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## **Recent Trends in Regional Financial Integration and Trade Liberalization in Maghreb Countries: A Multivariate Threshold Autoregressive Analysis**

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### **Abstract**

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Increased globalization over the last two decades has led to strong growth in international business activity and international financial integration. This phenomenon covers a wide array of economic activities, including regional and international integration, investment and trade, international financial shocks and disturbances. This paper takes stock of current trends in regional financial integration and trade liberalization processes for the case of Maghreb countries. It aims also to examine the effects of these recent trends on economic growth in an era of growing globalization and frequent financial shocks. Using Multivariate Threshold Vector Autoregressive (MVTAR) estimation with data from 1990 to 2012, this study argues that the greater and deeper regional financial integration and trade will have positive repercussions for each Maghreb country. In addition, estimation results show that the regional financial integration process plays a positive role in enlarging the borders of countries as well as the market size of each country and, consequently, in stimulating economic growth. Finally, we can assert that the study argues that political and structural impediments continue to hamper regional integration.

JEL: F36, E44, F65, G01, C3

Keywords: Regional financial integration, trade liberalization, globalization, Maghreb countries, multivariate threshold analysis.

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# Recent Trends in Regional Financial Integration and Trade Liberalization in Maghreb Countries: A Multivariate Threshold Autoregressive Analysis

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## **Abstract:**

Increased globalization over the last two decades has led to strong growth in international business activity and international financial integration. This phenomenon covers a wide array of economic activities, including regional and international integration, investment and trade, international financial shocks and disturbances. This paper takes stock of current trends in regional financial integration and trade liberalization processes for the case of Maghreb countries. It aims also to examine the effects of these recent trends on economic growth in an era of growing globalization and frequent financial shocks. Using Multivariate Threshold Vector Autoregressive (MVTAR) estimation with data from 1990 to 2012, this study argues that the greater and deeper regional financial integration and trade will have positive repercussions for each Maghreb country. In addition, estimation results show that the regional financial integration process plays a positive role in enlarging the borders of countries as well as the market size of each country and, consequently, in stimulating economic growth. Finally, we can assert that the study argues that political and structural impediments continue to hamper regional integration.

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## **Introduction**

Since the early 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. Accompanying these developments, the effects of financial integration on economic growth have been largely analyzed in the literature (*Obstfeld 1986; Bayoumi 1990; Eichengreen 1992; De Gregorio 1999; Agénor 2001; Edison and al. 2002; Lane and Milesi-Ferretti 2003; Brezigar-Masten and al. 2008; Manganelli 2010; Mougani 2012*). Indeed, increased globalization over the last two decades has led to strong growth in international business activity and international financial integration. This phenomenon covers a wide array of economic activities, including international trade, and external financial shocks and disturbances. In fact, it is found that financial integration can lead countries to

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improve their growth rates through the amelioration of financial systems and international trade. While, other studies indicate that financial integration hasn't significant effects on growth insofar such economic liberalization and openness can cause serious financial and economic disturbances.

In this context, the main objective of this work is to investigate the effects of financial integration on economic growth of Maghreb countries in the era of globalization. Our empirical investigation is based on multivariate threshold autoregressive estimation (MVTAR model) during the period 1990-2012. We find that the greater and deeper economic integration and regional trade (achieved through the liberalization of the openness of financial and trade transactions, the reform of the investment climate, the strengthening of competition and competitiveness) will have positive repercussions for each Maghreb country. In addition, estimation results show that the financial integration process plays a positive role in enlarging the borders of countries as well as the market size of each country and, consequently, in stimulating economic growth. On the other hand, in a globalized world characterized by financial shocks and economic crises, we find that financial external shocks affect negatively these countries and impede the implementation of financial and economic integration. Finally, we can assert that the study argues that political and structural impediments continue to hamper regional integration.

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

## **1. Literature review**

An overview of the literature shows that several studies have explored the link between financial integration, regional trade liberalization and economic growth. Despite the existence of numerous contributions over this link, results remain conflicting about whether financial openness plays a positive or a negative role in real economic growth. *King and Levine (1993 b)* indicate that several studies show that financial development is important to promote economic growth, even after controlling for a variety of indicators such as physical capital accumulation that have been usually considered as determinants of growth. *Obstfeld (1994)* indicates that financial liberalization can stimulate economic growth by improving the allocation of capital through risk sharing. In practice, empirical analyses use either *proxy variables for government restrictions on capital flows* or *measures of actual international capital flows*.

In contrast, many studies show that capital account liberalization hasn't a significant effect on economic growth. The *Grilli and Milesi-Ferretti (1995)* study has not confirmed the robust long-term effect of international financial liberalization on growth. In their empirical studies, they use a large sample of developing and developed countries and ended up by showing that the financial integration hasn't significant effects on economic growth.

The *Quinn's (1997)* study is one of the first works that deals with the relationship between capital account liberalization and economic growth. *Quinn (1997)* uses his own *proxy* variable to measure capital account restriction degree. Quinn's empirical estimates using a cross-section of 58 countries, over the period 1960 to 1989, give credit to the argument that capital account liberalization has a strongly significant effect on real per capita GDP growth. Similarly, *Klein and Olivei (1999)* find that the effect of open capital accounts on financial deepness and economic growth in a cross-section of countries over the period 1986-1995 is statistically significant and economically relevant. But, this result is largely driven by the developed countries included in the sample. Furthermore, *Levine (2001)* shows that financial sector liberalization can strengthen domestic financial systems leading to more investment, better efficiency in the allocation of capital and higher growth. Edwards (2001) finds also that capital account liberalization leads to growth in higher income countries.

In reviewing the literature on financial integration and growth, Eichengreen (2001) noted that various theoretical models imply inconsistent or weak effects from capital account liberalization. In contrary, several theoretical models have identified a number of channels (direct and indirect) through which financial openness process can promote economic growth in developing countries. As such, this process can stimulate growth directly through risk sharing; Moreover, indirect positive effects of financial openness on economic growth could come through its effect on the development of domestic financial markets. This can be true via two channels (*Brezigar-Masten and al., 2008*): First, increased competition between foreign financial intermediaries can lead to reduced intermediation cost and can stimulate demand for funds which tends to increase the size of domestic financial markets. Moreover, financial liberalization can affect domestic markets through the improvements of institutional framework; in other words, improved regulation and corporate governance can enhance the overall stability and reduce asymmetric information problems. Second, by allowing access to foreign financial markets in the form of direct lending by foreign financial intermediaries.

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 *Rancièrè, 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. The study of *Edwards S. (2009)* 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 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>1</sup>. Moreover, the results suggest that financial liberalization strategies increase the degree of vulnerability to external crises.

The economic literature suggests that financial development and capital flows liberalization are determining factors of economic growth because they provide a favorable support for financial integration between countries. In this regard, capital flows play a crucial role, in terms of promoting economic growth and increasing the flows of domestic and foreign investment (*Alessandrini 2010*). In general, financial integration helps domestic financial systems to allocate resources optimally across industrial sectors in a way which improves the overall diversification of the economy and lowers its volatility (*Manganelli and Popov, 2010*).

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, using quarterly data in a multivariate autoregressive vector (VAR) model during the period 1989-2009. 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. Thus domestic and external financial shocks negatively affect capital account liberalization and the domestic macroeconomic variables.

