MENA aggregate cycle and world conjuncture: Episodes of volatility and symmetry, and an ADL cointegration test

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1- INTRODUCTION

If the world trade does not stop increasing, it is important to mention that the commercial reports between rich and the low-income countries are driven by specific economic dynamics. The relation between economic integration and economic growth remains dependent on several structural divergence factors, such as trade nature, productive structures similarity, common and specific shocks, and the degree of international symmetry. The existence of many types of integration characterized by different regularities, in one hand, and the differences between countries in terms of their specialization paths, on the other hand, signifies that the impact of trade integration on business cycles symmetry differs from one type of integration to another. It is often accepted that countries do not share either the same degree of symmetry or the same speed of structural convergence. This is so related to the openness degree and the international propagation mechanisms. The productive structure asymmetries, the trade composition, and the international monetary transmission, imply that the countries react differently to common shocks. And, if the concept of business cycles symmetry became rather 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 less developed countries of the South, the notion of common cycles is yet an ambiguous question.

This article aims the study of aggregate fluctuations of MENA region in interaction with the world economy. We try to see in which measure their volatility and their symmetry have been modified, quite particularly after their integration. We argue in terms of what we called "*the MENA aggregate cycle*" whose evolution will be studied with regard to the world cycle (G7), the European cycle and to the Anglo-Saxon cycle [(1)]. Two approaches will be accomplished on various temporal horizons. The first static one will emphasize the contemporary business cycles evolutions. It will result in correlations, co-variations and aggregate volatilities measures. The second approach, dynamic, will try to test long-term relations between the different cycles through tests of co-integration à *la Pesaran, Shin, and Smith (2001)* [(2)]. More exactly, the Hodrick and Prescott filter is going to be adopted to decompose the real GDP of the MENA and the most industrialized nations. The cyclical components series are used to accomplish a static analysis centered on properties of variability,

[1] For the MENA zone, the list contains 15 countries (Tunisia, Algeria, Libya, Morocco, Egypt, Iran, Jordan, Saudi Arabia, Kuwait, Syria, Turkey, Utd. Arab. Em, Lebanon, Qatar, Bahrain), For the G7 (USA, GK, Canada, France, Italy, Germany, Japon),.

[2] Our paper is inspired by works of Agustin and Ken (2003) and by Chan and Lau (2007)

co-variation and correlation, and a dynamic analysis centered on long-term relations through what we call "*Autoregressive Distributed Model*", and the study of the short-term dynamics through "*Vectors Errors Correction Model*" [(3)].

2- Static analysis and evolution of aggregate cycles

The objective of this first analysis is to study the aggregate and specific MENA fluctuations. The idea consists on evaluating proprieties of variability, correlation, and co-variation, not only inside this zone, but also, in terms of its interaction with the most industrialized countries.

2.1- Cyclical volatilities of MENA countries

Figure 1 describes the evolution of cyclical components of the different countries of MENA zone for the period (1970-2010) and informs about the specific fluctuations in every country. Figures 2 give an idea about the amplitude and the frequency of the *aggregate* fluctuations having characterized the entire MENA region. The historical analysis of these graphs shows that since the 1970s, the periods which are characterized by a positive output-gap (the cyclical growth was higher than the production potential level) 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 two oil crises).
- Those of the years (1990-1993 and 1996-1998), and the most recent expansion period is (2005-2008) where the output-gap was around (3%).

By opposition, concerning the periods of recessions, we can begin with the years (1970-1971), manifestly the most intense, where the aggregate product of the MENA region evolved below its potential value with a negative value reaching (-4%). Since this date, the region knew another recession during (1981-1989), having the same high amplitude in 1986 (-4%). These periods remind us the counter oil crises, crises of debts, and the political instabilities which destabilized the Middle East region (the 8 years war between Iraq and Iran, war of Lebanon, Arab-Israeli conflict). Since 1989, the MENA knew another recession but of a weak duration

[3] It is to note that beyond the reasoning on an aggregated cycle of MENA region, we had the idea to opt for a certain dissociation, by dividing this region into two under group; the countries of North Africa (Morocco, Algeria, Tunisia, Libya, and Egypt), and countries of Middle East (Syria, Lebanon, Saudi Arabia, Qatar, Bahrain, Jordan, Kuwait, Emirates Arabia, Turkey, Iran).

