HOW SYNCHRONIZED IS THE MENA REGION WITH ADVANCED ECONOMIES? EVIDENCE FROM AN AUTOREGRESSIVE DISTRIBUTED LAG MODELS

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Abstract

This paper explores the patterns of aggregate cyclical behavior within the Middle East and North Africa region and among this region and the major industrialized economies. We seek to determine how the volatility and the symmetry of MENA countries have been modified following their recent liberalization initiatives. In particular, we ask the broad question of how far the MENA zone can "couple" with the most developed economies and maintain a relative synchronicity with the world business cycle over 1970-2010.

The Hodrick-Prescott filter is applied to decompose the real GDP of these countries and obtain the resulting series of cyclical components. These are compared at different time horizons: the contemporary, short-term, and long-term. Two approaches are used: a static one, based on properties of variability, co-variation and correlation, and a dynamic one, based on long-term relationships using an autoregressive distributed lag models and short-term dynamics using an error correction models. A long-term convergence between the MENA, the G7, the European, and the Anglo-Saxon cycles is confirmed particularly during 1989-2010, period under which the MENA countries have engaged an important economic integration process. This could denote a coupling of the region with the industrialized nations. The idiosyncratic cycles of the MENA countries are closely associated with the G7 experience, especially, in long term. While the European cycle has an important effect on the North African countries, the Middle East region is rather more dominated by the Anglo-Saxon zone.

Keywords: Aggregate Business Cycles, Synchronization, Co-integration, Autoregressive Distributed Lag Model, Vector Error Correction Model, Middle East and North Africa cycles.

JEL classification: F15, F42, F44

1. INTRODUCTION

During recent decades, there has been a renewed interest in the study of the international business cycles co-movement. It is largely assumed that countries do not share either the same degree of symmetry or the same speed of structural convergence. This seems substantially depending on the degree of openness and propagation mechanisms. The productive structure asymmetries, trade nature, and international monetary transmission, imply that countries may react differently to common shocks.

In this context, if the concept of *business cycles symmetry* has become a familiar phenomenon in the developed countries where the presence of common cycles is perceived as an indicator of international symmetry of economic shocks, for the developing countries, the notion of *common cycles* is yet an ambiguous question.

The patterns of specialization which characterize trade integration of industrialized economies (North) differ substantially from those who characterize the North-South and South-South nations. We expect a positive linkage between trade integration and the degree of international co-movement in the case of industrialized nations, and an ambiguous or negative linkage in the case of North-South or South-South integration. It appears capital to see if the lessons derived from the experience of the highest developed economies could hold when we take into account the integration of lower income nations for which the debate should be handled with a great deal of caution.

We are going to be interested to the case of *Middle East and North Africa* countries. Economic integration of this region has increased substantially, strengthen by upsurge of foreign direct investments, increasing inter and intra-industry trade, and higher financial integration. This integration is likely to deepen over time with the growing strategies of preferential trading agreements and regional cooperation arrangements either within the region or among the region and the most important economies. This makes business cycles of MENA countries constantly dependent on the evolution of the world conjuncture, and we estimate necessary to be aware of the changing patterns of business cycle co-movements in this region.

In this context, we note that among the key criteria considered in the optimal currency areas (OCA) literature, which aims to establish the conditions under which the benefits of joining a currency union would outweigh its costs, is the degree of symmetry between the potential members. This plays a key role in determining the cost of sacrificing an independent monetary policy. Countries with close international trade linkages and which exhibit more synchronicity are more likely to be members of an OCA. Hence, by studying the evolution over time of the international co-movement among the MENA region, this paper helps implicitly examining a question that could only be solved empirically: *to what extend a monetary union in the MENA zone can yield a success?*

This article explores the patterns of aggregate cyclical behavior within the MENA region and among the MENA and the major industrialized economies. We try to see how the volatility and the synchronicity of this region have been modified following their recently economic integration. We consider "*the MENA aggregate cycle*" whose evolution will be examined with regard to the G7, the European, and to the Anglo-Saxon business cycles (1). Two approaches are adopted at different time horizons. The first, a static one, will emphasize the evolution of the contemporary business cycle. The goal is to arrive at some tentative conclusions about various regularities of correlations, co-variations and aggregate volatilities. The second approach, a dynamic one, will evaluate the existence of long-term relationships between the different cycles by using a cointegration approach developed earlier by *Pesaran, Shin, and Smith (2001)*. For this purpose, the Hodrick Prescott de-trending technique is used to extract series of cyclical components from the real GDP of the MENA and the G7 countries. These series are used for both the static and the dynamic approaches (2).

The paper is organized as follows. Section 2 presents the static analysis. The goal is to study aggregate and individual MENA fluctuations focusing on some regularities such as proprieties of variability, correlation, and co-variation. This will be done not only within this region, but also in interaction with the cyclical behavior of the highest developed nations. In section 3, the question to be addressed is how far the MENA zone can "*couple*" with the most developed economies and maintain a relative synchronicity with the world business cycle. This will be discussed via a dynamic approach. The idea consists in using the estimates of both long-term relationships through an "*autoregressive distributed lag models*", and short-term dynamics through "*an error correction models*". Finally, Section 4 summarizes the major finding.

2. STATIC ANALYSIS AND EVOLUTION OF AGGREGATE BUSINESS CYCLES

In this analysis, we seek to study aggregate and specific MENA fluctuations using regularities of variability, correlation, and co-variation stylized facts. This will be done not only within the MENA region, but also in interaction with the cyclical behavior patterns of the major industrialized economies.

2.1. Cyclical volatilities of MENA countries

Figure 1 shows some information about the specific fluctuations within every MENA country. Figure 2 gives an idea about the magnitude and the variability of the aggregate fluctuations of the MENA region. The historical analysis of these graphs shows that since the 1970s, the periods which are characterized by a positive output-gap are:

- The years going from 1974 to 1981, with a maximal value of (5%) in 1976 (manifestly, it is the period which coincides with the oil price shocks).

- Those of the years (1990-1993 and 1996-1998), and the recent expansion period is (2005-2008) where the output-gap was around (3%).

The most intense periods of recessions starts with the years 1970-1971 when the aggregate product of the MENA region evolved below its potential value with a negative value reaching (-4%). A second recession was registered during 1981-1989, which has the same high amplitude (-4%) in 1986. These periods followed the oil price shocks, the crisis of debts, and the political instabilities which destabilized the Middle East region (the 8 years war between Iraq and Iran during 1980-1988, war of Lebanon in 1982, Arab-Israeli conflict in 1980). During 2001-2003, the MENA region was also perturbed by another recession, a fall which goes back up to the 11 September 2001 attacks and the war of Iraq. Finally, we note the important decline (2.5%) of the MENA potential GDP along 2009-2010: this coincides with the collapse of Lehman Brothers triggered the worst global financial crisis since the 1930s, which disturbed the USA in 2007 and propagated to the rest of the world.