In sum, financial integration gives an access opportunity to world capital markets, provides for a better allocation of savings and investment, and offers more sophisticated instruments to manage risks better. Also, as financial capital liberalization process has brought new global challenges to financial systems, it then prepares them to strengthen their macroeconomic fundamentals, revise their legal and regulatory frameworks, and improve the international financial architecture, by adopting a more active role within the global community of central banks, regulators and other authorities.

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<sup>1</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.

## 2. Overview of financial systems and financial integration in Maghreb countries

In recent years, Maghreb countries are well aware of the importance of modernizing their financial sectors 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 economic cooperation, and intensifying mutual commercial exchanges as a precursor for integration and the creation of a North African Common Market (*Russo and Ugolini 2008*).

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

**Table 1: Overview of AMU Countries in 2012**

Country	Pop'n M	GDP US \$ m	GDP per capita US \$	FDI inflow US \$ m	OPEC Y/N	Nonhydrocarbon Growth (%)	WTO Yr joined
Algeria	38.4	207,794	5,693	1484	Yes	5.4	No
Morocco	32.5	97,530	3,114	1204,37	No	-	1995
Tunisia	10.7	45,611	4,924	166,32	No	-	1995

Source: The International Monetary Fund, World Economic Outlook Database, World Development Indicators.

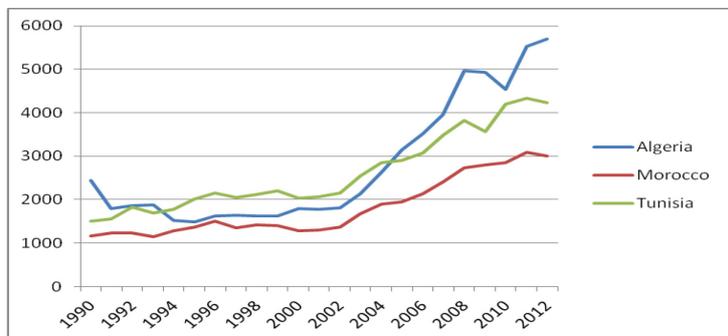
From the table it can be seen that the region's top economy in terms of overall GDP is Algeria, the member of OPEC (Organization of the Petroleum Exporting Countries). Nevertheless, Algeria's economic performance remains heavily dependent on the hydrocarbons sector owing to its importance in the economy; it accounts for over 40% of GDP, 98% of exports, and more than 70% of fiscal revenues (*KMPG, 2012*). While, the non hydrocarbon growth accounts for only 5,4% in 2012. Thereby, the construction of a strong economic and financial integration may be the main stimulator of Algerian economic growth excluding the hydrocarbon sector.

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 1 and 2 US million \$ of the FDI inflows. It is true that a substantial increase was recorded in these countries, but it is still insufficient on a global scale (*Reggad 2008*).

The main characteristics of the financial systems in these countries include the following (*Tahari and al, 2007*): (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. Thus, countries that have implemented deeper structural reforms have reaped the highest growth.

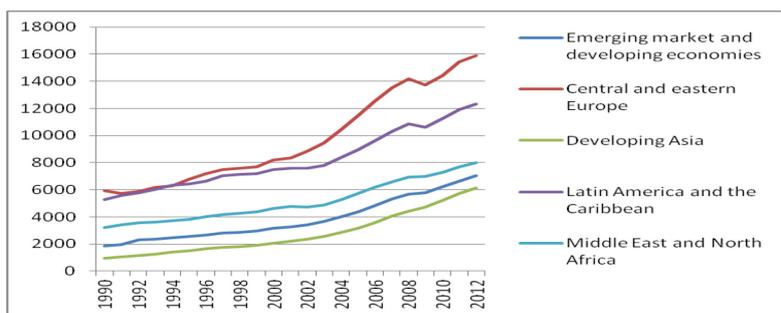
**Figure 1: GDP per capita in PPP terms (Intra-Maghreb Comparison)**



Source: The International Monetary Fund, World Economic Outlook Database, April 2013.

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 America). 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% of the subregion’s combined GDP and less than 3% of the subregion’s total trade (*Akhtar and Rouis 2010*). Some of the reasons for this low performance include high barriers to trade, lack of production base diversification, and political considerations.

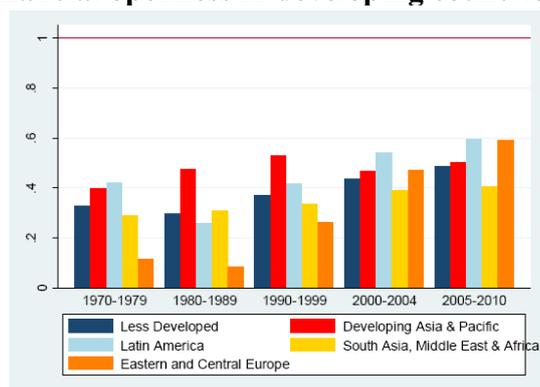
**Figure 2: GDP per capita in PPP terms (International Comparison)**



Source: The International Monetary Fund, World Economic Outlook Database, April 2013.

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.

**Figure 3: Financial openness in developing countries: a comparison**



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

Source: Ito and Chinn (2012)

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 (*Darrat and Pennathur 2002, p 80*). To strengthen financial linkages between the five member states, several multilateral financial agreements have been signed on issues relative mainly to regional trade, investment guarantees, interbank relationships, and financial settlements (see appendix, figure A-1). Also, Maghreb region needs to develop a strong institutional framework in order to foster integration.

### 3. Benefits and costs of financial integration in North Africa

In the real world, a duality of benefits and risks is inescapable because of the existence of asymmetric information and imperfect contract enforcement problems (*Obstfeld 1998*). 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 (*Buiter and Taci 2003*). 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.

#### 2.1 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 (*Agénor 2001, p 5*): 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; and

the increased efficiency as well as the greater stability of the domestic financial system associated with foreign bank penetration<sup>1</sup>.

For the case of North Africa, or more precisely 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 (*Martinez and al. 2008, p 10*).

Furthermore, the financial openness process and the concretization of financial integration project in the Maghreb 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 financial institutions into regional and global players by increasing their competitiveness in the area of globalization (*The African Development Bank Report, 2009*). 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 and 2007. Their findings include: (i) a reduction in inflation rates, except in Libya; (ii) a 30 % increase in real per-capita GDP; (iii) an increase in the share of total merchandise in GDP from 41.7 % in 1989 to 72.5 % in 2007; and (iv) an increase in inward FDI stock as a share of GDP by more than 100 % between 1990 and 2006.

## **2.2 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 (*Agénor 2001, p 12*): 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; and risks associated with foreign bank penetration.

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<sup>1</sup> About this concept, see the study of *Caprio and Honohan (1999)*.

In general, both domestic and external financial liberalization policies in several countries have increased their vulnerability to financial shocks; these policies appear to have been associated with costly financial shocks, as documented by *Williamson and Mahar (1998)*. 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 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 (*Eichengreen and Mussa 1998*).

The financial integration between the Maghreb countries 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 EU 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. Losses due to the lack of integration can reach more than 10 billion \$ per year for the entire region (*Martinez and al. 2008, p 10*). Moreover, the weakness of exchanges between the five North African countries (Algeria, Morocco, Tunisia, Libya, and Mauritania) hinders their growth rates due in particular to the rigidity of their economic structures, customs barriers and low levels of investment.