(2001-2003) [4]. And finally, we notice the considerable decline (2.5 %) of the potential GDP of the MENA region along 2009-2010: this inevitably reminds us the subprime financial crisis which disturbed the USA in 2007 and propagated after that to the rest of the world.

The most important remark to dress from figure 2 is that globally, the importance of MENA aggregate fluctuations sharply decreased during (1990-2010) in comparison with the years (1972-1989). In fact, since 1989, the volatility of MENA business cycle seems decreased. This can be explained by the disappearance of global shocks since mi-1980s, as well as by the engagement of MENA countries in structural adjustment plans and in more openness process with developed nations [5]. This result coincides with those concluded on the case of industrialized countries (Stock and Watson (2003); Agustin and Ken (2003)).

2.2-Cyclical Co-variation of the MENA

For the co-variation property, the question is to see if the aggregate cycle became more specific to the MENA region, or rather, it won in terms of international symmetry. The decrease of MENA volatility noticed previously, can find its origin in two explanations: firstly, the idiosyncratic fluctuations in every country weakened. Secondly, even if these fluctuations did not change, the degree of symmetry between countries decreased. Otherwise, the periods of expansion in certain countries can coincide with periods of recessions in others, and the final effect leads to a stabilization of the aggregate cycle. The question in that case is 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 propositions of Agustin and Ken (2003), and we are going 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 right term represents the sum of the volatilities (individual variance) of every country, while the second gives the pondered sum of co-variances between MENA countries. The idea is that this last term can serve as an indicator of coherence between countries. If there is no symmetry (the correlation coefficient is equal to zero), the aggregate variability would be completely explained by the sum of the individual volatilities. The decomposition of this equation gives figures 3-5, and their inspection gives the following results:

4 It is the fall which goes back up to the 11 September attacks and the war of Iraq.

5 To take on account the vast impact of trade openness, the studied period (1970-2010) is going to be divided into two under periods (1970-1988 and 1989-2010).

- The domestic fluctuations knew an important increase which began in 1972 and which gradually decreased since the mi-80s. These specific volatilities stabilized considerably since this date.

- The indicator of co-variations shows that the inter-MENA symmetry is sharply positive during (1972-1982) [(6)]. For the (1982-1989) period, the sign of this co-variation was close to zero. But, during (1990-2000), the MENA knew a new period of cyclical symmetry, where their co-variation became again of a positive sign. During (2001-2004), it becomes of a negative sign, and since this date, it becomes again of a positive values [(7)].

- These last two results lead us to conclude that the decrease in the aggregate variability of PSEM is the consequence of a net decrease of the specific volatilities in every country and a decrease in the degree of co-variation between the PSEM.

Beyond the reasoning on an aggregate MENA cycle, we opted for its dissociation in two under groups, the North Africa and the Middle East. In figure 6, it is easy to notice the existence of a high degree of positive co-variation between both zones during (1971-1982). This proves the importance of the role which can be played by global shocks in generating a high degree of international symmetry. During 1980s, both zones knew certain co-variation but of an opposite direction, which seems to become again positive quite particularly during the last decade [(8)].

Beyond the co-variation, these two regions seem to differ in terms of the amplitude of their fluctuations. The North Africa countries are characterized with a stabilized cycle since 1987. By opposition, the Middle East fluctuations, if recently show low amplitude in comparison to (1971-1982), they remain rather unstable. But, we think that since the studied period is relatively short, it is difficult to presume that it exists two different cycles within the MENA region.