The important conclusion from figure 2 is that globally, MENA aggregate fluctuations sharply decreased during 1990-2010 in comparison to the 1972-1989 period. This could be explained by the absence of global shocks since the mid-1980s, as well as by the structural adjustment plans applied by MENA countries.

To take into account the large impact of trade openness, we split our sample into two equally-sized parts: 1960-88, 1989-2010. The goal is to see whether MENA countries integration has played an important role to strengthen their symmetry towards the highest developed nations. This choice is based on two explanations: firstly, we know that MENA countries have been engaged in important liberalization initiatives since the beginning of 90s. Secondly, we estimate that since the middle of the 80s, the global shocks have disappeared. As we will see, subdividing the period does have significant effect in terms of the estimations results.

2.2. Cyclical Co-variation of the MENA region

Regarding the co-variation regularity, the question to be addressed is whether the aggregate cycle has become more specific to the individual MENA countries, or rather, more synchronized. In fact, the general pattern of a gradual decline in MENA volatility concluded previously could have two possible explanations: firstly, the idiosyncratic fluctuations within every MENA country have weakened. Secondly, the degree of symmetry between the MENA countries has decreased. Put it simply, the periods of expansion in certain countries can coincide with periods of recessions in others, and the resulting effect leads to more synchronicity of the MENA aggregate cycle. This raises an evident question: which of these two explanations would be behind a lower variability of the MENA business cycle? To answer this question, we are going to follow the method pursued by Duarte and Holden (2003) to decompose the following variability equation:

$$aggregate.volatility\,(y^c_{MENA}) = \sum_{i=1}^{15} \alpha_i^2 \operatorname{var}(y_i^c) + \sum_i \sum_{j \neq i}^{15} \alpha_i \alpha_j \operatorname{cov}(y_i^c, y_j^c)$$

The first term at the right hand side represents the sum of each country's volatility (individual variances), while the second term gives the weighted sum of the co-variances between MENA countries. The idea is that this last term can be used to justify the existence of an eventual synchronicity among the studied group. If there is no symmetry (the correlation coefficient is equal to zero), the aggregate variability would be entirely explained by the sum of the individual volatilities of GDP's cyclical components. The decomposition of this equation is given by figure 3 from which we underline that:

- Domestic fluctuations have increased considerably in 1972 and gradually decreased since mi-80s. These idiosyncratic volatilities seem rather stabilized after this date.
- The co-variations show that the symmetry within the MENA zone tend to be positive over 1972-1982. The co-variation intensity between the MENA countries has a negative sign before 1972. During 1982-1989, the sign of this co-variation was close to zero. But, during the 90s, the MENA faced a new period of cyclical symmetry, and their co-variation

has become once again of a positive sign, except during the years 2001-2004. Regarding this co-variation concept, we underline that the aim is to compare the evolution of several chronological series. Hence, we simply search for detecting if there is over time any dependence between the cyclical components series.

- These last two results lead to presume that the decline of the MENA aggregate variability is manifestly the consequence of a net decrease in the domestic volatilities and a decrease in the degree of co-variation among MENA countries.

In order to build more appropriate comprehension of the MENA region, we opted for its dissociation into two sub groups, the North Africa and the Middle East. From figure 4, it is easy to notice a high positive co-variation between both zones during 1971-1982. This proves the role which has been played by worldwide shocks in generating more international symmetry. During 1980s, both zones evolved in an opposite direction, but they tended to find a positive co-variation quite particularly during the last decade. In table 4, we calculated the correlations of the cyclical components of the different MENA countries, for two sub periods 1970-1988 and 1989-2010. The reported statistics show that globally, all the considered countries knew an increase in the degree of their cyclical correlations during the second sub period in comparison to the first sub period (3).

These two regions seem to differ in terms of their fluctuations amplitude. North Africa countries are characterized with a stabilized cycle since 1987. By opposition, the Middle East fluctuations, if recently they have a lower volatility in comparison to the 70s decade, they remain rather unstable. We think that since the studied period is relatively short, it is difficult to conclude that two different cycles exist within the MENA region.

2.3.The MENA and the highest developed countries aggregate cycle

From the historical analysis of figure 5 which describes the superposed evolution of the G7 and the MENA cycles, we can show the following results:

- The MENA region seems more volatile than the industrial nation's cycle.
- At first sight, there is a negative co-variation between the G7 and the MENA cycles, leading to conclude that there is rather an idiosyncratic behavior and an asymmetry of common shocks transmission between the two groups of countries.

We continue with figures 6-7 to get more clear information about the MENA zone behavior towards the European and the Anglo-Saxon zones:

- Over all the period, both, Anglo-Saxon and European cycles evolved in a symmetric way, mainly after the oil price shocks. The Anglo-Saxon zone seems to be often in advance with regard to the European zone.
- It seems that the importance of the G7 fluctuations had sharply decreased.
- It is difficult to conclude into the existence of two distinguished cycles within the G7. Both, Anglo-Saxon and European zones seem dominated by a single world cycle.
- North Africa seems more linked to the world cycle than the Middle East, and this is valid both in terms of amplitude and in terms of synchronization.

- Both, North Africa and Middle East zones tend to be in more convergence with the world business cycles, quite particularly since mid-90s.

Table 5 gives the correlation coefficients of the different aggregate cycles for the two sub periods (1970-1988 and 1989-2010). All of the reported coefficients are high for the second sub period, and the MENA cycle is relatively more correlated with the G7, the European, and the Anglo-Saxon countries. This holds when consulting figure 10. Over 1987-2010, correlation coefficient of the MENA with the three cycles was considerably important, and fluctuated around (0.9), except a little decrease during 2001-2004 when it reached (0.6). This coefficient fell down, became equal to zero during 1981-1982 and reached (0.3) during 1985-1986.

3. COUPLING OR DECOUPLING OF MENA ZONE: CO-INTEGRATION TEST

The following dynamic analysis seeks to evaluate long-term relationships among the studied aggregate cycles. More exactly, we test for the existence of a long-term equilibrium which could characterize the interdependent evolutions of the MENA, the G7, the European, and the Anglo-Saxon cycles. If this long-term relationship is confirmed, this will provide evidence for an increase in the symmetry between the MENA zone and the other aggregate cycles. That is, it will provide more information about the (*de*)*coupling* of the MENA region towards the world business cycle (the highest industrialized nation's cycle).