## **4. Empirical investigation**

### **4.1 Estimation Methodologies**

Most of the studies mentioned in the literature review, which have investigated the relationship between financial integration and economic growth (taking into account the effects of external shocks), used VAR models. However, several authors (*Beaudry and Koop 1993; Pesaran and Potter 1994; Potter 1995*) showed that linear models are too restrictive. These authors argued that linear models have a symmetry property, which implies that shocks occurring in a recession are just as persistent as shocks occurring in the case of expansion. Thus, linear models cannot adequately capture the asymmetries that may exist in various macroeconomic models.

This analysis is based on the utilization of annual and quarterly data on the case of the three North African countries during the period 1990-2012 and using a multivariate threshold autoregressive model (MVTAR) and generalized impulse response functions (GIRF). Our additional contribution consists in exploring the symmetry of external shocks affecting the country and its degree of synchronization. To do this, we first started with cointegration test; then we present the examination of vector autoregressive model (VAR) for the three studied countries. The

VAR technique allows us to perform the variance decomposition and examine the symmetry of the response of each country to external shocks. Then, we use the multivariate threshold autoregressive model to test the non-linearity which can exist between macroeconomic variables of our model.

This empirical study addresses the following questions: Is financial integration process good for stimulating economic growth in the region? *In times of financial shocks, is there a degree of economic tolerance which shields the economy from the impact of an external shock?* The major contribution of our paper is that it uses Tsay's MVTAR model to estimate the threshold value (a) regarding the impact of an external shock, and (b) the length of response of the threshold variable in each studied countries. We then employ the multiple regression model to test and identify the relationship between studied variables and (a) or (b) in each country.

In this section, we present the MVTAR model that we will be using in our empirical analysis.

#### 4.1.1 The multivariate threshold autoregressive model: estimation

MVTAR are models that can encompass different regimes. Each regime can be represented by a VAR model. However, the switching of the regime is governed by a switching variable, so that any crossing above or below the threshold will trigger a change of regime. The origin of this model of *Tsay (1998)* dates back to the univariate threshold autoregressive model (TAR) of *Tong (1978)*. The objective of a TAR model is to divide data into different regimes through a threshold variable, where (b) represents the delay periods of the threshold variable. At the beginning, the threshold variable uses the delay (b) period of the dependent variable; hence, the univariate TAR model is also referred to as SETAR (self-exciting TAR).

As expressed by *Tsay (1998)*, the MVTAR model is considered as follows:

$$Y_t = \begin{cases} f_1(Y_{t-1}, Y_{t-2}, \dots; \varepsilon_{1t} | \theta_1) & \text{if } z_{t-d} \leq r \\ f_2(Y_{t-1}, Y_{t-2}, \dots; \varepsilon_{2t} | \theta_2) & \text{if } z_{t-d} > r, \end{cases} \dots\dots\dots (1)$$

where  $Y_t$  represents the real per capita GDP as well as the variable of financial integration,  $f_i(\cdot)$  are well-defined functions such that  $f_i(\cdot) \neq f_j(\cdot)$  if  $i \neq j$ ,  $\theta_i$  are finite-dimensional parameters,  $\varepsilon_{it}$  denote noise terms,  $z_{t-d}$  is the threshold variable with a delay (lag)  $d$  (*Huang and al, 2012*).

The study of *Tsay (1998)* focuses on linear models that may depend on a vector of endogenous variables  $Y_t = (Y_{1t}, \dots, Y_{kt})$  with  $k$ -dimensional time series, and a  $v$ -dimension vector of exogenous variables  $X_t = (X_{1t}, \dots, X_{vt})$ ; with  $r$  an interval of the possible threshold values. According to *Tsay's* study, by achieving these conditions,  $Y_t$  follows a multivariate threshold model with threshold variable  $z_t$  and delay (lagged period)  $d$ , if it satisfies the following equation:

$$Y_t = c_j + \sum_{i=1}^p \phi_i^{(j)} Y_{t-i} + \sum_{i=1}^q \beta_i^{(j)} X_{t-i} + \varepsilon_i^{(j)} \quad \text{if } r_{j-1} < z_{t-d} \leq r_j \quad \dots\dots\dots (2)$$

where  $j = 1, \dots, s$ ,  $c_j$  vectors of constants,  $p$  and  $q$  are numbers of non negative integer. The satisfied innovations  $\varepsilon_i^{(j)} = \sum_j^{1/2} a_t$ , where  $\sum_j^{1/2}$  are symmetric positive matrixes and  $\{a_t\}$  is a sequence of serially uncorrelated random vectors with mean 0 and covariance matrix  $\mathbf{I}$ , the identical matrix. The threshold variable  $z_t$  is assumed to be stationary and have a continuous distribution. This model (2) with  $s$  regimes is considered linear in the threshold space  $z_{t-d}$ , but it is nonlinear in time when  $s > 1$ .

For estimating equation (2), Tsay (1998) consider the null hypothesis that  $Y_t$  is linear versus the alternative hypothesis that it follows the multivariate threshold model. To do this, the author generalizes the test statistic of Tsay (1989) to the multivariate model in equation (2) and use simulation to study the finite-sample performance of the test statistic. Before estimating equation (2), we need to test for possible potential non-linearity (threshold effect) in this equation. *Tsay (1998)* suggests using the arranged regression concept to construct the test statistic. The goal of this arranged regression is to detect the threshold nonlinearity of  $Y_t$  (assuming that  $p$ ,  $q$ , and  $d$  are known). To this end, Tsay (1998) uses the least squares method and places the model in a regression framework.

$$Y'_t = X'_t \phi + \varepsilon'_t \quad t = h+1, \dots, n \quad \dots\dots\dots (3)$$

where  $h = \max(p, q, d)$ ,  $X_t = (1, Y_{t-1}, \dots, Y_{t-p}, X'_{t-1}, \dots, X'_{t-q})'$  is a  $(pk + kv + 1)$ -dimensional regressor,  $\phi$  denotes the parameter matrix. For this equation, the threshold variable  $z_{t-d}$  assumes values in  $S = \{z_{h+1-d}, \dots, z_{n-d}\}$ . An important feature of the arranged regression is that it effectively transforms a threshold model into a change-point problem, because regression is arranged according to the increasing order of threshold variable  $z_{t-d}$ .

In order to estimate the conditional least squares estimation of the threshold variable in equation (2), Tsay (1998) assumes that  $p$ ,  $q$ , and  $s$  are known and the threshold variable  $z_t$  is given. But the delay  $d$  and the thresholds are part of the parameters. The aim of the Tsay's study is to generalize the results obtained by *Chan (1993)* and *Hansen (1996)* for the univariate case. For simplicity, the model is written as follows:

$$Y_t = \begin{cases} X'_t \phi_1 + \sum_1^{1/2} a_t & \text{if } z_{t-d} \leq r_1 \\ \dots\dots\dots (4) \\ X'_t \phi_2 + \sum_2^{1/2} a_t & \text{if } z_{t-d} > r_1 \end{cases}$$

where  $a_t = (a_{1t}, \dots, a_{kt})'$ ;  $z_{t-d}$  is stationary and continuous with a positive density function  $f(r)$  on a bounded subset of the real line  $R_0 \subset R$ , and  $d \in \{1, \dots, d_0\}$ , where  $d_0$  is a fixed positive integer. The estimation of parameters of model (4) which are  $(\phi_1, \phi_2, \Sigma_1, \Sigma_2, r_1, d)$  requires the conditional least squares technique. This estimation can be obtained using two steps.

