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On the Optimality of the Maghrebian Area: An Analysis of the Macroeconomic Shocks

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This paper studies the possibility of a monetary union in the Maghreb using the traditional criteria of the theory of the optimal currency areas. First, we examined the degree of shocks correlation in order to see whether the shocks affecting Maghrebian countries are symmetrical or asymmetrical. The analysis of the growth rates reveals dispersions and that of the inflation rates shows that essential efforts remain to be provided regarding monetary cooperation. By developing a structural VAR model based on the methodology of Blanchard and Quah (1989), we show that the macroeconomic shocks are rather heterogeneous in this area supporting the assumption of a relatively high dispersion of the economic growth rates. However, our results reveal a relative symmetry of the supply shocks between Morocco and Tunisia.

Keywords: optimal currency areas, (a) symmetry of shocks, Arab Maghreb Union, structural VAR

Classification JEL: F32, F33, F42

I. Introduction

The end of the 20th century was marked by an increasing integration of the economies. Whether it was in the form of bilateral or multilateral trade agreements, of economic union or free trade areas, in all these cases the economies concerned become increasingly integrated.

The developing countries did not remain out of this movement of integration based on free trade. Indeed, after having tried policies based on imports substitution and the protection of national industry, most developing countries are engaged, today, in processes of economic integration. Developing countries sought to adhere to the world trade organization or to join regional blocks already created by more advanced countries. It is within this framework that we can situate the agreements signed by the majority of the southern Mediterranean countries with the European Union.

In the northern side of Mediterranean shore, economic integration was concretized by the creation of the single market and followed by a complete monetary integration with a single currency. Either more, the European block does not cease widening. Since January 2007, the European Union counts 27 members with the addition of Romania and Bulgaria.

However, in the south of the Mediterranean, we see no progress of the integration

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process. Since the signing of the treaty of Marrakech (February 1989), which officialised the creation of the Arab Maghreb Union (AMU), two decades have passed; and we are still far from a unified economic area in the Maghreb.

The purpose of this paper is to try to reanimate the debate on Maghreb integration. Precisely, we want to focus on monetary integration as a better engine of integration in the Maghreb. Rather than to determine whether the Maghrebian countries form or do not form an optimal currency area, this article studies symmetry (or asymmetry) shocks in the economies of the Maghreb.

The first section studies monetary integration among Maghrebian countries in the light of the developments of the theory of optimal currency areas. In the second section, we analyze the macroeconomic shocks inside the Maghrebian area from a static as well as a dynamic point of view.

II. The Maghreb and Traditional Criteria of Optimality

When we evoke monetary integration among a group of countries, we are raising the question to know if the group constitutes an optimal currency area or not. The first work on the optimal monetary areas sought to define the structural characteristics of an economy that could make useless the variations of the exchange rate with respect to the other currencies. This was the subject of the works of Mundell (1961), Ingram (1962), McKinnon (1963), Kenen (1969) who constitute the approach known as "traditional" theory of optimal currency areas.

A. The Mobility of the Factors of Production

Mundell's article (1961) stimulated the debate on the concept of "optimal currency area."The criterion suggested by Mundell to define an optimal currency area is the mobility of factors of production. Thus, an optimal currency area is characterized by a strong mobility of factors inside the area and a low mobility between the area and the rest of the world. For Mundell the mobility of labour could replace the variation of the exchange rate such as the means of adjustment to the shocks affecting the regions of the area. The typical example is the USA where labour mobility is relatively strong and plays an important role in the absorption of asymmetric shocks between regions.[1]

In the case of the Maghrebian countries, the mobility of labour is not very high and remains especially prone to the diplomatic relations. Immigrants in other Maghrebian countries, on several occasions, paid the price of the diplomatic tensions between their country of origin and the host country. However, the mobility of labour inside Maghrebian area can be easily stimulated given the relative homogeneity of sociocultural conditions.

In the same line as Mundell, Ingram (1962) presents the criterion of the mobility of capital like shock absorber of the asymmetrical shocks affecting the countries. Thus, if the financial market of the area is strongly integrated, the flexibility of the exchange rate is useless. The flow of capital ensures the adjustment of any imbalance of the payments among the regions of the area. "Thus the problems of balance of payments among the American States would be regulated easily; the mobility of the capital is indeed perfect in that a credit is held on all the territory of the United States as soon as it is emitted "[2].

According to this criterion of financial integration, the Maghreb is far from constituting an optimal currency area. Indeed, no form

[1]See, for example, works of Blanchard and Katz (1992) and De Grauwe (1992).
[2]Salin (1974, p.102).

of financial integration can be detected among the Maghrebian countries. The control of capital flows is applied in each country regarding the rest of the world, including the Maghrebian partners[3]. Certainly, Morocco and Tunisia have engaged recently a process of financial liberalization, but this process does not implicate the other countries (Algeria, Libya and Mauritania). At this level, no comparison can be made with the case of Europe where the liberalisation of capital movements was established at the beginning of 1993.

Either with Mundell (labor factor) or with Ingram (capital factor), it is the quality of the adjustment to asymmetrical shocks which makes it possible to delimit the optimal currency area. The mobility of the factors of production is thus presented as a remedy for the rigidity of the prices and as a better substitute for the flexibility of the exchange rate that was sacrificed by the adhesion to a currency area. However, to establish their criteria, the authors leave the assumption of the occurrence of an asymmetrical shock. Neither Mundell nor Ingram wonders about the origin of this asymmetry of the shocks. It was the concern of McKinnon (1963), Kenen (1969).