3.1. The co-integration approach and the ADL modelling

Among the various problems that could be faced by much of the earlier studies of business cycle, concerns estimations on non-stationary series. The coefficient estimates can follow nonstandard distribution and generate spurious regression. Hence, to overcome, several approaches choose the correlation tests rather than estimating dynamic interrelationships, while others studies tend to use the first differences of the integrated series. Finally, several studies conduct alternative traditional techniques of co-integration, developed by Engle and Granger (1987) and Johansen and Juselius (1990) (4). However, we have to note that within the recent development of time series analysis, there are not only these standard approaches, but recently, new cointegration technique, à la "*Pesaran, Shin and Smith*", has emerged and seems being widely adopted in practical applications.

Pesaran, Shin, and Smith (1996 and 2001) developed a new approach to test the existence of long-term linear relationships among an endogenous variable and a set of regressors when their integration order cannot be surely known. The proposed tests are based on Wold standard statistics, and the calculated *t-statistics* are used to test the significance of the lagged levels of the various variables. The asymptotic distributions of these statistics are not standard under the null hypothesis of no co-integration among the levels of the included variables, independently of the fact that the regressors are I(0) or I(1). Two groups of critical values are obtained: A first group corresponds to the case where all the regressors are strictly I(1), and a second group corresponds to the case when all the variables are I(0). These two classes of critical values give a certain "*band*" covering all the possible classifications of regressors in variables I(1), I(0), or mutually co-integrated.

Among these new and traditional techniques, there are some important differences:

As underlined by Chan and Lau (2007), many limits emerge when adopting the standard approach. First of all, this one is static and does not account for dynamic linkages among variables. Secondly, the co-integration result depends widely on the choice of the endogenous variable, itself constituting an arbitrary process. Thirdly, if there are several co-integrated vectors, the Engle-Granger approach can give rise to estimates which are a linear combination of these vectors, and this can conduct to an identification problem. Finally, the estimated coefficients have no standard distributions and cannot be used to test hypotheses concerning the coefficients real values.

Chan and Lau (2007) underlined that the traditional procedure à la Johansen and Juselius (1990) seems restrictive because it requires a certain distinction between the integrated I(1) and stationary I(0) variables. Johansen and Juselius (1990) proposed a multivariate approach where the a priori choice of the endogenous variable is not necessary. This procedure determines the number of cointegrated vectors and produces maximum likelihood estimates of these vectors. Introducing an I(0) variable in a wrongly way would overestimate the cointegrated vectors number. As a result, the hypothesis of no co-integration among variables is often likely to be rejected even when none exists. Many other limits with the Engle-Granger method can be stressed. The choice of the dependent variable, which itself, is an arbitrary process, determines substantially the cointegration result. Furthermore, the approach is static and does not account for dynamic interrelationships among the variables.

Regarding the new techniques à la Pesaran, Shin and Smith, Duarte and Holden (2003) underline that these turn to be more attractive for two main reasons:

Firstly, long-term relationships can be estimated without any a priori use of unit-root tests or a priori knowledge of the integration order of the studied series. In our work, applying the HP filter makes sure that the cyclical components series are stationary. We carried out Dickey-Fuller test for unit-roots, and our expectations were confirmed. The null hypothesis of non-stationarity of the cyclical component is rejected in every case. Therefore, the use of the standard techniques turns out to be inappropriate and instead the distributed lag approach is used.

Secondly, another merit is that no matter whether the explanatory variables are exogenous or not; the current and long-term parameters can be estimated by applying OLS method to an autoregressive model after having specified an appropriate lag length.

3.2. The estimated ADL specification

Every analyst seeking to evaluate business cycle symmetry has the possibility of adopting an "*Autoregressive Distributed Lag Models"*. Here it is the Pesaran, Shin, and Smith (2001) version that we follow. It can be estimated independently of the fact that the series are I(0) or I(1). This approach allows not only avoiding the usual unit-root tests but also not to worry about the exogeneity order of the variables. The current and long-term parameters can be estimated by applying OLS, after having specified the lag appropriate number. The ADL specification and the long-term estimations can be obtained from the following model (5). By using lagged polynomials operators, we have:

$$\Pi(L,p)Y_t = \alpha + \sum_{i=1}^{k}\gamma_i(L,q_i)X_{it} + u_t \qquad (1)$$

$$\Pi(L,p) = 1 - \Pi_1 L - \Pi_2 L^2 - \ldots - \Pi_p L^p$$

$$\gamma_i(L,q_i) = 1 + \gamma_{i1}L + \gamma_{i2}L^2 + \ldots + \gamma_{iq}L^{qi} \text{ for } i = 1,2,\ldots,k$$

Where L is the lag operator ($Ly_t = y_{t-1}$).

Or more simply by writing it under the general form:

$$Y_t^c = \alpha + \sum_{i=1}^{p}\beta_i Y_{t-i}^c + \sum_{j=1}^{k}\sum_{i=1}^{q}\gamma_{ji}X_{jt-i}^c + \mu_t \qquad (2)$$

The following expressions give the long-term estimates of α and γ_{ji} which account for the response of (Y_t^c) to a unitary change in (X_{it}^c):

$$\alpha^* = \frac{\hat{\alpha}}{\hat{\beta}_i(1,\hat{p})} = \frac{\hat{\alpha}}{1-\hat{\beta}_1 - \ldots.. - \hat{\beta}_p}$$

$$\gamma^* = \frac{\hat{\gamma}_j(1,\hat{q}_j)}{\hat{\beta}_i(1,\hat{p})} = \frac{\hat{\gamma}_{j0} + \hat{\gamma}_{j1} + \ldots + \hat{\gamma}_{jq}}{1-\hat{\beta}_1 - \ldots. - \hat{\beta}_p}$$

With $\hat{p}$ and $\hat{q}_i$ denoting the estimated values of (p) and (q_i).

The idea is to start with a dynamic model (equation (3)) allowing the changes in a variable of interest (here the MENA cycle) to past changes of itself and other variables, as well as to lagged levels of these variables. The estimation allows testing not only the existence of long-term relationship, but also, the existence of an "*unrestricted error correction models"*. More specifically, to test long-term relationships, the following version with error correction of the ADL model is adopted:

$$\Delta Y_t^c = \alpha + \rho Y_{t-1}^c + \sum_{i=1}^{k}\theta_i X_{it-1} + \sum_{i=1}^{p}\beta_i \Delta Y_{t-i}^c + \sum_{j=1}^{p}\sum_{i=1}^{k}\gamma_{ij}\Delta X_{it-j} + \mu_t$$

(3)

$(\Delta = (1-L))$ represents the first difference operator. (Y_t^c) reflects the MENA aggregate cycle taken as the dependant variable; the variable (X_{it}) can express three cycles, those of the G7, Anglo-Saxon, and European zones, introduced as the explanatory variables (here, k=3).