2.3-The MENA and the aggregate cycles of developed countries

The historical analysis of figure 7, which redraws the superposed evolution of the G7 and the MENA cycles, allows getting the following results:

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[6]According to graphs, it seems that the degree of co-variation and thus the symmetry between the MENA was of a negative sign before 1972s.

[7] As regards to the notion of co-variation, it is necessary to mention that it is a question of comparing the evolution of several chronological series. The purpose is to detect if there is dependence between the series of the cyclical components which evolve over time.

[8] In table 1, we calculated the correlations of the cyclical components of the different MENA countries, for two under periods 1970-1988 and 1989-2010. The results show that globally, all the considered countries knew an increase in the degree of correlation of their cyclical fluctuations during the second period in comparison with the first one.

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- The MENA is very volatile in comparison to industrial nations.

- At first sight, there is a negative co-variation between the world and the MENA cycles, leading to conclude that at priori, there is a rather idiosyncratic behavior between the G7 and the MENA zone, and we can talk about certain asymmetry of common shocks transmission between the two groups of nations.

We continue with figures 8-9 where we tried to build a certain idea on the dissociated behavior of the MENA zone towards the European and the Anglo-Saxon zones. We remark that:

- Over all the period, both, Anglo-Saxon and European cycles, evolved in a symmetric way, mainly after the two oil crises. The exception is situated during the 80s when they knew a negative co-variation. The Anglo-Saxon cycle seems to be often in advance with regard to the European cycle.
- It seems that the importance of the cyclical fluctuations in the G7 had sharply decreased.
- It is difficult to conclude into the existence of two distinguished cycles within the G7. Both zones, Anglo-Saxon and European, seem to be led 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 synchronization.
- Both, North Africa and Middle East zones seem winning in terms of symmetry with regard to the world business cycles, quite particularly since mi-90s.

Table 2 gives the correlation coefficients of the different aggregate cycles for the two periods (1970-1988 and 1989-2010). The results show that for the second period, the MENA cycle became relatively more correlated with the G7, the Europe, and the Anglo-Saxon countries. This is more confirmed when consulting the figure 10 which shows that during (1987-2010), the correlation coefficient of 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 via the ADL approach

The dynamic analysis of the cyclical components allows estimating the existence of a long term relation between the different studied cycles. More exactly, we try to test the existence of a long term equilibrium which could characterize the joint evolutions of the MENA, the G7, the European, and the Anglo-Saxon cycles. If this long term relation is confirmed, this will prove the increase of the symmetry between the zone MENA and the other aggregate cycles, and that it will be necessary to speak rather about a *coupling* and not about a *decoupling* of the MENA towards the industrialized nations.

3.1-The co-integration approach and the ADL modeling

Among the various problems faced by the empirical works, especially those which are treating with business cycles, there is the question of stationarity. The estimated coefficients can follow a no standard process, which can generate biased regressions. To avoid these difficulties, several approaches choose correlation tests rather than to estimate dynamic interrelations between aggregates. Others studies adopt the first differentiation of integrated series. Finally, several studies turn to the traditional techniques of co-integration, developed by Engel and Granger (1987) and Johansen and Juselius (1990). The co-integration means that a set of no stationary series can have similar trend movements which, through a certain linear combination, give rise to stationary series or relations of long term equilibrium. However, it is important to mention that within the recent development of time series analysis, there not only these standard or traditional approaches, but recently, there was emergence of new techniques of co-integration, à la "*Pesaran, Shin and Smith*".

Pesaran, Shin, and Smith (1996 and 2001) developed a new approach able to test the existence of long-term linear relation between 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 or the F-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 according which there is no co-integration between 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 built: A first group corresponds to the case where all the regressors are strictly I(1), and a second group correspond to the case when all the variables are I(0). These two classes of critical values give a "band" covering all the possible classifications of regressors in variables I(1), I(0), or mutually co-integrated.