**a)**- First, for given  $d$  and  $r_1$ , model (4) reduced to two separated multivariate linear regressions from which the least square estimates of  $\phi_i$  and  $\Sigma_i$  ( $i = 1, 2$ ) are readily available. The estimates are:

$$\hat{\phi}_t(r_1, d) = \left( \sum_t^{(i)} X_t X_t' \right)^{-1} \left( \sum_t^{(i)} X_t Y_t' \right)$$

and

$$\hat{\Sigma}_t(r_1, d) = \frac{\sum_t^{(i)} (Y_t - X_t' \hat{\phi}_i^*) (Y_t - X_t' \hat{\phi}_i^*)'}{n_i - k} \dots\dots\dots (5)$$

where  $\sum_t^{(i)}$  denotes the sum of all the observations in the regime  $i$ ,  $\hat{\phi}_i^* = \hat{\phi}_i(r_1, d)$ ,  $n_i$  is the number of data points in regime  $i$ , and  $k$  is the dimension of  $X_t$  satisfying  $k < n_i$ , for  $i = 1, 2$ . The author denotes the sum of squares of residuals by:

$$S(r_1, d) = S_1(r_1, d) + S_2(r_1, d)$$

where  $S_i(r_1, d)$  denotes the trace of  $(n_i - k) \hat{\Sigma}_i(r_1, d)$ .

**b)**- The second step consists in estimating the conditional least squares of  $r_1$  and  $d$  which are obtained by the following equation [as recommended by Chan (1993) and Hansen (1996) to minimize the sum of squared residuals]:

$$(\hat{r}_1, \hat{d}) = \arg \min_{r_1, d} S(r_1, d)$$

where  $1 \leq d \leq d_0$  and  $r_1 \in R_0$ . The results of the least squares estimates for the parameters in (5) are:

$$\hat{\phi}_i = \hat{\phi}_i(\hat{r}_1, \hat{d})$$

and

$$\hat{\Sigma}_i = \hat{\Sigma}_i(\hat{r}_1, \hat{d})$$

In this analytical framework, the *Tsay's (1998)* study follows the same approaches as *Chan (1993)* and *Hansen (1996)* to determine the asymptotic properties of the conditional least squares estimators.

After determining the optimal thresholds, it is necessary to test the non linearity of the model against the linearity hypothesis. In other words, it seems necessary to test the significance of the MVTAR model against the VAR model. For this end, it is assumed that the null hypothesis ( $H_0$ ) is  $\phi_1 = \phi_2$  which means that the coefficients are equal for the two regimes; and the alternative hypothesis ( $H_1$ ) for nonlinearity is  $\phi_1 \neq \phi_2$ . For this test, Hansen (1996) proposes the standard Wald test and uses the F statistic:

$$F = \frac{S_0 + S_1}{\delta^2} \quad \text{and} \quad F = \sup_{r_1 \in \Gamma} F(r_1)$$

where  $S_0$  represents the sum of squared residuals under  $H_0$  and  $S_1$  is the sum of squares of the residues under  $H_1$ . This test statistic is certainly classical in the econometric literature, but it does not follow a standard distribution and the critical values that correspond to Chi-square are not appropriate. Indeed, the threshold  $r_1$  is not identified under the null hypothesis; this difficulty is called in the literature "*Davies problem*" (see *Davies, 1977*). However, this problem can be solved by referring to the methodology of *Hansen (1996)*. It is sufficient to simulate the asymptotic distribution of the likelihood test by *the bootstrap procedure*<sup>1</sup> to determine the p-value of the statistic. According to *Hansen (2000)*, we can generate the p-value using a distribution function as shown in the equation below. The decision rule is: if the p-value of  $F_1$  is smaller than the selected critical value (1%, 5% or 10%) we reject the null hypothesis of linearity.

$$p - value = 1 - \left[ 1 - \exp\left(-\frac{1}{2} F_1\right) \right]$$

In this paper, we examine the effect of financial integration on economic growth in the MENA countries, taking into consideration the existence of external financial shocks. This study is based on multivariate threshold autoregressive model and the utilization of generalized impulse response functions proposed by *Koop, Pesaran and Potter (1996)*.

#### 4.1.2 Generalized impulse response functions

The generalized impulse response functions proposed by *Koop et al. (1996)* are an instrument used to evaluate the response to shocks in multivariate threshold VAR. The responses depend on the size and the sign of the shock, the history when the shock hits the system and the assumption about

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<sup>1</sup> In statistics, bootstrap is a method for assigning measures of accuracy to sample estimates. This technique allows estimation of the sampling distribution of almost any statistic using only very simple methods. Bootstrap is the practice of estimating properties of an estimator (such as its variance) by measuring those properties when sampling from an approximating distribution. It may also be used for constructing hypothesis tests. It is often used as an alternative to inference based on parametric assumptions when those assumptions are in doubt, or where parametric inference is impossible or requires complicated formulas for the calculation of standard errors.

shocks hitting the economy in the future (*Galvão 2003*). In other words, an impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamical system. The best way to describe an impulse response is to view it as the outcome of a conceptual experiment in which the time profile of the effect of a hypothetical  $m \times 1$  vector of shocks of size  $\delta = (\delta_1, \dots, \delta_m)'$ . Hitting the economy at time  $t$  is compared with a base-line profile at time  $t + n$ , given the economy's history. There are three main issues: (i) the types of shocks hitting the economy at time  $t$ ; (ii) the state of the economy at time  $t - 1$  before being shocked; and (iii) the types of shocks expected to hit the economy from  $t + 1$  to  $t + n$ .

Denoting the known history of the economy up to time  $t - 1$  by the non-decreasing information set  $\Omega_{t-1}$ , the generalized impulse response function of  $Y_t$  at horizon  $n$  is defined as follows: (6)

$$GI_x = (n, \delta, \Omega_{t-1}) = E(Y_{t+n} | \mathcal{E}_t = \delta, \Omega_{t-1}) - E(Y_{t+n} | \Omega_{t-1})$$

Unlike the traditional impulse response analysis, this approach does not require orthogonalization of shocks and it is invariant to the ordering of the variables in the model.

#### 4.2 Descriptive data

To examine the effects of financial integration on economic growth of three Maghreb countries (Algeria, Morocco, and Tunisia) taking into consideration the existence of external financial shocks, we use annual data from the period 1990-2012. 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>1</sup>, and the World Economic Outlook Database (IMF), 2012. The exact source for each variable is presented in Appendix (table A-1).

#### 4.3 Regression specification

From the examination of theoretical and empirical literature review, aimed to study the effects of financial integration on economic growth, taking into consideration the existence of external financial shocks, we specify the model of our study. More specifically, this study is based on those conducted by *Brezigar-Masten and al (2010)*; *Adler and Tovar (2012)*; *Zenasni and Benhabib (2013)*. We specify the model with two endogenous variables (namely  $Y_1$  and  $Y_2$ ) and several multivariate exogenous variables (including control variables). The basic VAR model has the following general equation:

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<sup>1</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  $j^{\text{th}}$  lagged variable of  $(Y_1, Y_2)_t$  and  $X_k$  is the  $k^{\text{th}}$  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.