B. The Degree of Openness of the Economy

For McKinnon (1963) an economy is open if the ratio of traded goods/non-traded goods is high, i.e., the foreign trade represents a high percentage of the national income. In the extreme case where the economy would be completely opened, i.e., where all the consumed and invested goods would be imported and all the produced goods would be exported, the interior prices would be necessarily given outside. In this case, it becomes impossible to cause any monetary illusion by means of the depreciation of the exchange rate. Thus, "the competitive advantage" that a depreciation of the currency is supposed to produce will not occur since, in this very open economy, the prices in terms of foreign currency are constant. The national prices are aligned on the external prices so that the prices in terms of national currency are increased in exact proportion of the monetary depreciation. The flexible exchange rates are not efficient to stabilize an economy subjected to external fluctuations.[4]

On the empirical level, the share of foreign trade in the GDP estimates the degree of openness of an economy. To use the McKinnon criterion, we must consider the trade (exports and imports) of the country in question with the other countries of the area to which it belongs. Indeed, it is only with these countries that the instrument of the exchange rate would not be usable any more in the event of constitution of a currency area.

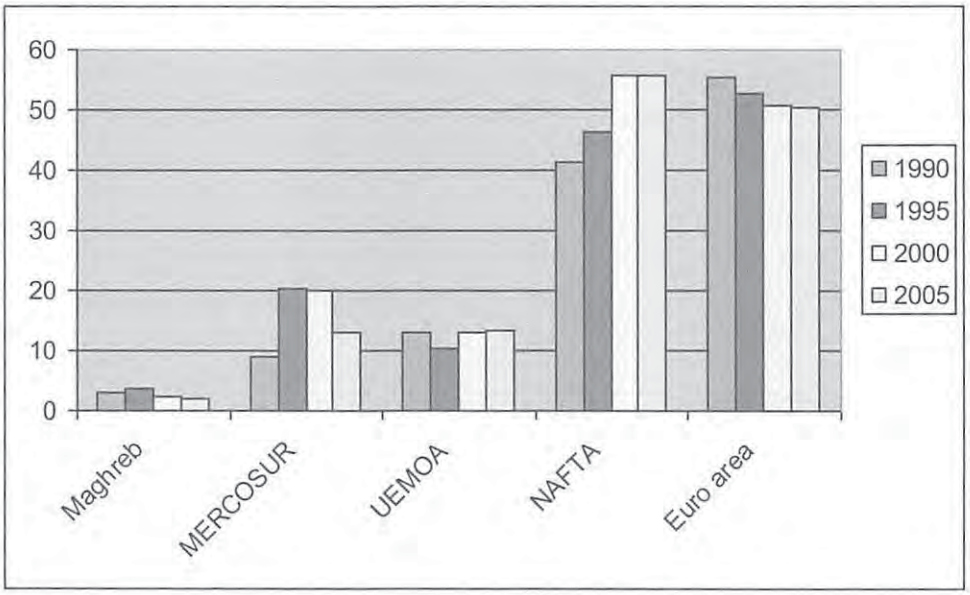
A very weak intra-regional trade characterizes the Maghrebian area. Indeed, the intra Maghreb trade had not exceeded the 3 percent of the total exports of the Maghreb. Compared with the other areas, the Maghreb is very late in the process of regional integration (Figure 1).

[3]A light reduction of this control is to be noted in Morocco and Tunisia with the introduction of partial convertibility of the dirham and the dinar.

[4]Thus, "if one moves along the spectrum which goes from closed economies towards opened economies, the flexible exchange rates become at the same time less effective as a mean of control of external balance and more detrimental to the internal prices stability" McKinnon (1963, p. 226).

Figure 1: Intra Trade of the Group in % of Exports of the Grouping

Source: UNCTAD Handbook of Statistics, Calculation of the Authors



Actually, the Maghrebian countries seem to have a true preference for the European goods and services rather than those "made in the Maghreb."Thus, whereas the Maghreb intra- trade represented, in the year 2005, less than 2% of exports of the Maghrebian countries, their trade with the European Union represented more than 62% of their total trade.[5]

C. The Diversification of the Economy

Kenen (1969) presented the degree of diversification of the economy as a criterion of optimality of a currency area. Indeed, if an economy is much diversified, it will not be affected by changes of the external demand that will carry only on a small part of its exports. If there is a decrease in the demand for one of the exported products, the resulting unemployment should be less significant than in the case of a less diversified economy. Thus, for a well-diversified economy, there is no need to modify the relative prices by an action on the exchange rate.

The criterion of Kenen involves that the diversification of the intra trade minimizes the probability of major external shock and the need for the corresponding adjustment. If they occur, the sectoral shocks are likely to cause macroeconomic effects of weak width. When the number of sectors concerned with the regional trade is very important, the positive shocks compensate, in general, the negative shocks.

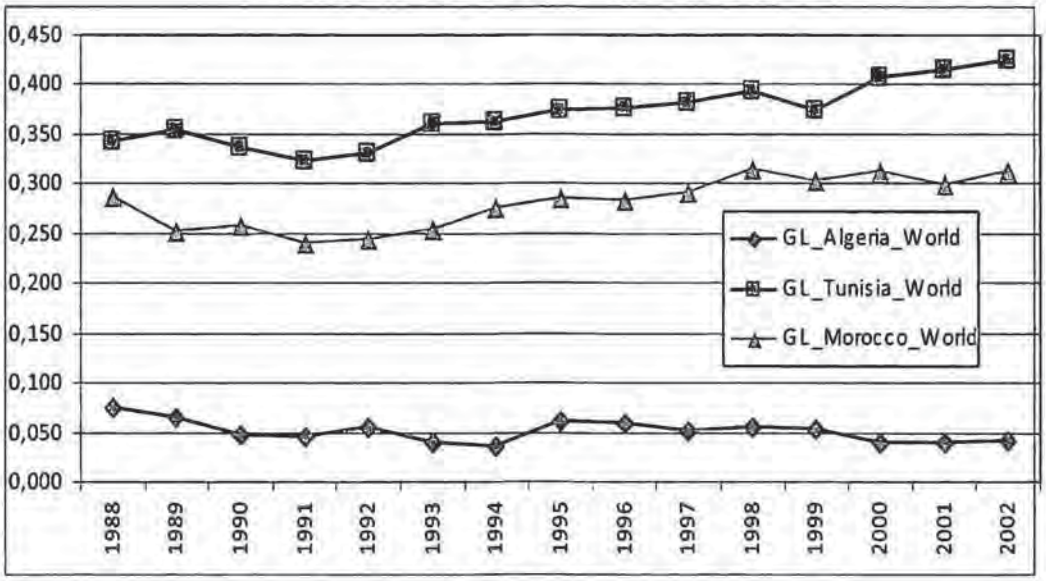
Among the indices used to measure the diversification of the exchanges, the index of Grubel-Lloyd makes it possible to estimate the share of the intra-industy trade in the total trade.