Between new and traditional techniques, there would be several differences:

- As underlined by Chan and Lau (2007), several limits are associated to the adoption of the traditional approach. First of all, this one is static and does not account for dynamic interdependences. Secondly, the co-integration conclusion depends widely on the choice of the endogenous variable, itself constitutes an arbitrary process. Thirdly, if it exist several co-integrated vectors, the procedure of Engel-Granger can give rise to an estimation which is a linear combination of these vectors, and this can generate an identification problem. Finally, the estimated coefficients have no standard distributions and cannot be used to test hypotheses concerning the real values of the coefficients.

Chan and Lau (2007) mention that the traditional procedure à la Johansen and Juselius (1990) seems restrictive because it requires a certain distinction between the integrated variables I(1) and the stationary ones I(0). Johansen and Juselius (1990) proposed a multivariate approach where the preliminary choice of the endogenous variable is not necessary. This procedure determines the number of co-integrated vectors and gives estimations of likelihood maximum of these vectors. At least, introducing in an unjustified way a variable I(0) will result in an overestimation of the number of co-integrated vectors. Consequently, it is going to have always a rejection of the hypothesis of no existence of a co-integration relation between variables.

↳ For the new techniques à la Pesaran, Shin and Smith, Agustin and Ken (2003) mention that these turn to be more attractive for two main reasons:

First of all, the existence of a long term relation can be estimated without preliminary resort to unit-root tests. We note that in our work, the application of the HP filter makes us sure that the cyclical components series are stationary. To be reassured, we made Dickey-Fuller unit-root test, and our expectations were confirmed. So, the use of the standard techniques turns out to be inappropriate.

Secondly, the fact that the explanatory variables are exogenous or not, this is not important; the court and long-term parameters can be estimated by applying the OLS to an autoregressive model after having specified an appropriate lag number.

3.2- The estimated ADL specification

Every analyst aiming at the evaluation of business cycle symmetry, has the possibility of adopting what we qualify as an "*Autoregressive Distributed Lag*". In our work, it is the Pesaran, Shin, and Smith (2001) version which will be followed. This version can be estimated independently of the fact that the series are I(0) or I(1). This approach allows not only avoiding the usual passage by unit-root test but also not to worry about the exogeneity order of the variables. The parameters of court and long-term can be obtained by applying the OLS, after having specified the lag appropriate number. The ADL specification and the long-term estimations can be obtained from the following model [(9)]. By using lagged polynomials operators, we have:

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

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

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

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

Or more simply, by writing it under the general form:

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

The following expressions give the long term estimators that account for the response of (Y_t^c) to a unitary change in (X_{it}^c). It is about terms (α) and (γ_{ji}), where the long terms correspondent values may be estimated as following:

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

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

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

The idea is to start with a dynamic model (the equation (3)) allowing studying the changes of a variable of interest according to its own past and that of the other variables, as well as according to the lagged levels of these variables. The estimation allows testing not only the existence of a long term relation, but also, the existence of an "*Unrestricted Errors Correction Model*". More specifically, to test the long-term relations, the following version with errors correction of the ADL model is adopted:

$$\Delta Y_t^c = \alpha + \rho Y_{t-1}^c + \sum_{i=1}^{k} \theta_i X_{it-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i}^c + \sum_{j=1}^{p} \sum_{i=1}^{k} \gamma_{ij} \Delta X_{it-j} + \mu_t \tag{3}$$

[9] Concerning ADL modeling, the interested reader can consult, besides the works of Pesaran and Shin (1996), Pesaran, Shin, and Smith (1996 and 2001), the following references: Luke Keele and Suzanna De Boef (2004); Uwe Hassler and JÄurgen Wolters (2006).