The procedure consists in testing the joint null hypothesis (H_0) according to which $(\rho = \theta_i = 0)$ against the alternative that they are not all zero. If H_0 is accepted, this proves that there is no cointegration relationship. By this way, we are focusing on conventional Wold statistics. However, since the asymptotic distributions of the statistics are non standard, irrespective of whether the regressors are I(0), I(1), or mutually co-integrated, Pesaran et. al (1996) have proposed what they called "*the bounds testing procedure*" with the corresponding critical values. Two groups of critical values are built; the superior border and the lower border are calculated on the base according to which variables are I(0) and I(1), respectively. The cointegration is confirmed if the calculated F-statistics falls outside the critical value bounds, independently of integration order of the regressors. But, if the F-statistic falls inside indefinite zone (inside the critical value bounds), it would be necessary to run a priori knowledge of the integration order of the series before going deeper to estimations.

More concretely, and for our ADL specification, the unrestricted errors correction model can be expressed as follows:

$$\Delta Y_t^c = a + \sum_{i=1}^{p} b_i \Delta Y_{t-i}^c + \sum_{i=1}^{p} c_i \Delta G7Y_{t-i}^c + \sum_{i=1}^{p} d_i \Delta EUROY_{t-i}^c + \sum_{i=1}^{p} e_i \Delta ANGY_{t-i}^c + \rho_1 Y_{t-1}^c + \rho_2 G7Y_{t-1}^c + \rho_3 EUROY_{t-1}^c + \rho_4 ANGY_{t-1}^c + \mu_t$$

With *Y*, *G7Y*, *EUROY, ANGY* are the aggregate cycles of MENA, G7, euro zone, and the Anglo-Saxon zone, respectively. The procedure consists in testing the null hypothesis $H_0 : \rho_1 = \rho_2 = \rho_3 = \rho_4 = 0$ against $H_0 : \rho_1 \neq 0, \rho_2 \neq 0, \rho_3 \neq 0, \rho_4 \neq 0$.

Finally, after having specified this long-term analysis, we move to the short-term specification. This can be expressed as follows:

$$\Delta Y_t^c = \sum_{i=1}^{p} \nu_i \Delta Y_{t-i}^c + \sum_{j=1}^{k} \sum_{i=0}^{q} \tau_{ji} \Delta X_{ji-i}^c + \lambda (Y_{t-1}^c - \alpha^* - \gamma^* X_{t-1}^c) + \mu_t \qquad (4)$$

(Y_t^c) and (X_{jt}^c) have the same significance than the equation (3); (α^*) and (γ^*) are the long-term parameters. The term λ denotes the errors correction coefficient (ECT) which measures the adjustment speed (6). The difference between Y_{t-1} and $\gamma^* X_{t-1}$ measures the importance of the long-term relationships failure between (Y_t) and (X_t). If the (ECT) has a negative sign, the model tends to converge to a long-run equilibrium. In relation to our main purpose, this coefficient can be seen as an indicator of cyclical symmetry. For a given shock affecting leader country, this coefficient reflects the adjustment speed at which the disturbed system converges to its long-term path. The higher this coefficient, the more important is the speed of convergence. In particular, after an asymmetric shock, the value is higher (Duarte and Holden, 2003).

3.3.-The dynamic analysis results

The specified ADL model allows studying the dynamic interrelationships among the different cycles. The common character of the international fluctuations will be estimated through the examination of the long-term relationships among the

MENA business cycle with regard to those of the G7, European and Anglo-Saxon countries. Our starting step is a dynamic model which allows studying the changes in one important variable (here, the MENA aggregate cycle) according to its own past and the past of the other variables, as well as according to lagged levels of these variables. More simply, it is the equation (3) which links the changes of the MENA cycle, according to its own past variations and the past of the other variables (G7, Euro-zone, Anglo-Saxon zone), as well as according to the lagged levels of these variables.

The results of the ADL estimations are summarized in table 1. They show that for 1970-2010 the hypothesis H_0 is rejected. In fact, we note that F-statistics falls outside the critical value bounds. This proves that the MENA cycle is conducted by long run co-movement with regard to the three other cycles (7).

Table no. 1 Co-integration test for the MENA, G7, Anglo-Saxon and European zones

Estimated model	Under periods		Entire period
F [MENA/(G7, Anglo-Saxon, Europe)]	1970-1988	1989-2010	**1970-2010**
MENA	2.966755*	3.853406	3.921973
North Africa countries	*2.840489**	*2.224247*	*4.034933*
Middle East countries	*2.965295**	*3.919776*	*2.877995**

The values give the *F-statistics*. The two criteria of Akaike (AIC) and Schwartz (AIS) are used to determine the appropriate lags number. The G7, Anglo-Saxon and European cycles are introduced as exogenous variables. Borders of the appropriate critical values are tabulated in Pesaran, Shin, and Smith (1996 and 2001). For the estimated specification, with a constant and without trend, k=3, and a 95% confidence level, these values are equal to (2.79, 3.67). (*) denotes the acceptance of H_0 of no existence of co-integration relationship for a significance level at 5%. In most estimates, the regressors have a reasonable R^2 (which borders 0.5) with a Durbin-Watson very close to 2, which means a low co-linearity between variables.

To go deeper, the previous estimations were accomplished once again by replacing the MENA aggregate cycle by the North Africa cycle and the Middle East cycle. The results show that during 1970-2010, the calculated F-statistics falls outside the critical value bounds only for the North Africa case, and falls inside the critical value bounds for the Middle East one. Consequently, over the studied period, the long-term cointegration is confirmed only for the North Africa region. Note that this cointegration does not hold in any case for the 1970-1988 period. For the 1989-2010 period, assumed to be a period of integration to the world economy, long-term equilibrium is well confirmed, whether we consider the whole MENA sample, or, when separating it into two zones, the North Africa and the Middle East.

In table 2, the values of the long-term parameters have a positive sign on response to the different cycles (G7, Anglo-Saxon and European). Both for MENA aggregate cycle and the North Africa and the Middle East business cycles, the G7 aggregate cycle seems to be the most significant, and has the highest degree of influence on these regions. This leads to presume that generally, the common shocks and the idiosyncratic cycles of the MENA zone are tightly linked to the G7 experience, in particular, in the long-term.