Using the model (2) of *Tsay (1998)* cited above, the variables of our study are presented as follows:

➤ The endogenous variables are:  $GDP_{it}$  variable representing the logarithmic of growth in real GDP per capita for countries and  $FI_{i,t}$  which denotes financial integration measured by the sum of net foreign assets<sup>1</sup> and external liabilities<sup>2</sup> as a percentage of GDP as indicated in *Lane and Milesi-Ferretti (2007)*.

➤ The exogenous variables are:  $FDev_{it}$  is a measure of the development of domestic financial systems; it is calculated by the liquid liabilities as a share of real GDP (M3/GDP);  $Dshocks_{it}$  is a dummy variable of external financial 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). This vector contains  $FDI_{i,t}$  that represents Foreign Direct Investment measuring the inflows of capital in countries;  $TO_{i,t}$  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.  $\varepsilon_{i,t}$  is the error term.

$$FI_{it} = \alpha_1 + \beta_1 FI_{it-1} + \lambda_1 GDP_{it-1} + \delta_1 FDev_{it} + \gamma_1 Dshocks_{it} + \varphi_1 FDev_{it} \times Dshocks_{it} + \theta_1 X_{it} + \mu_{1it} \dots\dots(1')$$

$$GDP_{it} = \alpha_2 + \beta_2 GDP_{it-1} + \lambda_2 FI_{it-1} + \delta_2 FDev_{it} + \gamma_2 Dshocks_{it} + \varphi_2 FDev_{it} \times Dshocks_{it} + \theta_2 X_{it} + \mu_{2it} \dots\dots(2')$$

## 5. Empirical results

### 5.1 Stationarity and Cointegration tests results

Using the econometric methods mentioned above, this section presents the results of the preliminary analysis necessary prior to the estimation of the multivariate threshold model. The analysis concerns the estimation results about the effects of financial integration on economic

<sup>1</sup> Net Foreign Assets (NFA) = Total Assets - Total Liabilities

<sup>2</sup> External liabilities are measured by the sum of portfolio liabilities and FDI liabilities as a share of total liabilities.

growth in Maghreb countries taking into consideration the impact of external financial shocks on this relationship.

### 5.1.1 Stationarity test results

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.

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 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* all are stationary in the 1<sup>st</sup> differences. 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 <sup>st</sup> Differences	Algeria		Morocco		Tunisia	
	ADF Test	PP Test	ADF Test	PP Test	ADF Test	PP Test
<b>Y<sub>1</sub></b>	- 3.268** (0.0199)	- 3.086** (0.0317)	- 4.198*** (0.0012)	- 3.727*** (0.0054)	- 2.714* (0.9984)	- 2.673* (0.7104)
<b>Y<sub>2</sub></b>	- 3.582*** (0.0083)	- 3.129** (0.0283)	- 2.887** (0.0513)	- 3.141** (0.0275)	- 3.345** (0.0161)	- 3.707*** (0.0057)
<b>FDev</b>	- 3.171** (0.0255)	- 3.211** (0.0229)	- 3.240** (0.0213)	- 3.529*** (0.0096)	- 3.111** (0.0297)	- 3.426** (0.0128)
<b>Dshocks</b>	- 3.416** (0.0132)	- 3.733*** (0.0053)	- 3.416** (0.0132)	- 3.733*** (0.0053)	- 3.416** (0.0132)	- 3.733*** (0.0053)
<b>FDI</b>	- 3.022** (0.0403)	- 3.281** (0.0200)	- 3.232** (0.0223)	- 5.005*** (0.0001)	- 2.786* (0.0651)	- 4.201*** (0.0012)
<b>TO</b>	- 3.463** (0.0116)	- 3.708*** (0.0057)	- 3.302** (0.1740)	- 4.126*** (0.0015)	- 2.672* (0.0839)	- 3.944*** (0.0028)
<b>Inf</b>	- 3.414** (0.0138)	- 3.057** (0.0345)	- 3.552** (0.0097)	- 3.735*** (0.0057)	- 2.924** (0.0472)	- 4.459*** (0.0005)
<b>ExRate</b>	- 3.259** (0.0204)	- 4.311*** (0.0008)	- 2.974** (0.0418)	- 2.956** (0.0436)	- 3.517** (0.0100)	- 3.403** (0.0137)
<b>Kaopen</b>	- 3.677*** (0.2698)	- 4.034*** (0.0016)	- 3.820*** (0.0041)	- 3.623*** (0.0073)	- 3.316** (0.0174)	- 3.623*** (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.

### 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	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.

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 2 cointegrating equations in the Max-eigenvalue test at the 0.05 level.

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 in the Maghreb region). In other words, 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.

## 5.2 Estimating VAR model

In this section, we first estimate a simple VAR model (one regime VAR model). The VAR is a technique that enables us 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 (*Benhabib and al., 2010*).

### 5.2.1 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 table 4.

This table 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. Thus, Algeria is especially sensitive to these shocks. In this point, *Allegret, and al. (2012)* confirm in their study on the case of the East Asian countries that studied external shocks explain higher levels of GDP; for instance, for the case of Japan and Hong Kong (which are especially sensitive to these shocks), they explain respectively 58.8 and 36.8 of their real GDP variance. External shocks tend to be persistent as their weight in the real GDP variances increases with time horizon. 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, the third part of table 4 presents the fraction of the variance of the financial development variable due to external shocks over the period 1990-2012. 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 the last part of table 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.

**Table 4: the fraction of the variance of the macroeconomic variables due to external shocks, 1990-2012**

	Variables	Horizons	Algeria	Morocco	Tunisia
External Shocks	The variance of <i>FI</i>	1-4	6.62	2.71	5.87
		16-20	18.68	11.15	11.81
	The variance of <i>GDP</i>	1-4	1.09	0.80	0.59
		16-20	8.83	4.12	1.64
	The variance of <i>FDev</i>	1-4	4.39	11.55	0.56
		16-20	13.73	59.87	6.19
	The variance of <i>Fundamentals</i>	1-4	2.80	0.69	1.54
		16-20	8.97	1.73	4.43

Notes : "1-4" correspond à la moyenne entre 1 trimestre et 4 trimestres après la survenance d'un choc. "16-20" correspond à la moyenne entre 16 et 20 trimestres après la survenance d'un choc.

### 5.3 Results of Impulse Response Functions

Dynamic responses of each studied variable to the external shocks are depicted in appendix B 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, 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, as shown in the study of *Allegret, and al. (2012)*, 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. This evidence is confirmed also by *Dincer and al (2011)* studying the case of Turkey; they show that that capital flows would increase domestic liquidity, which can decrease the nominal interest rate and the effect

on the real interest rate. 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.

