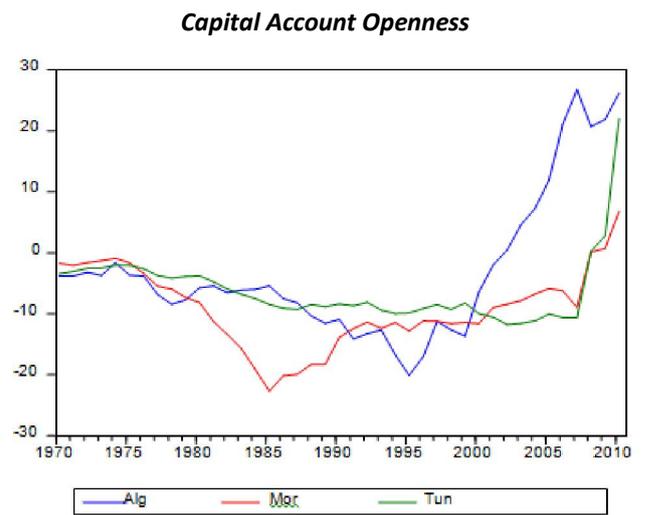
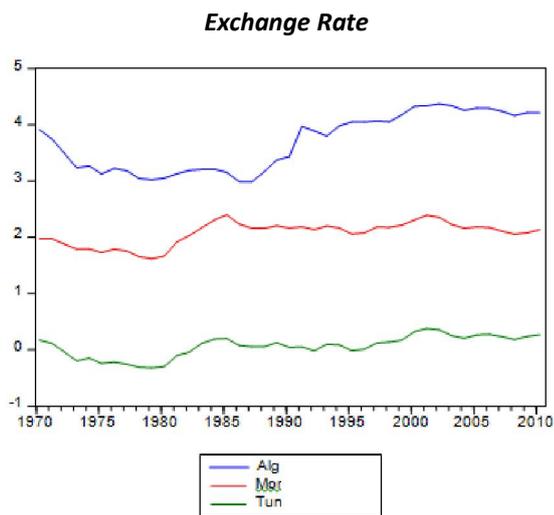
Source: World Bank Report (2009), "2008 MENA Economic Developments and Prospects".

Table A.1 Definition and sources of variables

Variable	Definition	Source
<b>FI</b>	FI denotes financial integration measured by the sum of net foreign assets (NFA) and external liabilities (EL) as a percentage of GDP. The NFA data for the Maghreb countries are available at the Lane and Milesi-Ferretti (2007) database; and the EL data are calculated using the sum of portfolio liabilities and FDI liabilities as a share of total liabilities (available on the database mentioned above).	<ul style="list-style-type: none"> <li>• Updated and extended version of Lane and Milesi-Ferretti (2007) database.</li> <li>• The World Bank Indicators (African Development Indicators), and authors' calculations.</li> </ul>
<b>GDP growth</b>	This variable represents the growth of the real per capita gross domestic product.	<ul style="list-style-type: none"> <li>• IFS;</li> <li>• SESRIC Database.</li> </ul>
<b>FDI</b>	Direct Foreign Investment flow as % of GDP. This variable measures the inflows of capital in countries.	<ul style="list-style-type: none"> <li>• CNUCED</li> <li>• UNCTADstat</li> </ul>
<b>FDev</b>	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.	<ul style="list-style-type: none"> <li>• International Financial Statistics (IFS).</li> <li>• The SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012.</li> </ul>
<b>Dshocks</b>	<i>Dshochs</i> is a dummy variable of external shocks taking on a value of one if country <i>i</i> experiences a financial disturbances in period <i>t</i> and zero otherwise.	/
<b>TO</b>	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.	<ul style="list-style-type: none"> <li>• The SESRIC BASEIND (Basic Social and Economic Indicators) Database 2012.</li> </ul>
<b>Inf</b>	This variable measures the inflation rate in the three Maghreb Countries. It represents the annual rate of change of the Consumer Price Index.	<ul style="list-style-type: none"> <li>• International Monetary Fund, World Economic Outlook Database, April 2012.</li> </ul>
<b>ExRate</b>	Exrate denotes the exchange rate variable; it is calculated from nominal exchange rates and CPIs.	<ul style="list-style-type: none"> <li>• IFS, Global Insight, Oxford Economic Forecasting and ERS Baseline Regional Aggregations.</li> </ul>
<b>Kaopen</b>	This variable measures the extent of openness in capital account transactions.	<ul style="list-style-type: none"> <li>• The Chinn-Ito index (2010 Update Version).</li> </ul>

Fig A-2. Correlations between studied variables 1990Q1-2010Q4





## APPENDIX B. VARIANCE DECOMPOSITION

**Table B-1. The fraction of the variance of the FI due to external shocks, 1990Q1-2010Q4**

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	2.24	0.65	1.31
	16-20	22.61	85.19	58.41

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, 1990Q1-2010Q4**

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	1.88	0.20	0.08
	16-20	2.36	0.34	2.20

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 FDev due to external shocks, 1990Q1-2010Q4**

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	0.21	0.01	0.04
	16-20	1.40	0.23	3.99

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 Fundamentals due to external shocks, 1990Q1-2010Q4**

Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	1-4	1.09	0.24	0.42
	16-20	33.74	26.79	18.84

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.