And in a more detailed way, we note also that in comparison to the Anglo-Saxon cycle, the European cycle tends to have a relatively higher impact on the North Africa countries. The forecast and\or the determination of the future fluctuations of these countries can be realized by leaning on the information provided by the European cycle. Concerning the Middle East region, it seems more influenced by the Anglo-Saxon cycle.

Table no. 2 The ADL long term coefficients for the MENA, G7, Anglo-Saxon and European zones

	C	G7	Anglo-Saxon zone	Europe zone
MENA	1.20E-05 [0.085813]	0.44729 [2.548]	0.21335 [2.002]	0.20314 [2.401]
North Africa	1.89E-05 [1.954]	0.41214 [2.638]	0.19502 [1.706]	0.31255 [2.211]
Middle East	1.09E-05 [2.803]	0.45462 [2.591]	0.30012 [2.009]	0.12228 [1.201]

The values between brackets are T-statistics. The choice of the optimal lagged number is made according to both criteria of Akaike and Schwartz. In most of the estimations, the regressions have a reasonable R^2 (about 0.99) with a Durbin-Watson equal to 2.2.

The modeling of the short-term dynamics is given in table 3. We note that:

- The lagged errors correction term (ECT_{t-1}) has the expected negative sign and a significant coefficient in most cases, indicating that once the system is perturbed, there will be adjustment mechanisms permitting the restoration of the long-term equilibrium.
- The lagged changes in the G7 and the Anglo-Saxon cycles are active with positive and significant coefficients while the coefficient relative to the European cycle seems lower.
- By looking to the errors correction term (ECT) coefficient amplitude, the North Africa region has an adjustment speed which reaches 2 years. This convergence speed seems more important than that of the Middle East region (around 3 years). This can reflect a higher synchronization degree of the North Africa countries, in particular, after being perturbed by an asymmetric shock (8).

Table no. 3 The « Unrestricted Errors Correction » specification of the ADL model

Endogenous variables	C	D_{-1}	$\Delta G7_{-1}$	$\Delta G7_{-2}$	ΔANG_{-1}	ΔANG_{-2}	ΔEUR_{-1}	ΔEUR_{-2}	ECT_{-1}
			Exogenous Variables						
$\Delta MENA$	0.051	0.531	1.663**	-0.980	0.912 *	-0.002	0.611	-0.044	**-0.712**** (-3.002)
$\Delta NorthAfr$	-0.080	0.631	1.956 **	-1.023	1.520 **	-0.010	1.012	-0.813	**-0.555*** (-5.110)
$\Delta Midd.East$	-0.005	0.812	1.315***	-0.999	1.100	-0.209	0.947***	-0.465	**-0.320** (-4.559)

The values in brackets are T-statistics. (***), (**) and (*) denote respectively, a 1%, 5% and 10 % significance level.

4. CONCLUSION

The HP filter was used to determine the cyclical components series of the real GDP of the MENA and G7 countries. They were used to conduct a static analysis, centered on properties of variability, co-variation and correlation, and a dynamic analysis, centered on long-term relationships through an "*Autoregressive Distributed Lag Model*", and short-term dynamics through an "*Error Correction Model*".

The static analysis gives the following results :

The MENA fluctuations volatility has sharply decreased and gained greater stability since the 1990s. This is the result of a decrease in the idiosyncratic volatilities and in the co-variation degree among the MENA.

A greater harmonization between the MENA aggregate cycle and the world business cycle tends to be confirmed from around 1989. This might be due to the integration strategies pursued by the region at the end of the 80s, and probably, to an increase in the productive structures similarity between the MENA countries and the highest industrialized economies. Looking for the appropriate mechanisms of regional cooperation between MENA countries would thus be of an important consideration to limit the effects of external instabilities.

The cyclical fluctuations of the MENA countries are found to be more volatile than those of the industrialized nations. There is rather a negative co-variation between the G7 and the MENA business cycles. There would be rather an idiosyncratic behavior, and an asymmetry in terms of global shocks transmission between the G7 and the MENA region.

The dynamic analysis gives the following conclusions :

Estimations prove the existence of long-run equilibrium relationship, reflecting cyclical convergence between the MENA, the G7, the European, and the Anglo-Saxon cycles. This result holds for the 1970-2010 period, when considering the entire MENA sample, and is also confirmed for the North Africa and the Middle East cycles when introduced separately, particularly for the (1989-2010) sub period under which they have engaged an important integration process to world economy. This can be seen as synonym of an increase in the degree of cyclical symmetry between the MENA region and the word business cycle, and thus we can talk about a "*coupling*" of the MENA region with the industrialized nations.

The long-run coefficients are positive in response to the G7, Anglo-Saxon, and European cycles. The G7 business cycle seems to be the most significant for the MENA group. Common shocks and idiosyncratic cycles of this region are more likely to be tightly associated to the G7 experience, especially, in the long-term.

In comparison to the Anglo-Saxon cycle, the European cycle has more significant influence on the North Africa zone. However, the Middle East one would be more influenced by the Anglo-Saxon zone.

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Notes

1. For the MENA zone, the list contains 15 countries (Tunisia (TUN), Algeria (ALG), Libya (LIB), Morocco (MOR), Egypt (EGY), Iran (IRA), Jordan (JOR), Saudi Arabia (SAO), Kuwait (KUW), Syria (SYR), Turkey (TUR), United Arab Emirates (UAE), Lebanon (LEB), Qatar (QAT), Bahrain (BAH)); The G7 (USA, UK, Canada, France, Italy, Germany, Japan). We used the real GDP (at 1990 constant price) taken from the World Development Indicator database.

2. Furthermore, cross-country productive structure dissimilarity and patterns of trade as well as reactions to shocks which could be country- or region specific, may lead us suspecting that business cycles symmetry might vary with the studied sample of countries. Hence, for more robustness, the MENA region will be dissociated into two sub-groups, the North Africa countries (Morocco, Algeria, Tunisia, Libya, and Egypt), and the Middle

Eastern countries (Syria, Lebanon, Saudi Arabia, Qatar, Bahrain, Jordan, Kuwait, Emirates Arabia, Turkey, Iran).

3. We underline that Kuwait and Lebanon have negative correlations with the rest. The other countries all have high positive values in both sub periods.

4. Cointegration could be seen as an appropriate method of simultaneously modeling log-run persistence and co-movement among aggregates. It means that a set of non-stationary series could have similar trend movements which, through some linear combination, can give rise to stationary series or long-term relationships.