$GL=1-|Mj-Xj|/(Mj+Xj)$, with Mj and Xj are the imports and exports of the sector j. The index is calculated, initially at the sectoral level, and in a second time, at the total level by holding account on the

[5] UNCTAD Handbook of Statistics.

Figure 2: Evolution of the Intra-Branches Exchanges in the Total Trade.

Source: CHELEM, Calculations of the Authors.



Calculations are carried out using CHELEM data (Comptes harmonisés sur les échanges et l'économie mondiale), database of the CEPII (Centre d'études prospectives et d'informations internationales)

weigh of each sector in the total trade.[6]

An index close to the unit reflects specialization intra-sectors reflecting an exchange of similar products. On the other hand, the index of Grubel-Lloyd is close to zero in the case of the inter-sectors exchanges; the countries are specialized in different sectors of activity. Figures 2, 3, and 4 show the evolution of the index of Grubel - Lloyd for the three Maghrebian countries over the period 1988-2002.[7]

Figure 2 depicts the evolution of the index of Grubel-Lloyd for each of the three countries (Algeria, Morocco, and Tunisia). It gives the share of the intra-branches exchanges of each country in its total trade. It clearly appears a great disparity between Tunisia and Morocco, on the one hand, and Algeria, on the other hand. Indeed, Algeria is characterized by a Grubel-Lloyd index close to zero, which means that the share of intra-branches exchanges in the Algerian foreign trade is very weak. This result is predictable since the Algerian foreign trade is largely dominated by the hydrocarbon sector (more than 90 percent of Algerian exports relates to the oil sector). On the contrary, the Tunisian and Moroccan economies seem more diversified. Thus, the share of intra-branches trade is more significant as well in the total trade as in the intra-Maghreb trade (Figure 3).

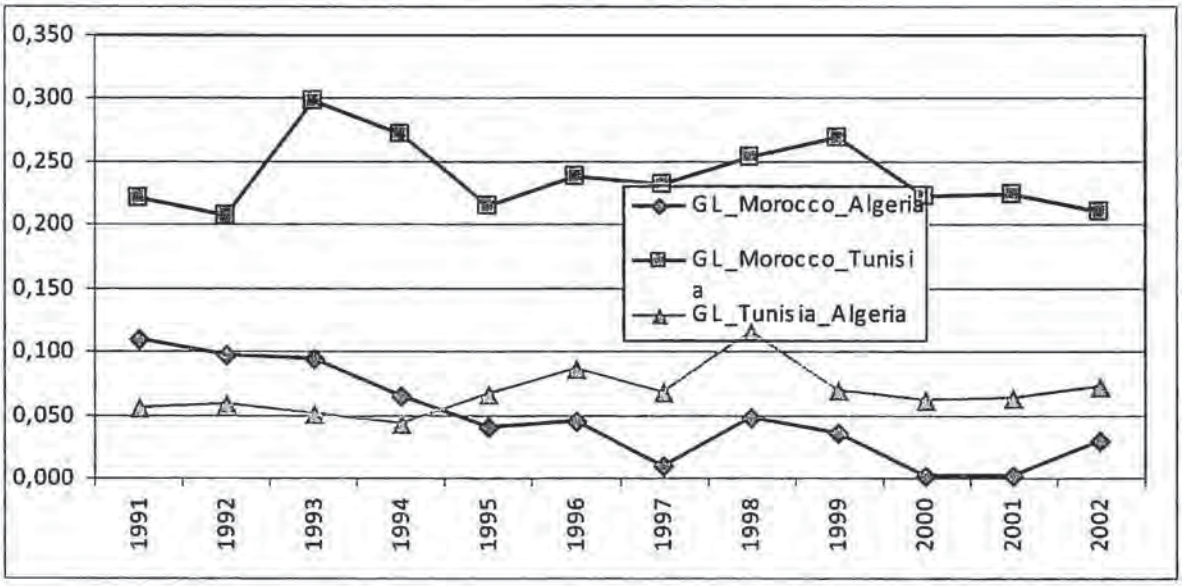
The strong predominance of the hydrocarbon sector in the Algerian foreign trade induced that the Grubel-Lloyd index calculated for the trade between Algeria and its Maghrebian partners is very close to zero. With Morocco or Tunisia, the Algerian trade is inter-branches and relates to little diversified products. A clear improvement of the index of Grubel-Lloyd is recorded when we consider the Tunisian-Moroccan trade. The two countries exchange more diversified range of products. This is likely to minimize the probability of major

[6] 72 sectors were used for the calculation of the Grubel-Lloyd index. We note that for a higher level of aggregation, the Grubel-Lloyd indicator comprises a bias towards higher values (see Fontagné and Freudenberg 1999).

[7] Due to the deficiency in the details of the data on the exchanges of Libya and Mauritania, the index of Grubel-Lloyd could not be calculated for these countries.

Figure 3: Evolution of Intra-Branches Exchanges in the Intra-Maghreb Trade.