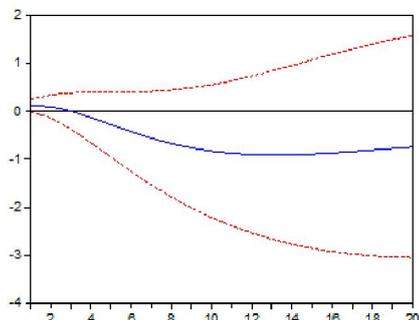
APPENDIX C. IMPULSE RESPONSE FUNCTIONS TO AN EXTERNAL SHOCK, 1990Q1-2010Q4

ALGERIA

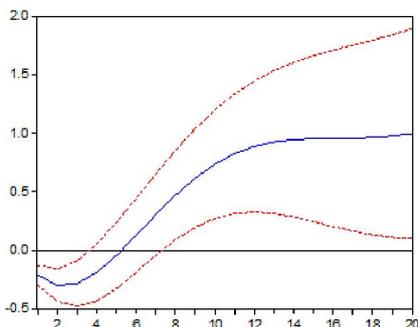
MOROCCO

TUNISIA

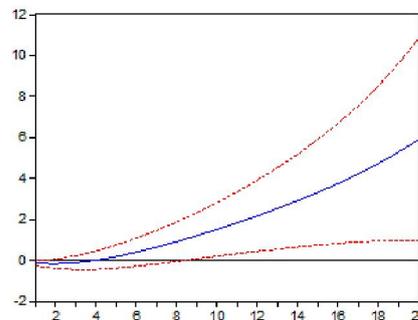
Responses of FI to shocks



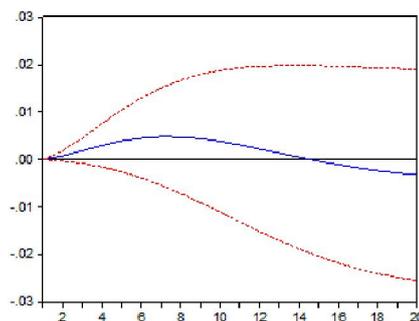
Responses of FI to shocks



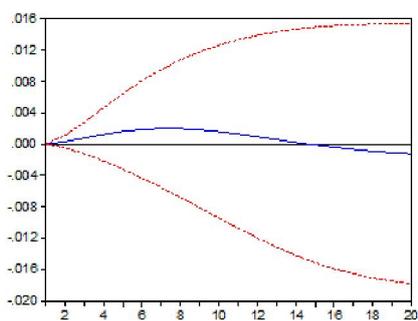
Responses of FI to shocks



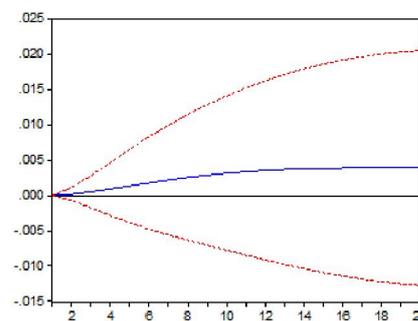
Responses of GDP to shocks



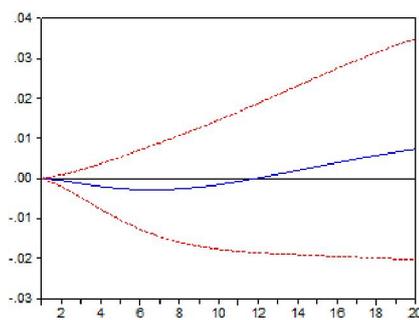
Responses of GDP to shocks



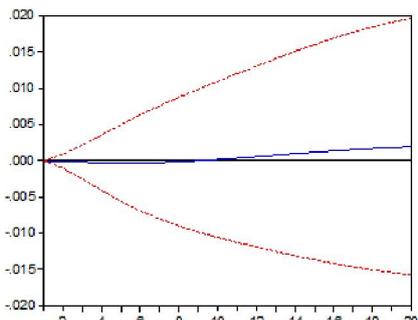
Responses of GDP to shocks



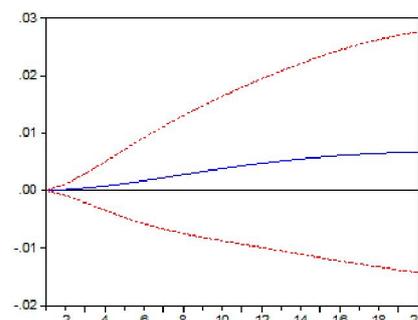
Responses of FDev to shocks



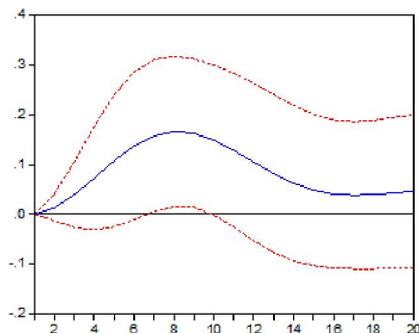
Responses of FDev to shocks



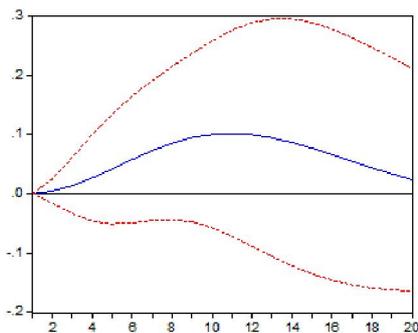
Responses of FDev to shocks



Responses of Fundamentals to shocks



Responses of Fundamentals to shocks



Responses of Fundamentals to shocks