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

The procedure consists in testing the null hypothesis (H_0) according to which $(\rho = \theta_i = 0)$ against that of no nullity of these parameters. If (H_0) is accepted, this proves that there is no relation of co-integration. It is about the conventional Wold statistics or simply the F-statistics. However, since the asymptotic distributions of the statistics are not standard independently of the fact that the variables are I(0), I(1), or mutually co-integrated, Pesaran and al (1996) 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 co-integration is confirmed if the calculated F-statistics is situated out of the critical values of both borders, independently of the fact that variables are I(1) or I(0). But, if the Wold statistics is within the indefinite zone (between the critical values of both borders), it would be necessary to know the integration order of the series before leading the 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 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, it is question to pass to the short-term specification. This last one can be express 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 [10]. The difference between Y_{t-1} and $\gamma * X_{t-1}$ measures the importance of the long term relation failure between (Y_t) and (X_t). If the (ECT) has a negative sign, the model will tend to converge on a long-term equilibrium. And, in agreement with our analysis, this coefficient can be also associated to the concept of a symmetry since, given a shock affecting a leading country, it would indicate nothing else than the speed with which the system would converge to its long term path. The more this coefficient is higher, the more the speed of convergence and\or synchronization, in particular after an asymmetric shock, is higher (Agustin and Ken (2003)).

3.3-The dynamic analysis results

So built, the ADL model allows studying the dynamic interrelations between the different cycles. The common character of the international fluctuations will be estimated through the examination of the long term relations between the MENA aggregate fluctuations with regard to those of G7, European and Anglo-Saxon countries. To do this, our point of departure was a dynamic model allowing studying the changes of a variable of interest (here, the MENA aggregate cycle) according to its own past and that of the other variables, as well as according to lagged levels of these variables. More simply, it is the equation (3) which is going to link the changes of the MENA cycle, according to its own past variations and 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 3. They show that over (1970-2010) period, the hypothesis H_0 is rejected. In fact, we notice that F-statistics are out of the superior border of the critical values, and do not belong to the indefinite zone. This proves that the MENA is led by a long-term co-movement with regard to the three other cycles [11].

[10] The mechanism of errors correction allows correcting any short-term disequilibrium. In fact, at the long term, the coefficient of errors correction is equal to zero. However, if the variables deviate from the long-term relation, this coefficient is going to be different of zero and every variable fits gradually to restore the long term equilibrium relation.

[11] This result confirms the graphic evolutions of the various cycles, interpreted previously in the static analysis.

Table 3: 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 adopted to determine the appropriate lags number. The cycles of G7, Anglo-Saxon and European regions are introduced as exogenous variables. Both borders of the appropriate critical values of F-statistics 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 relation for a significance level equal to 5%. In most estimations, the regressors have reasonable R^2 (which borders 0.5) with Durbin-Watson very close to 2, what is sign of a low colinearity between variables.

We wanted to go further, and the previous estimations were redone by replacing the MENA aggregate cycle by that of North Africa firstly and the Middle East secondly. The results show that during (1970-2010), the calculated F-statistics are out of the indefinite zone of the critical borders only for the North Africa cycle, and not for the Middle East. Consequently, over the studied period, the long-term co-integration relation, towards the world conjuncture, is verified only for the North Africa region [(12)]. We should note that this co-integration is not confirmed in any case for the (1970-1988) under period. On the other hand, for (1989-2010), that we considered as a period of insertion in the world economy, the long-term equilibrium relation is confirmed, whether we consider the entire MENA sample, or also, when working separately on the North Africa and the Middle East countries.

In table 4, the values of the long-term parameters are of a positive sign on response to the different cycles, G7, Anglo-Saxon and European. Whether for the MENA aggregate cycle or also, for those of the North Africa and the Middle East taken separately, we notice that the G7 cycle seems to be the most significant, and has the highest degree of influence. This leads us to presume that generally, the common shocks and the idiosyncratic cycles of the MENA zone are tightly linked to the G7 experience, in particular, at the long term.

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[12] We'd just introduced the MENA aggregate business cycle (which had been sometimes dissociated into two cycles: the North Africa and the Middle East) as dependent variable. However, we can make the same reasoning by considering the series of the cyclical components of each of the MENA studied countries taken as endogenous variable, and the cycles of G7, Anglo-Saxon and European as exogenous variables. In the same order of ideas, the estimations can be led to test the relations of co-integration between the MENA countries.