Source: CHELEM, Calculations of the Authors.



external shocks and the need for the corresponding adjustment. However, this improvement of the Grubel-Lloyd index could be insufficient to state that the two countries constitute an optimal currency area. Indeed, in the existing currency areas, the indicator of intra-branches exchanges is generally close to one. Thus, the countries of the Euro zone have a Grubel-Lloyd index near to 60 percent with a certain disparity among the countries of the "hard core" and those of the "periphery ".[8]

In summary the trade intra-Maghreb is mainly inter-branches in opposite to the Europe-Maghreb trade (Figure 4). Over the period 1988-2002, the share intra-branches exchanges increased for the three Maghrebian countries. Particularly, the indicator of Morocco-Europe exchanges recorded a clear improvement. The foreign trade of Morocco with the Euro zone is going to be more and more intra-branches with a share that passed from 43 percent in 1988 to 60 percent at the beginning of the years 2000. In spite of this increase, Morocco remains in second position after Tunisia in terms of importance of the trade intra-branches. As expected because of the high weight of the hydrocarbon sector, Algeria recorded the weakest index.

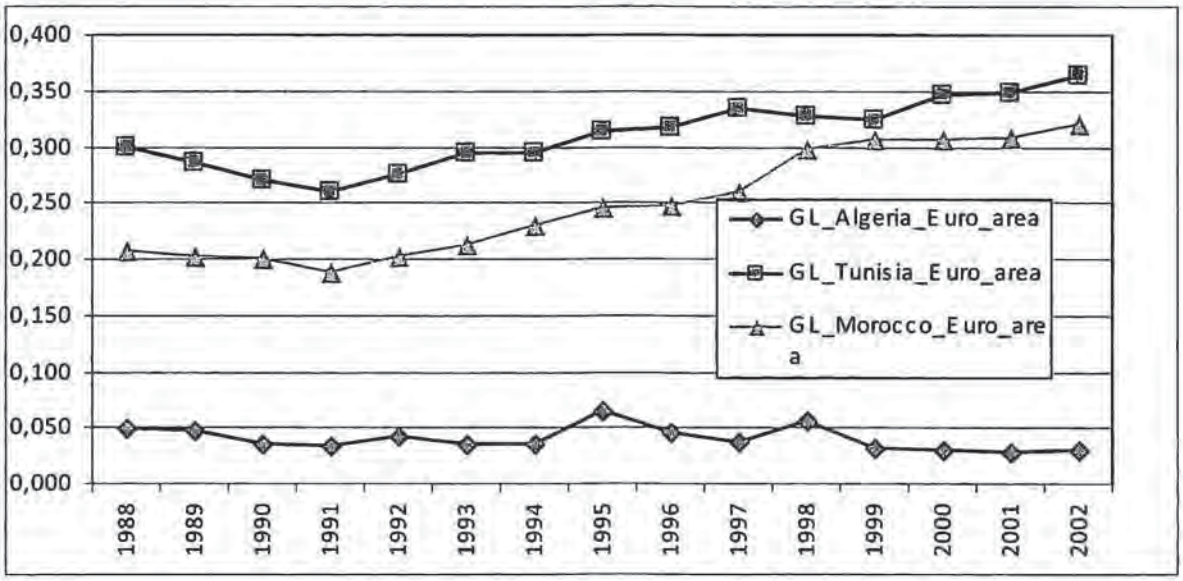
In total the Maghrebian economies do not appear to satisfy all of the criteria for an optimum currency area (OCA). It follows that the Maghreb is an area in which the optimal adjustment is done by changing the exchange rate. However, before a final decision on the non-optimality of the area of Maghreb, we need to study the degree of symmetry of shocks affecting the Maghrebian economies. Indeed, changing the exchange rate becomes particularly unhelpful if the shocks' affecting the economies of the area are symmetrical.

In these circumstances, it is highly likely that the supply and demand shocks affect in the same way the economies concerned. A symmetrical transmission of shocks does not imply a change of terms of trade and countries can easily maintain fixed exchange rates among their currencies.

[8]See, for example, Suardi (2001).

Figure 4: Evolution of Intra-Branches Exchanges in the Europe-Maghreb Trade.

Source: CHELEM, Calculations of the Authors.



III. An Analysis of Macroeconomic Shocks in the Maghreb

The previous section showed that the Maghreb is far from being an OCA because of the absence of any criterion making it possible to answer asymmetrical shocks. However, before confirming the non-optimality of the Maghrebian area, we must verify the nature of asymmetric shocks within the area. Indeed, a symmetrical transmission of shocks between two countries leaves unchanged the terms of trade, and both countries can easily maintain fixed exchange rate between their currencies. The two countries can constitute an OCA.

To study the symmetry of shocks in the Maghrebian countries, we will, as a first step, make a descriptive analysis of the convergence of inflation and economic growth in the Maghreb. The study of real convergence is supplemented by studying the correlation of business cycles. In a second step, a dynamic analysis with a SVAR model will be conducted to determine the nature of macroeconomic shocks in the Maghreb.

A. A Static Analysis

The observation of the growth rates and the rates of inflation could give a first indication of real and nominal convergence among the Maghrebian economies. Figure 5 considers the evolution of the real GDP in the five countries of the UMA from 1970 to 2004.

The figure shows a strong divergence on the evolution of the growth rates that could be interpreted as the sign of the existence of asymmetrical shocks. The dispersal in the evolution of growth rate is even more pronounced when considering the case of Libya compared to other countries in the Arab Maghreb Union. However, a relative convergence of growth rates could be detected in the Maghrebian area from the early 1990. The result is a low real convergence in the Maghreb. In actuality a weak real convergence exists in the Maghreb. What about nominal convergence?

Figure 5: Evolution of GDP Growth Rates in Constant Dollars in the Maghreb. Source: CHELEM.