5. Regarding the ADL modeling, we can consult the works of Pesaran and Shin (1996), Pesaran, Shin, and Smith (1996 and 2001), Keele and De Boef (2004); Hassler and Wolters (2006).

6. The mechanism of error correction reflects any short-term disequilibrium decrease. In fact, in long-term, the error correction coefficient is equal to zero. However, if the variables deviate from the long-term relationship, this coefficient is going to be different from zero and each variable adjusts gradually to converge to the equilibrium path.

7. This finding confirms the results found previously in the static analysis.

8. This confirms our finding in the static analysis: in comparison to the Middle East region, the North Africa aggregate fluctuations seem more strictly linked to the world business cycle, both in terms of amplitude and symmetry.

Appendix

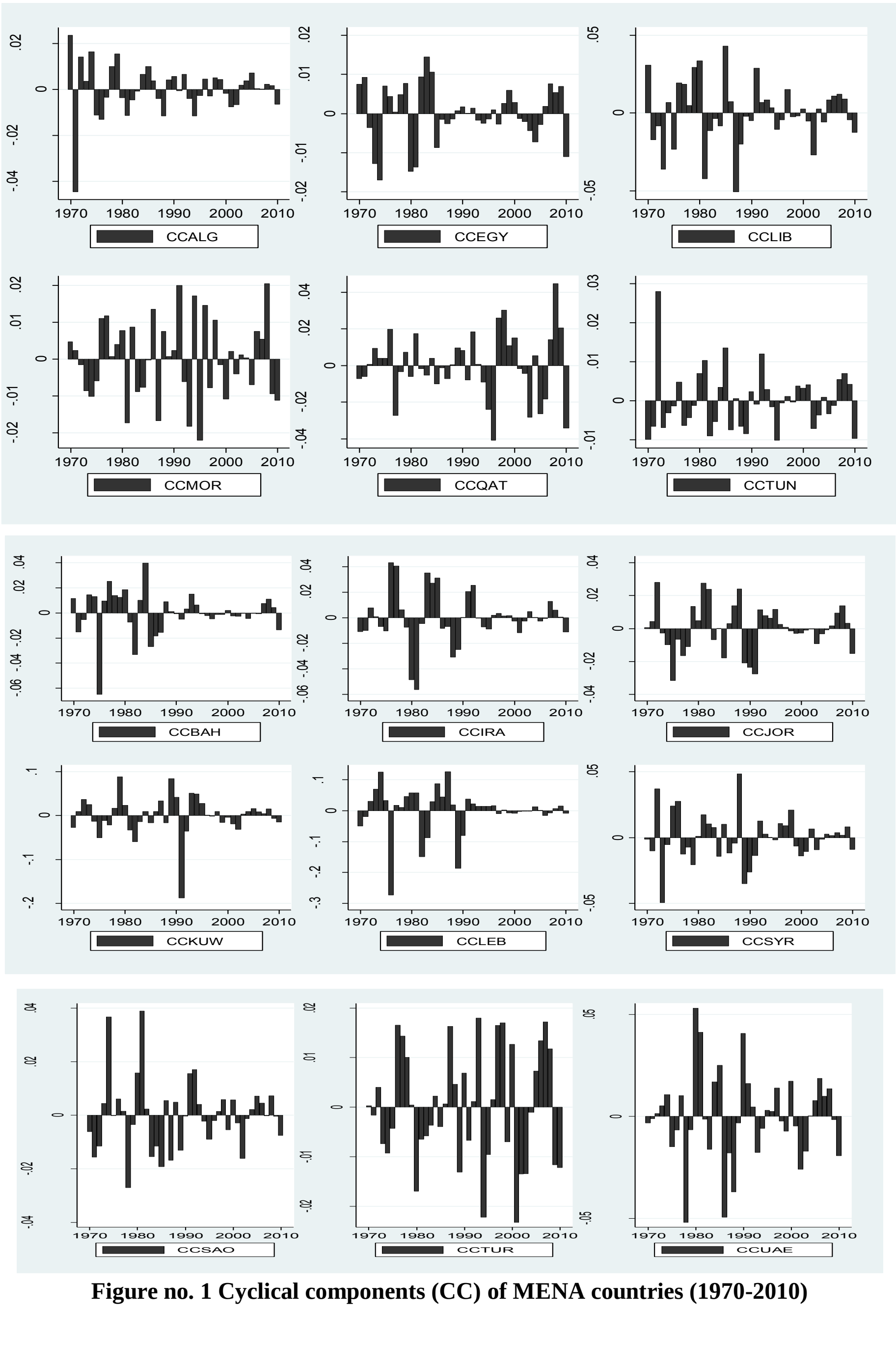

Figure no. 1 Cyclical components (CC) of MENA countries (1970-2010)