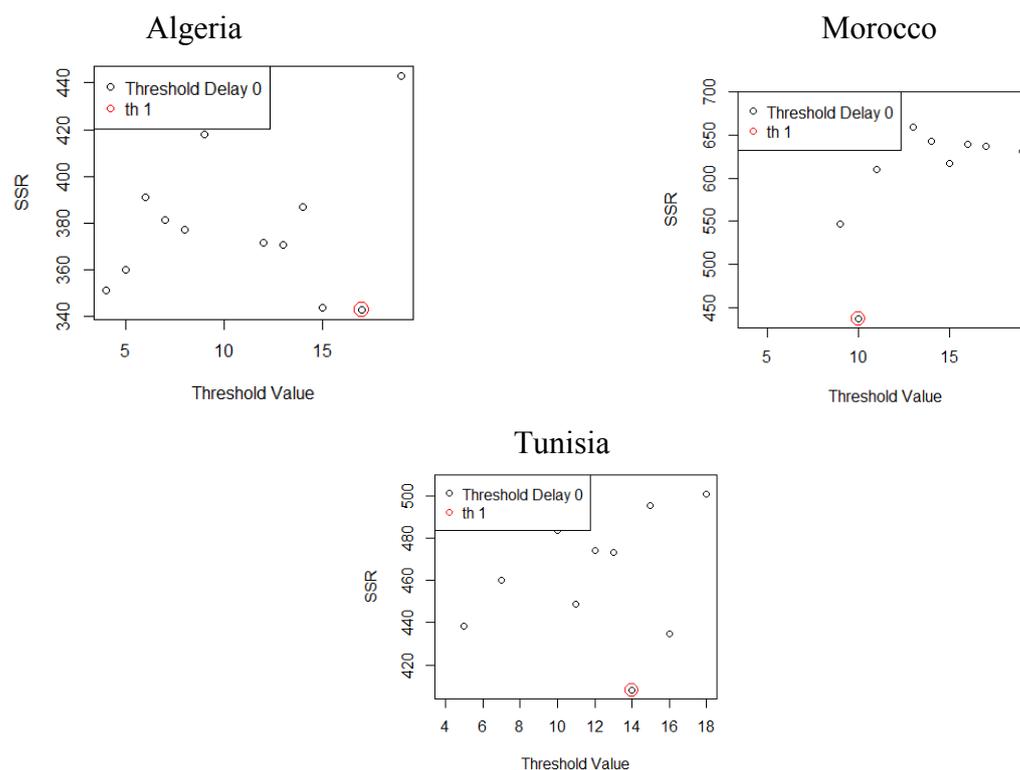
**Table 5: Linearity test results**

	<b>Algeria</b>	<b>Morocco</b>	<b>Tunisia</b>
<b>Threshold estimate</b>	0.783	0.541	0.682
<b>LM test for no threshold</b>	32.661 (0.0290)	30.743 (0.0368)	29.166 (0.0321)
<b>Chi squared value</b>	2.83048E-17	1.65988E-16	2.40416E-15

Values in brackets represent the "p-value".

Indeed, table 5 shows that the hypothesis of linearity is not accepted for the three countries. Then, the results of the variance decomposition and impulse responses functions presented above are not sufficient. In other words, the estimation results indicate the existence of non-linearity between variables, which justifies the use of MVTAR model for the studied countries. Results of generalized impulse responses functions for Algeria, Morocco and Tunisia are presented below.

**Figure 4: Grid threshold results based on MVTAR model**



Source : Elaborated by the author

After testing the linearity hypothesis on the study variables for the three countries, it is necessary to proceed to the nonlinearity test and impulse response functions based on MVTAR model. Results of nonlinearity test are presented in Table 6. These results can be divided into two sub-samples (two

regimes): a higher regime in which the switching variable is situated above the threshold (*upper regime*) and a lower one in which the switching variable is situated below threshold (*lower regime*). In fact, Figure 4 presents the grid search results which indicate the threshold value of each studied country using the interest rate as switching variable.

From results presented in table 6 and figures in appendix C, we find that, in the upper regime, responses of interest rates variable are positive for the three countries. However, these positive responses begin to decline from the second period for the Algerian and Tunisian case. By changing the switching variable with a proxy variable (*liquid liabilities*) as a measure of monetary policy in North Africa, the responses are positive for Algeria (with a decrease of this effect that arrived to point zero after five periods) and Tunisia; while, they become negative for the case of Morocco on the second period. These results can be explained by the absence of liquidity effects in the Maghreb countries because of their restricted financial systems. Therefore, when the switching variable (and/or the proxy variable) is above the threshold, a financial shock affecting foreign country has not significant effects on the economic growth of Maghreb countries.

**Table 6: Results of nonlinearity test based on MVTAR model**

Threshold regimes	Threshold variables	Estimated Threshold coefficient	Std.Error	t value
<b>Algeria</b>				
<b>Interest rate</b>	<b>Low regime</b>	- 1.1813 (0.2325)	0.2018	5.8518
	<b>High regime</b>	1.1866 (0.0032)	0.3515	3.3656
<b>Liquid liabilities</b>	<b>Low regime</b>	0.5012 (0.2186)	0.3930	1.2722
	<b>High regime</b>	0.7410 (0.0016)	0.2019	3.6693
<b>Morocco</b>				
<b>Interest rate</b>	<b>Low regime</b>	- 1.4918 (0.0109)	0.5289	2.8205
	<b>High regime</b>	1.3681 (0.0010)	3.8481	0.3555
<b>Liquid liabilities</b>	<b>Low regime</b>	3.1142 (0.0272)	1.3023	2.3914
	<b>High regime</b>	- 0.5235 (0.0924)	0.2954	1.7719
<b>Tunisia</b>				
<b>Interest rate</b>	<b>Low regime</b>	- 0.4333 (0.3532)	0.4554	0.9515
	<b>High regime</b>	2.5085 (0.0297)	0.2340	1.0719
<b>Liquid liabilities</b>	<b>Low regime</b>	- 0.1406 (0.0652)	0.3072	0.4578
	<b>High regime</b>	0.1578 (0.0812)	0.6562	0.2406

Values in brackets represent the "p-value".

In addition, concerning the low regime, results indicate the existence of negative responses to interest rate for all countries (from the third period in Morocco; however, the negative effect has known a slight increase in Tunisia from the second period). When using the proxy variable (liquid liabilities), which has a significant impact in financial transactions of North African economies, we find that, in the case of Algeria and Morocco, responses to external financial shocks are positive (from the second period in Algeria). However, they are negative for Tunisia. In sum, the estimation results indicate the existence of asymmetric responses of interest rates to positive and negative shocks of the monetary policy. In addition, negative interest rates indicate that when the switching variable (interest rate) is below threshold levels, an external financial shock negatively affects the financial systems of the three North African economies, through its negative impact on interest rates. From these results, we can assert that the negative external shock can destabilize the construction of integration project between Maghreb countries and impede the improvement of the levels of economic growth and development of these economies in long run.

## **Conclusion and Policy Recommendations**

In this paper, we discuss the recent trends and developments in regional financial integration and trade liberalization policies in Maghreb countries. Using the Multivariate Threshold Autoregressive (MVTAR) approach over the period 1990-2012, we find that the greater and deeper economic integration and regional trade will have positive repercussions for each studied country. In addition, estimation results show that the financial integration process plays a positive role in enlarging the borders of countries as well as the market size of each country and, consequently, in stimulating economic growth. On the other hand, in a globalized world characterized by financial shocks and economic crises, we find that financial external shocks affect negatively Maghreb countries and impede the implementation of financial and economic integration. Moreover, responses of domestic variables to external financial shocks are more symmetric, thus justifying the non reinforcement of economic and financial cooperation between the studied countries. Consequently, external shocks affect negatively these economies and impede the implementation of economic and financial integration project between them. However, this vulnerability to shocks can be reduced if these economies intensify financial and commercial transactions between them and a deeper monetary, financial, and economic integration.