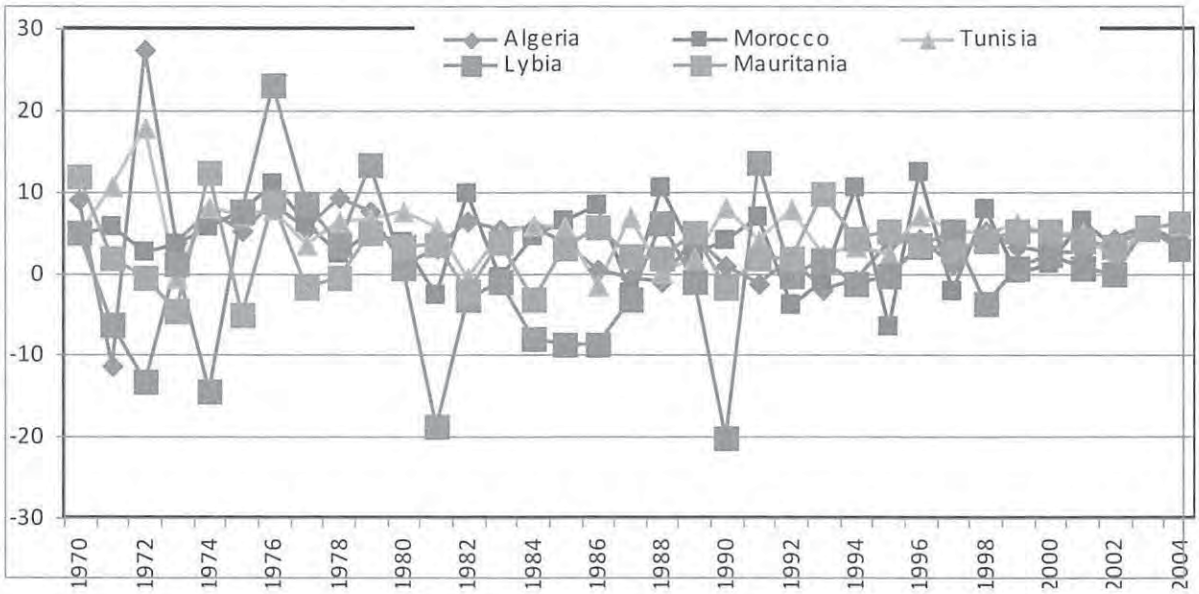
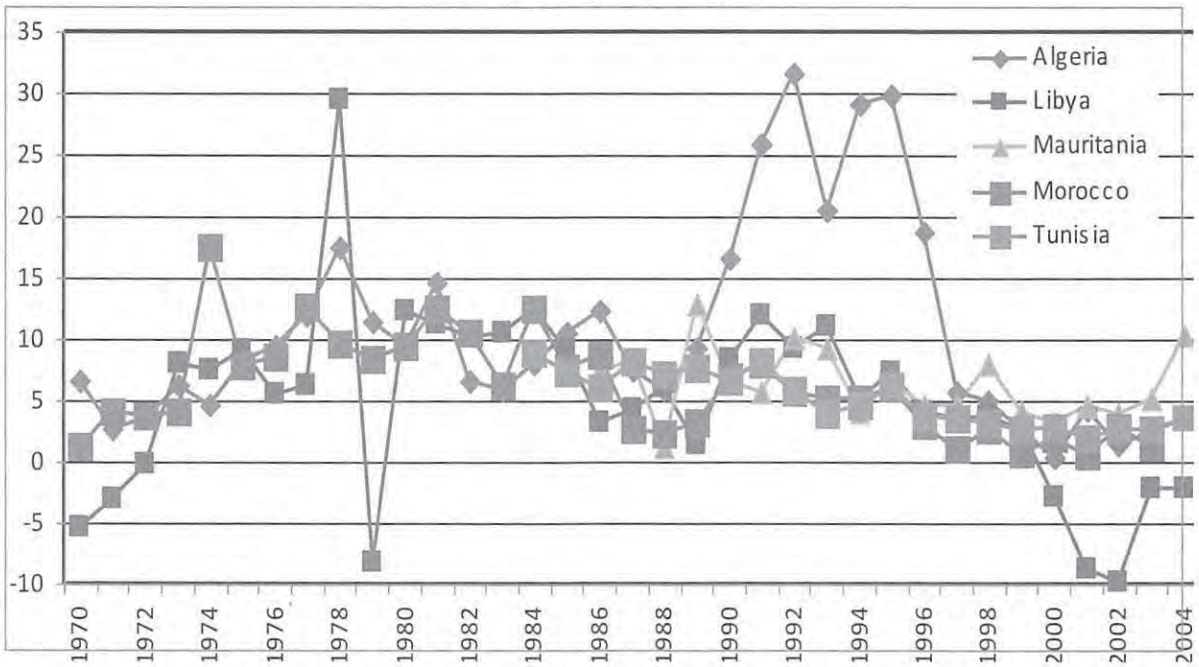


Figure 6: Evolution of inflation rates in the Maghreb. Source: CHELEM.



Beyond the high value of the rates of inflation in the Maghreb, what we retain is the strong divergence on the evolution of these rates. This is most obvious when considering the case of Algeria and Libya. Inflation rates seem fairly dispersed as rates of economic growth. However, it is noteworthy that the dispersion is once again less marked at the end compared to the beginning of the period.

To complement the static analysis of economic convergence in the Maghreb, we study the cross-correlations of business cycles and economic growth rates. Indeed, a positive correlation indicates that the cyclical part of these cycles is more synchronized. The higher the correlation, the more the economies are so-called synchronized and prone to symmetrical shocks.