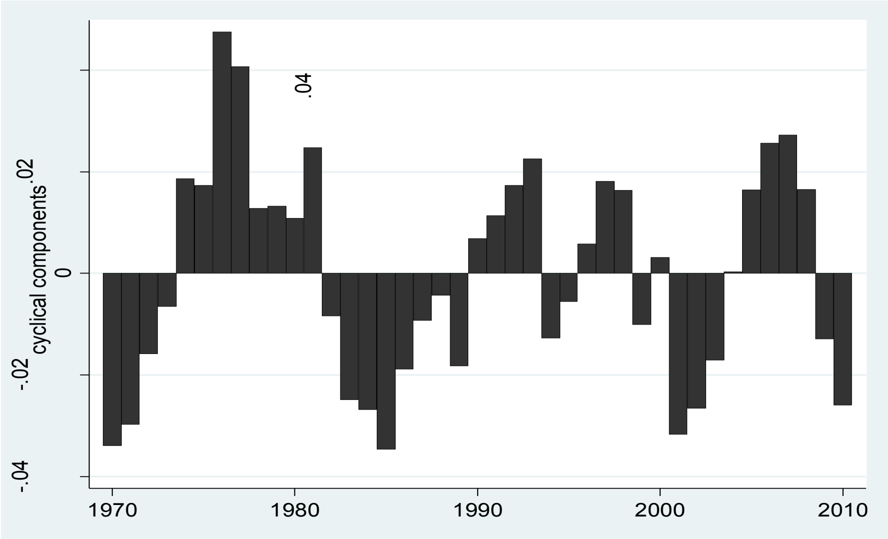

Figure no. 2 MENA aggregate fluctuations

Table no. 4 Correlation of MENA cyclical components

	ALG	BAH	EGY	IRA	JOR	KUW	LEB	LIB	MAR	QAT	SAO	SYR	TN	TUR	UAE
ALG	1.000	0.960	0.953	0.957	0.952	0.783	0.764	0.937	0.973	0.977	0.939	0.879	0.955	0.941	0.976
BAH	0.849	1.000	0.993	0.991	0.996	0.845	0.893	0.896	0.979	0.977	0.984	0.964	0.993	0.980	0.990
EGY	0.969	0.747	1.000	0.989	0.993	0.829	0.909	0.873	0.978	0.983	0.975	0.976	0.998	0.979	0.990
IRA	0.506	0.607	0.404	1.000	0.985	0.785	0.893	0.876	0.980	0.973	0.990	0.962	0.991	0.977	0.989
JOR	0.946	0.743	0.969	0.256	1.000	0.871	0.906	0.893	0.970	0.974	0.976	0.973	0.990	0.979	0.985
KUW	-0.842	-0.660	-0.848	-0.424	-0.836	1.000	0.768	0.782	0.777	0.807	0.786	0.838	0.819	0.835	0.806
LEB	-0.077	-0.361	-0.039	-0.307	-0.064	0.243	1.000	0.713	0.846	0.845	0.889	0.964	0.905	0.885	0.857
LIB	0.782	0.946	0.668	0.608	0.646	-0.594	-0.423	1.000	0.904	0.901	0.875	0.795	0.869	0.873	0.895
MAR	0.976	0.824	0.979	0.500	0.933	-0.824	-0.108	0.776	1.000	0.976	0.966	0.933	0.978	0.957	0.986
QAT	0.931	0.908	0.868	0.637	0.829	-0.789	-0.219	0.854	0.922	1.000	0.955	0.936	0.985	0.965	0.986
SAO	0.788	0.937	0.664	0.654	0.650	-0.675	-0.349	0.917	0.762	0.929	1.000	0.951	0.976	0.979	0.977
SYR	0.962	0.891	0.924	0.569	0.900	-0.866	-0.240	0.848	0.956	0.971	0.879	1.000	0.973	0.963	0.947
TN	0.987	0.847	0.968	0.524	0.940	-0.842	-0.085	0.778	0.982	0.953	0.809	0.979	1.000	0.975	0.990
TUR	0.950	0.778	0.962	0.559	0.884	-0.782	-0.044	0.722	0.982	0.908	0.724	0.926	0.964	1.000	0.977
UAE	0.873	0.931	0.778	0.668	0.742	-0.792	-0.314	0.923	0.849	0.952	0.963	0.937	0.881	0.814	1.000

The lower triangular part is relative to the 1970-1988 period, and that triangular superior is relative to the 1989-2010 period.