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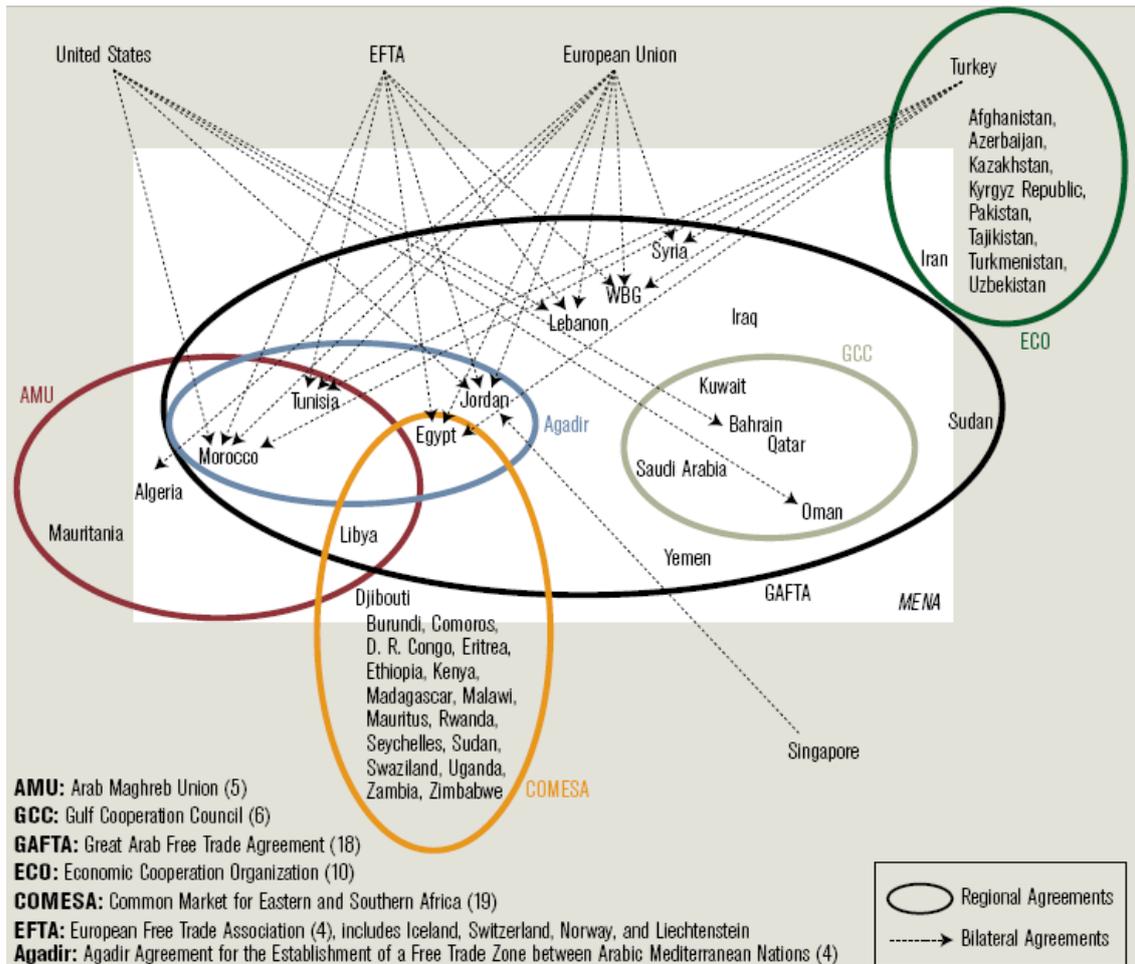
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# Appendix

## Appendix A

**Figure A.1: The network of Trade Agreements across world regions**



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

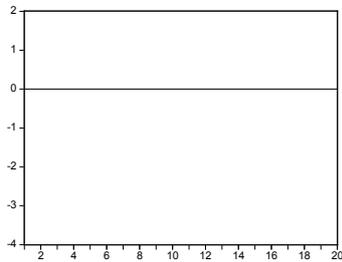
**Table A.1: Definition and sources of variables**

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<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.	<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 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>Dshocks</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>

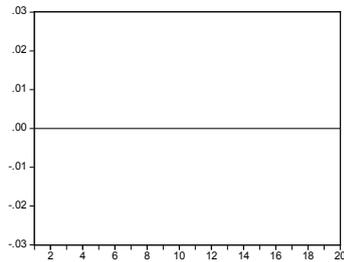
## Appendix B: Impulse Response Functions to an External Shock, 1990-2012