We use students' t-statistic to test the significance of correlations of economic growth rates and business cycles. This is possible because the two variables are stationary in level (as shown by the unit root test presented in Appendix A)

In most cases, the cross-correlation coefficients of economic growth rates are

Table 1: Cross-Correlations of the Cycles Businesses and Economic Growth Rates :

	Algeria	Libya	Morocco	Mauritania	Tunisia
Cross-correlations of the businesses cycles					
Algeria	1 (-)				
Libya	-0.033 (-0.185)	1 (-)			
Morocco	0.016 (0.091)	0.220 (1.305)	1 (-)		
Mauritania	-0.043 (-0.246)	0. 115 (0.658)	-0.073 (-0.414)	1 (-)	
Tunisia	**0. 364** (2.371)	-0.201 (-1.184)	-0.109 (-0.624)	-0.017 (-0.099)	1 (-)
Cross-correlations of economic growth rates					
Algeria	1 (-)				
Libya	-0.042 (-0.237)	1 (-)			
Morocco	0.176 (1.025)	0.158 (0.914)	1 (-)		
Mauritania	-0.089 (-0.509)	0.268 (1.631)	-0.047 (-0.267)	1 (-)	
Tunisia	**0.320** (2.016)	-0.024 (-0.137)	-0.119 (-0.685)	-0.117 (-0.670)	1 (-)

Source: CHELEM, calculations of the authors
Notes: *t statistics are given between brackets. In fact, Correlation coefficients significantly different from zero.*

very low and insignificant. The only significant correlation is to note between Algeria and Tunisia it is of low-intensity. The business cycles are extracted using the Hodrick-Prescott filter (HP). The correlation coefficients of business cycles confirm the results found with economic growth rates; the coefficients are very weak and insignificant. Again, the only significant correlation coefficient is the one linking business cycles of Algeria and Tunisia. Although it is significantly different from zero, this ratio is relatively low.

In total, the static study detects neither real convergence nor nominal convergence between the Maghrebian countries. However, the static study should be complemented by a dynamic analysis to determine the nature of macroeconomic shocks faced by North African economies.

B. A Dynamic Analysis: Structural VAR Model

We identify the impact of supply and demand shocks (real and nominal) and assess their influence on macroeconomic variables for the countries of the Arab Maghreb Union (AMU). We assume that each country i member of the AMU is submitted, at every moment t, to different kinds of shocks: supply shocks (ε_t^s), real demand shocks (ε_t^d) and nominal demand shocks (ε_t^m).

The identification of these shocks is obtained from a Structural VAR model (SVAR), which presents a privileged framework to treat this kind of problems. The SVAR model that we estimate includes real GDP (GDP), the real effective exchange rate (TCR), and the money supply (MON). Note that all variables are expressed in logarithms. The data that we use is annual covering the period from 1970 to 2004. It is derived from the databases CHELEM of the CEPII and WDI of the World Bank.

Observations relating to the three macroeconomic variables (production, real exchange rate, and money) make it possible to identify the shocks affecting the economies. We suppose that the growth rates series of real GDP ($\Delta lnPIB_t$), real exchange rate ($\Delta lnTCR_t$) and money (Δlnm_t) result directly from the supply and demand shocks (real and nominal) which could affect the economy in the past or continuing to affect it actually.

Let $\Delta x_t = \begin{pmatrix} \Delta lnPIB_t \\ \Delta lnTCR_t \\ \Delta lnm_t \end{pmatrix}$ and $\varepsilon_t = \begin{pmatrix} \varepsilon_t^s \\ \varepsilon_t^d \\ \varepsilon_t^m \end{pmatrix}$

, where Δ represents the first-difference operator, and $\varepsilon_t^s, \varepsilon_t^d$ *and* ε_t^m denote supply, demand and monetary shocks, respectively.

The structural model can be written as:

$$\Delta x_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \cdots = A(L)\varepsilon_t \qquad (1)$$

where

$$A(L) = \begin{pmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) \end{pmatrix},^{9}$$

It is assumed that the structural shocks $\varepsilon_t = (\varepsilon_t^s, \varepsilon_t^d, \varepsilon_t^m)'$ are serially uncorrelated and have a covariance matrix normalized to the identity matrix.

The model (1) cannot be estimated directly since the structural shocks are not directly observable and require to be estimated. It is admitted, that the model (1) admits the following reduced form:

$$\Delta x_t = B(L)\Delta x_{t-1} + \mu_t \qquad (2)$$

where μ_t is a vector reduced-form disturbance. The theorem of representation of Wold implies

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[9] A(L) represents matrixes of impulse response functions to shocks affecting variables of the vector X_t.

that any process VAR admits an infinite moving average representation (MA) as:

$$\Delta x_t = C(L)\mu_t \qquad (3)$$

where $C(L) = (1 - B(L)L)^{-1}$ and the lead matrix of $C(L)$ is, by construction, $C_0 = I$. By comparing equations (1) and (3) we obtain the relationship between the structural and reduced form disturbance as:

$$\mu_t = A_0\varepsilon_t \quad (4)$$

We deduce from the expression (4) that

$$E(\mu_t\mu_t') = A_0E(\varepsilon_t\varepsilon_t')A_0' = \Sigma \qquad (5)$$

However by assumption we have

$$E(\varepsilon_t\varepsilon_t') = I \qquad (6)$$

That implies that:

$$A_0A_0' = \Sigma \qquad (7)$$

As $\mu_t = A_0\varepsilon_t$, the structural shock matrix that we must estimate has the following expression: $\varepsilon_t = A_0^{-1}\mu_t$. The problem remains of identifying the structural shocks (ε) from the VAR reduced-form residuals (μ) and their variance. From (4), it is known that the solution depends on the identification of the matrix A_0, which entails n^2 elements (where n is the number of dependent variables in the model; in this particular case 3). Since Σ is a symmetrical matrix,[10] Equation (5) gives $\frac{n(n+1)}{2}$ restrictions on the matrix A_0. Therefore, $\frac{n(n-1)}{2}$ extra restrictions must be imposed which means, in this model, 3 restrictions. Following Blanchard and Quah (1989), long-run economic restrictions are applied to identification.