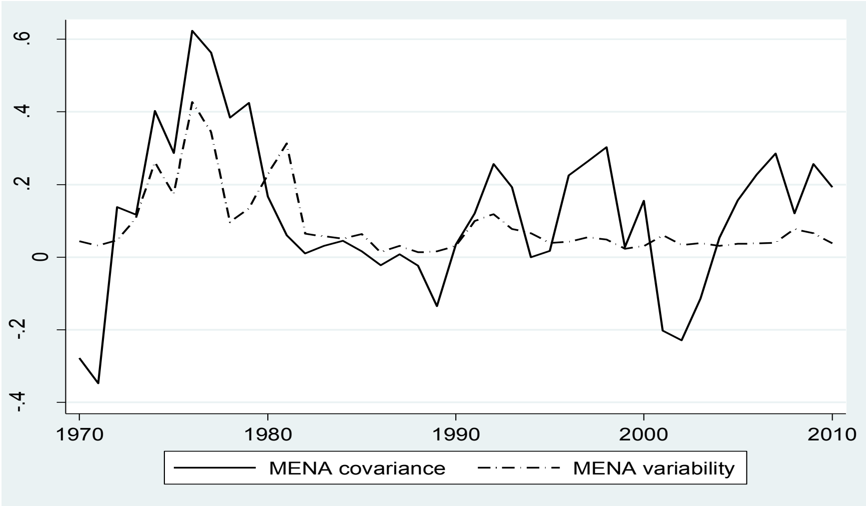

Figure no. 3 Superposed evolution of MENA co-variation and variability

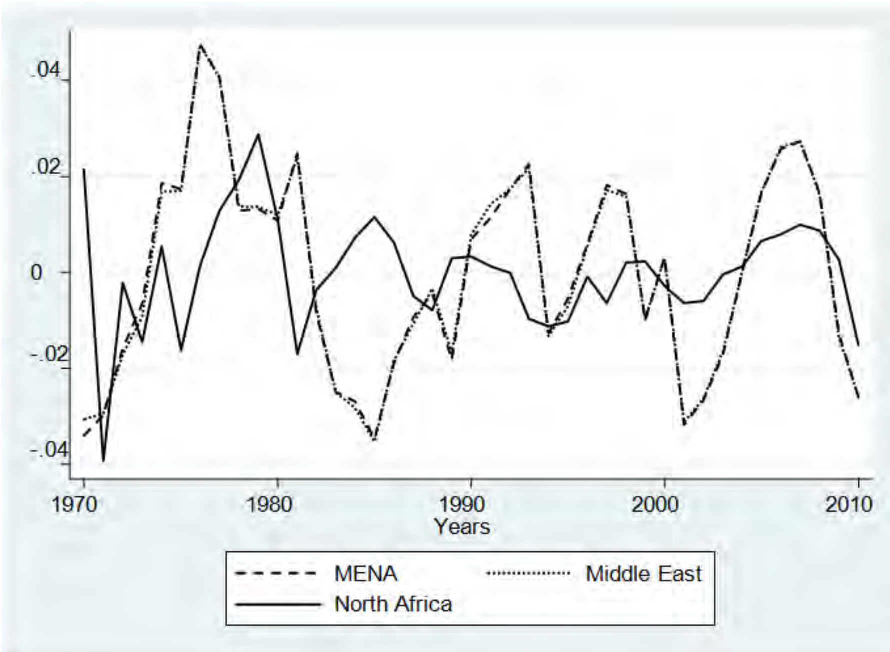

Figure no. 4 North Africa and Middle East fluctuations

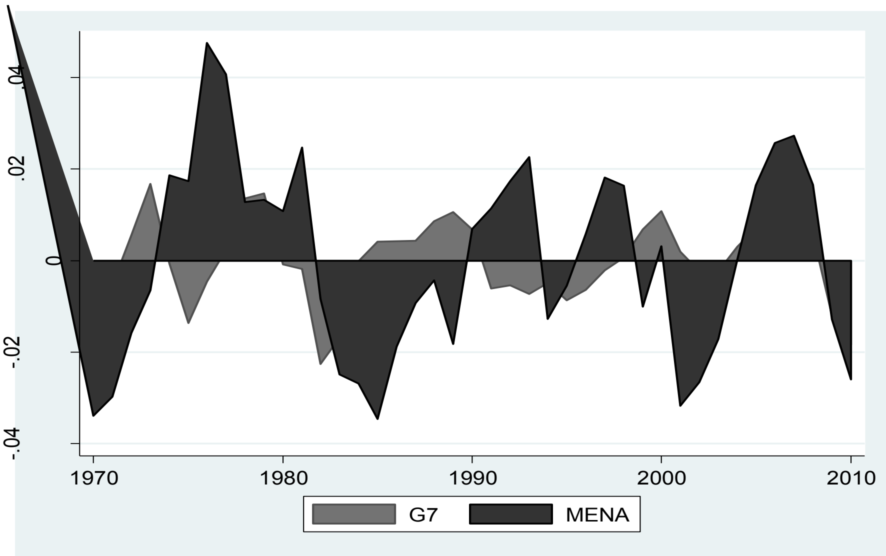

Figure no. 5 Aggregate G7 and MENA Fluctuations

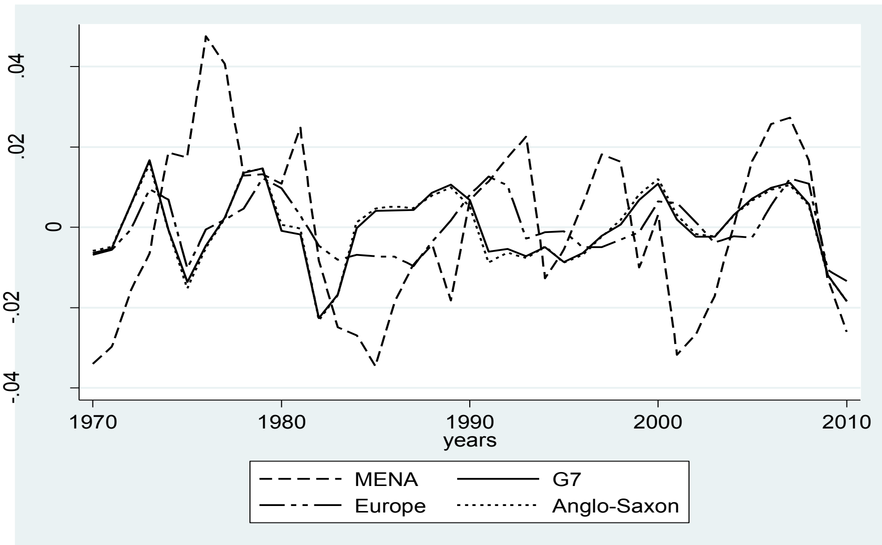

Figure no. 6 G7, Anglo-Saxon, European, and MENA cycles

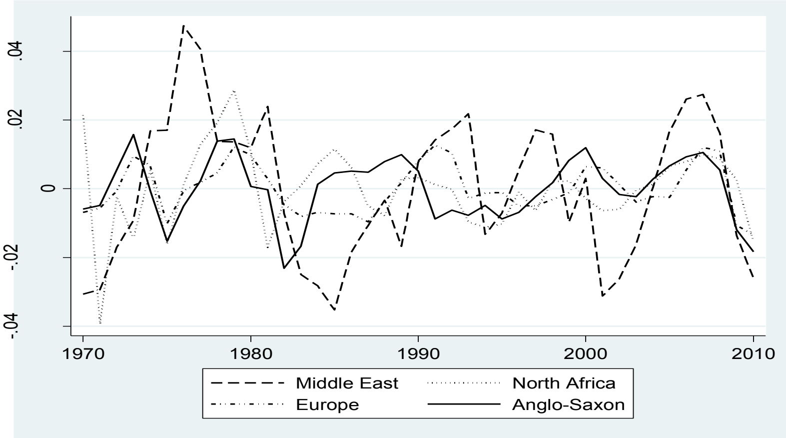

Figure no. 7 G7, Anglo-Saxon, European, North Africa and Middle East cycles

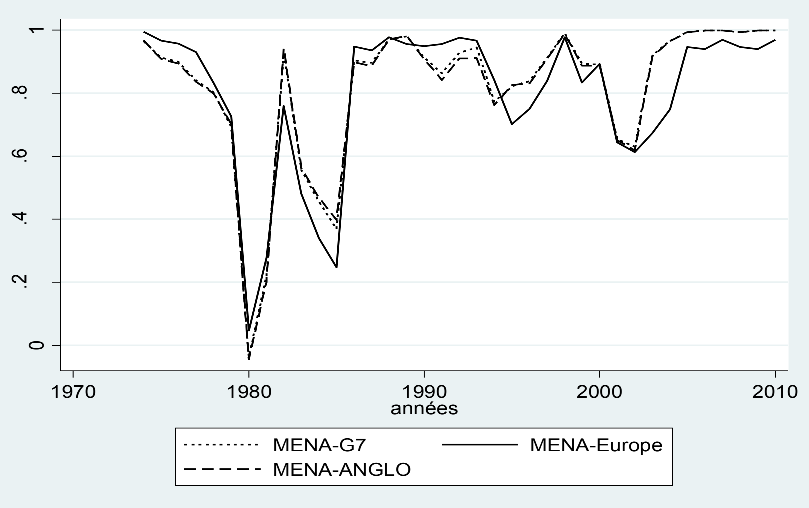

Figure no. 8 Correlations of MENA with G7, Anglo-Saxon, and European cycles

It is a *5-year rolling correlation*. The choice of this number of years parts of the principle that we supposed that on average, the duration of a cycle is equal to 5-year.

Table no. 5 Correlation of aggregate business cycles

	G7	MENA	Anglo-Sax	Europe	North.Afr	MiddleEast
G7	1.000000	0.973147	0.999798	0.988206	0.972649	0.970687
MENA	0.862431	1.000000	0.969083	0.966643	0.968710	0.999916
Anglo-Sax	0.999879	0.860037	1.000000	0.987664	0.969247	0.966468
Europe	0.988753	0.910167	0.987506	1.000000	0.950259	0.965083
North.Afr	0.944587	0.936455	0.943756	0.974168	1.000000	0.966560
Middle.East	0.864992	0.999853	0.862524	0.911993	0.935955	1.000000

The lower triangular part describes the (1970-1988) period and that triangular superior describes the period (1989-2010) period.