### ALGERIA

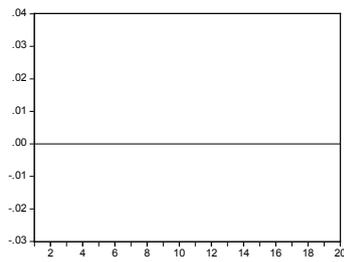
Responses of FI to shocks



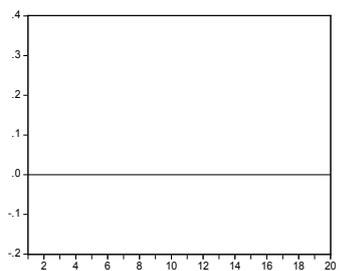
Responses of GDP to shocks



Responses of *FDev* to shocks

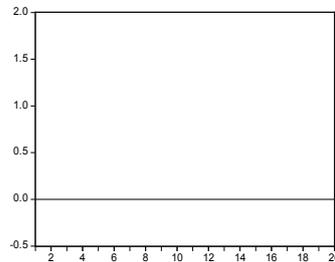


Responses of *Fundamentals* to shocks

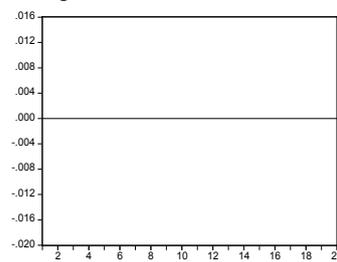


### MOROCCO

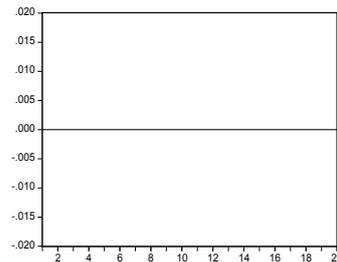
Responses of FI to shocks



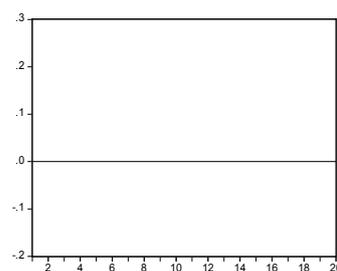
Responses of GDP to shocks



Responses of *FDev* to shocks

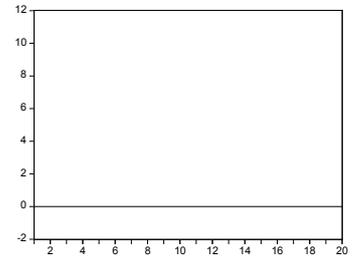


Responses of *Fundamentals* to shocks

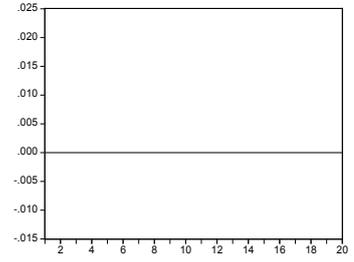


### TUNISIA

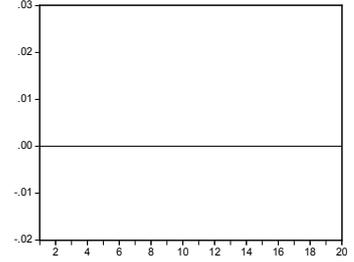
Responses of FI to shocks



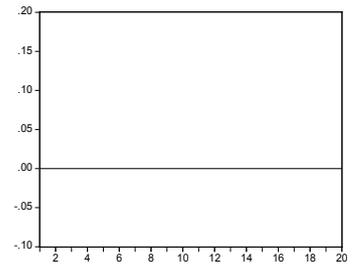
Responses of GDP to shocks



Responses of *FDev* to shocks



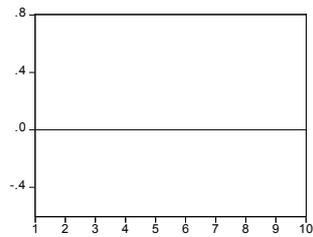
Responses of *Fundamentals* to shocks



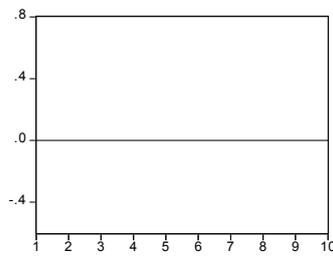
## Appendix C: Generalized Impulse Response Functions based on MVTAR model, 1990-2012

### Algeria

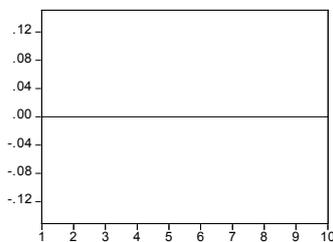
Upper regime : Interest\_rate



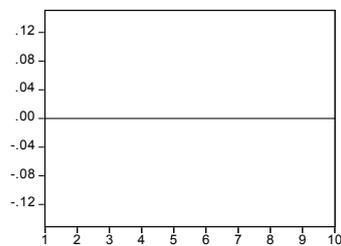
Lower regime : Interest\_rate



Upper regime : Iiquid\_liab

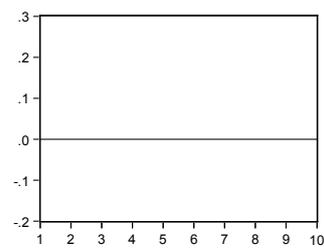


Lower regime : Iiquid\_liab

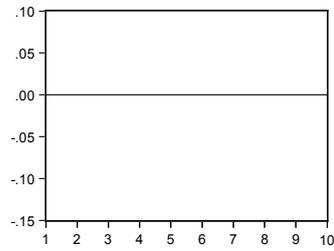


### Morocco

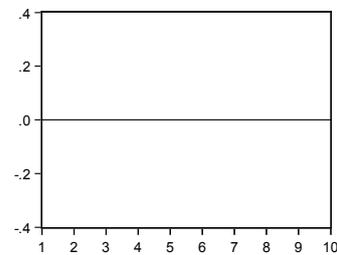
Upper regime : Interest\_rate



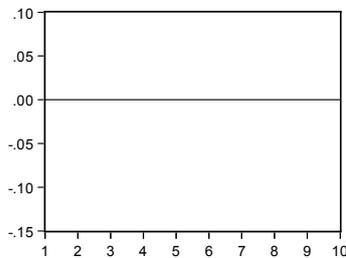
Lower regime : Interest\_rate



Upper regime : Iiquid\_liab

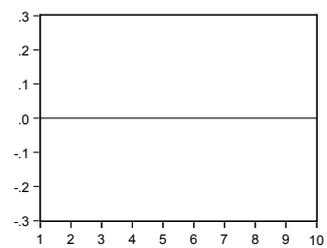


Lower regime : Iiquid\_liab

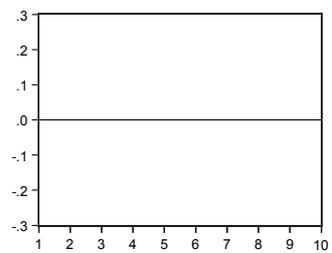


### Tunisia

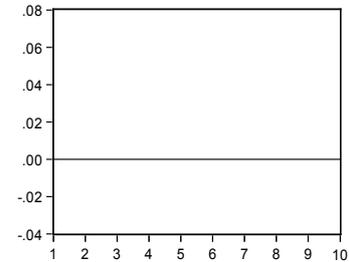
Upper regime : Interest\_rate



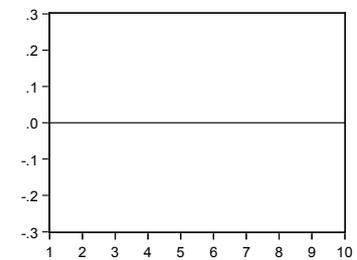
Lower regime : Interest\_rate



Upper regime : Iiquid\_liab



Lower regime : Iiquid\_liab



## Appendix D: Summary Results of Recent Empirical Studies on External Shocks and Financial Integration

Studies	Countries	Period	Methods	Main results
<b>Aghion and al. (2004)</b>	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.
<b>Blecker (2008)</b>	Mexico	1979-2007	DOLS Approach <sup>1</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.
<b>Edwards (2009)</b>	Six regions in the World <sup>2</sup>	1970-2004	Panel Probit Analysis	Financial integration strategies increase the degree of vulnerability to external crises.
<b>Brezigar Masten, and al. (2008)</b>	31 European countries	1996-2004	GMM	Financial integration stimulates a steadier provision of finance through domestic financial markets also in crisis times.
<b>Dincer, Kandil, and Trabelsi (2011)</b>	Turkey	1989-2009 (Quarterly)	Multivariate VAR model	Domestic and external financial shocks affect negatively capital account liberalization and the domestic macroeconomic variables in Turkey.
<b>Allegret and Benkhodja (2011)</b>	Algeria	1990-2010 (Quarterly)	DSGE model <sup>3</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.
<b>Adler and Tovar (2012)</b>	40 EME <sup>4</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.
<b>Kazi, Wagan, and Akbar (2012)</b>	14 major OECD countries	1981-2010 (Quarterly)	Augmented VAR Approach	Financial integration can play an important role to propagate the shocks to other countries.
<b>Allegret, and al. (2012)</b>	9 East Asian countries	1990-2010 (Quarterly)	SVARX model <sup>5</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 author.

<sup>1</sup> DOLS Approach: Dynamic Ordinary Least Squares Approach

<sup>2</sup> Regions are: Industrial Countries, Latin American and Caribbean, Asia, Africa, Middle East, Eastern Europe.

<sup>3</sup> DSGE model: Dynamic, Stochastic, General equilibrium model.

<sup>4</sup> EME: Emerging Market Economies.

<sup>5</sup> SVARX model: Structural VAR Model with Block Exogeneity.