C. Identification

We can potentially identify three shocks from our three variables: a supply or productivity shock (ε_t^s), a real demand shock (ε_t^d), and, a nominal demand shock (a monetary policy shocks) (ε_t^m).

In order to identify the structural shocks, the following long-run restrictions are imposed:

- H_1: The domestic supply shock has no effect on the real exchange rate (a small open economy assumption). Besides, The statistic tests accept the hypothesis of an exogenous real exchange rate on the threshold of 5 percent;
- H_2: both supply and real demand shocks affect real GDP in the long run;
- H_3: monetary shocks have no longrun effect on either output or real exchange rates.

It follows that three elements of the matrix A (1) representing the sum of coefficients of impulses response functions are equal to zero. These long-run restrictions amount to $A_{13}(1)= A_{21}(1)=A_{23}(1)=0$, which are sufficient to identify the A_i matrix and, hence, the series of structural shocks.

D. Tests of Specification

The estimation of the parameters of the model requires the stationnarity of the variables. [11] In this study, Augmented-Dickey-Fuller (ADF) test is employed to investigate the nature of the series. Three specifications of the test are tested (with no regressors, with an intercept, with both an intercept and a trend). When results for the different specifications are mixed, we turn to Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests to decide on the times-series nature. We have retained the Schwarz information criterion to decide on the number of lags to consider. Since we are handling annual data, we consider it is plausible to assume that we cannot go beyond five lags. The results allows us to conclude that all of the

[10] The observed reduced-form residuals permit to determine the matrix Σ.

[11] Indeed, the long-term constraints make sense only if the dynamics has a persistent component due to the presence of unit roots.

variables may be considered integrated of order one (I(1)) in all countries.

The variables being integrated of order one, we, consequently, used trace and λ max tests developed by Johansen [1988]). According to the test results for all Maghrebian countries, the variables are not cointegrated.[12]

Under these conditions, we calculate the supply and demand shocks (real and nominal) starting from the residuals of the VAR model with one lag. This number of lags is given by using the test of exclusion of Wald (LR)13.This test is khi-deux carried out step by step to detect if the reduction of a unit of lags changes the results significantly. In all the cases, the optimal number of lags is one. Finally, the choice of one VAR with one lag is consolidated by the Akaike information criterion (AIC) and the test of FPE.14

E. Results

The supply shocks that are mostly due to technology shocks have permanent effects on production. Thus, changes in production resulting from persistent supply shocks reflect the structural asymmetries between economies. These fluctuations would be independent of economic policies. Thus, the fact to assess the degree of asymmetry of supply shocks becomes a crucial element in assessing adjustment costs arising from a monetary union.

As shown in Table 2, the correlation coefficient of supply shocks between Morocco and Tunisia is around 65 percent and significantly different from zero, reflecting the symmetry of supply shocks between these two countries. This result is consistent with the results found with the criterion of diversification. Thus, based on the criterion of correlation of supply shocks, a currency area comprising the two countries could be optimal.

The correlation coefficient between Mauritania and Libya is significantly different from zero but relatively low. Only the correlation coefficient between Libya and Algeria is significantly negative, which suggests the asymmetry of supply shocks between these two countries. Overall, the structural asymmetry of supply shocks in the Maghreb is less pronounced than suggested by the static study.

In addition shocks have a temporary effect on production. These shocks are usually induced and can be corrected by economic policies. Therefore, evaluating the degree of asymmetry of these shocks gives an indication of the degree of coordination of monetary and fiscal policies.[15] The correlations of real demand shocks are not, in the majority, significant; and, when they are significant, they are significant in a negative way. We also notice that the correlations of the monetary shocks are not significant.

The lack of correlation of demand shocks reflects the absence of any form of coordination between Maghrebian leaders to follow convergent policies. However, the results found in our study are inherent in the identification restrictions used. In other words, if the "true" model of the economy is a model where the real demand shocks do not have long-term effects on economic growth and where the real exchange rate is not exogenous, then our identification of shocks is not correct.

[12] Indeed, the estimation of SVAR model requires, as a preliminary, the absence of cointegration between the series.

[13] This test is that of the ratio of probability proposed by Sims (1980) and Doan (1992).

[14] Final prediction error.

[15] See for example Bayoumi and Eichengreen [1992]

Table 2. Cross Correlations of the Structural Shocks

	Algeria	Libya	Morocco	Mauritania	Tunisia
Cross correlations of the shocks of offer					
Algeria	1 (-)				
Libya	**-0.464** **(-2.966)**	1 (-)			
Morocco	0.030 (0.168)	0.090 (0.049)	1 (-)		
Mauritania	0.018 (0.099)	**0.304** ***(1.803)***	0.033 (0.185)	1 (-)	
Tunisia	0.212 (1.036)	-0.212 (-1.227)	**0.649** **(4.831)**	-0.247 (-1.439)	1 (-)
Cross correlations of the real shocks of request					
Algeria	1 (-)				
Libya	0.249 (1.454)	1 (-)			
Morocco	-0.057 (-0.322)	0.213 (1.231)	1 (-)		
Mauritania	**-0.328** **(-1.965)**	0.051 (0.287)	0.163 (0.935)	1 (-)	
Tunisia	0.064 (0.362)	-0.129 (-0.737)	0.088 (0.502)	0.056 (-0.317)	1 (-)
Cross correlations of the monetary shocks					
Algeria	1 (-)				
Libya	0.177 (0.984)	1 (-)			
Morocco	0.122 (0.696)	0.036 (0.203)	1 (-)		
Mauritania	-0.120 (-0.686)	0.118 (0.674)	0.204 (1.177)	1 (-)	
Tunisia	0.133 (0.645)	0.024 (0.135)	0.195 (1.124)	-0.036 (-0.205)	1 (-)

Notes: *t-statistics are given between brackets.*
In fact, correlation coefficients significantly different from zero.

F. Forecast Error Variance Decomposition

Table 3 shows the results of the decomposition of the variance of the variables considered. For the five countries, fluctuations in the growth rate of real GDP are explained largely by supply shocks. Indeed, in the first period, the supply shock contrbutes to 85 percent of forecast error variance of real GDP growth rate. This effect persists over the long term. As for the real exchange rates, it is the real demand shocks that dominate their fluctuations.

Table 3: Forecast Error Variance Decomposition

	Real GDP Growth Rate			Real Exchange Rate		
	Supply Shocks	Demand Shocks	Monetary Shocks	Supply Shocks	Demand Shocks	Monetary Shocks
Algeria	81.77/69.95	4.42/6.02	13.81/24.03	21.05/31.63	77.69/62.65	1.26/5.72
Libya	94.45/91.96	5.18/5.93	0.37/2.11	2.21/5.41	89.95/85.05	7.84/9.54
Morocco	85.28/73.94	10.41/18.35	4.31/7.71	3.18/3.76	96.06/95.29	0.77/0.95
Mauritania	97.26/87.37	2.53/11.90	0.21/0.73	40.85/40.85	53.41 / 51.18	5.74/7.98
Tunisia	88.11/79.04	11.2/20.02	0.69/0.91	18.72/18.22	81.14/81.58	0.14/0.21
	Monetary Growth Rate					
	Supply Shocks		Demand Shocks		Monetary Shocks	
Algeria	48.13/38.30		3.14/7.14		48.73/54.12	
Libya	0.27/34.23		71.25/46.17		28. 48/19.60	
Morocco	22.83/24.67		0.66/0.68		76.51/74.65	
Mauritania	0.76/5.70		60.64/63.84		38.60/30.46	
Tunisia	17.59/15.08		0.44/2.28		81.98/82.64	

This table indicates for each variable on line the proportion of the variance of the error of forecast, at the horizon of 1 year and 10 years, ascribable to the structural shocks.

The fluctuations of the monetary growth rate are dominated by the monetary shocks except for Mauritania and Libya where, on average, 60 percent of the fluctuations of the growth rate of the money are explained by real demand shocks. These results seem to confirm the identification of shocks found and are comparable with those found in the empirical literature on the subject.

IV. Conclusion

Based on the traditional OCA criteria, our analysis suggests that it is difficult to defend any proposed monetary integration in the Maghreb. On the contrary, any form of monetary integration should cause considerable economic costs. Maghrebian countries have evidenced a low degree of trade integration and asymmetric shocks.

On the contrary, any form of monetary integration would result in significant economic costs. As shown by the European example, any attempt to stabilize exchange rates among economies likely would be affected by asymmetric shocks involving significant economic costs that may lead to the questioning of the initial agreements. The experience of European Monetary Snake in the early 1970's and the setbacks that have the EMS in the early 1980's and 1990 demonstrate the difficulty of supporting of exchange stabilization agreements in the event of divergence of economic structures of countries concerned.

Notwithstanding, at present, economic and monetary union with single currency is a reality in Europe. Now the question is if there were in Europe a strong political will to make the project of monetary integration successful. For that, it was necessary to support the inherent costs in the passage to the single currency. Indeed, the monetary integration project is characterized by a strong temporal asymmetry on the level of the costs and advantages created by the integration.

Although the costs are immediate and perceptible in the early stages of monetary integration, the benefits in terms of monetary stability are particularly noticeable in the long term once the credibility of monetary integration is established. These benefits tend to increase as the project of monetary integration progresses. In this sense, Frankel and Rose (1998) argued that a currency area would create ex-post the conditions for its optimality. Thus, monetary integration has a significant stimulating effect on trade. The potentiality to develop intra-Maghreb trade is important and monetary integration can be very helpful. The area of the Maghreb will be an optimum currency area provided that the monetary integration project is initiated.

Finally, our analysis of macroeconomic shocks suggests a relative symmetry of shocks between Tunisia and Morocco exists. These two countries could constitute the "hard core" of a currency area in the Maghreb. A "two-speed" Maghreb could be a better alternative at the lack of enthusiasm has prompted the idea of a monetary union grouping the five countries of the UMA.

Appendix A: Unit Root Test

Table 1: Unit Root Test

Augmented Dickey-Fuller (Schwarz Info criterion with MAXLAG = 5)						
	The Businesses Cycles			Economic Growth Rates		
	(i)	*(ii)*	*(iii)*	*(i)*	*(ii)*	*(iii)*
Algeria	-3.831***	-3.776***	-3.682**	-5.236***	-7.696***	-8.156***
Lybie	-2.907***	-2.865**	-2.832	-5.177***	-5.136***	-5.132***
Morocco	-6.618***	-6.512***	-6.392***	-1.022	-9.887***	-10.219***
Mauritania	-4.951***	-4.871***	-4.782***	-2.245**	-8.548***	-9.712***
Tunisia	-4.140***	-4.072***	-4.001**	-1.615*	-6.238***	-6.767***
Phillips-Perron Unit Root Test						
Algeria	-3.960***	-3.911***	-3.829**	-5.554***	-7.419***	-8.005***
Lybie	-3.067***	-3.026**	-2.986	-5.169***	-5.127***	-5.124***
Morocco	-6.606***	-6.502***	-6.384***	-5.411***	-9.467***	-10.315***
Mauritania	-4.920***	-4.822***	-4.708***	-5.606***	-8.417***	-13.451***
Tunisia	-4.073***	-4.002***	-3.924**	-2.229**	-6.237***	-6.767***

(i) With no regressors (ii) With an intercept (iii) With an intercept and a trend.

The table reports t-statistic values.
*, ** and *** mean that the null hypothesis of unit root is rejected respectively at 10%, 5% and 1%.

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