And in a more detailed way, we notice also that in comparison to the Anglo-Saxon cycle, the European cycle appears 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 thus realized by leaning on the information supplied by the European cycle. For the Middle East region, it seems that this region is more influenced by the Anglo-Saxon conjuncture than that of the European one.

Table 4: The ADL long term coefficients for the MENA, G7, Anglo-Saxon and European zones

	C	G7	Anglo-saxonne zone	Europe zone
MENA	1.20E-05 [0.085813]	0.44729 [2.54817]	0.00408 [0.10386]	0.00048 [0.04720]
North Africa	1.89E-05 [0.136227]	0.41214 [2.63806]	0.00347 [0.08813]	0.01255 [0.87326]
Middle East	1.09E-05 [0.078321]	0.45462 [2.59186]	0.00426 [0.10833]	0.00147 [0.14760]

The values between brackets are T-statistiques. The choice of the number of optimal lagged number is made according to both criteria of Akaike (AIC) and Schwartz (AIS). In most of the estimations, the regressions have 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 5. We notice that:

- The lagged errors correction term (ECTt-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 allowing restoration of long-term equilibrium.
- The lagged changes of the world and the Anglo-Saxon cycles are active with positive and significant coefficients while the coefficients relative to the European cycle seem lower.
- By looking to the amplitude of the errors correction term (ECT) coefficient, the North Africa region has an adjustment speed which reaches 2 years, approximately. It is about a convergence speed which is more important compared to the Middle East region (around 3 years). This can be interpreted as a possibly higher degree of synchronization of the North Africa countries, in particular, after being perturbed by an asymmetric shock (13).

[13] This fact confirms what we noticed previously in the static analysis when we found that in comparison to the Middle East region, the North Africa aggregate fluctuations seem more strictly linked to the world business cycle, in terms of amplitude and in terms of symmetry.

Table 5: 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)
$\Delta North.Afr$	-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-statistiques. (***), (**) and (*) denote respectively, a 1%, 5% and 10 % significance level.

4- Conclusion

The HP filter was used to obtain the cyclical components series of real GDP of the MENA and G7 countries. These series were used to lead a static analysis, centered on properties of variability, co-variation and correlation, and a dynamic analysis, centered on the study of the long-term relations through an "*Autoregressive Distributed Model*", and on the study of short-term dynamics through an "*Errors Correction Model*".

➥ The static analysis gives the following results :

The importance of MENA fluctuations sharply decreased since the 1990s. This is the resultant of a decrease in idiosyncratic volatilities firstly, and to a lesser extent, the resultant of a decrease in the co-variation degree between the MENA.

The MENA became more symmetric with the world business cycle since 1989. This can be due to integration strategies pursued by these countries at the end of the 80s, and to a probably more productive structures similarity. The research of the best mechanisms of regional cooperation between the MENA would thus be of a major importance to limit the effects of external instabilities.

The MENA fluctuations are very volatile in comparison to those of the industrialized nations. There is rather a negative co-variation between G7 and MENA. There would be rather an idiosyncratic behavior, and an asymmetry in terms of global shocks transmission between the G7 and the MENA.

➥ The dynamic analysis gives the following conclusions :

There is a long-term equilibrium which reflects convergence between the MENA, the G7, the European, and the Anglo-Saxon cycles. This relation is confirmed for the MENA sample for the (1970-2010) period, and is also confirmed for North Africa cycle and for Middle East cycle taken separately, particularly after the period of insertion of MENA in the world economy (1989-2010). This proves the increase of the co-movement or the synchronization between the MENA region and the word cycle, and thus we can evoke rather a coupling of MENA with regards to the industrialized nations.

The long-term coefficients are positive in response to G7, Anglo-Saxon, and European cycles. But, whether for the MENA aggregate cycle or for those of the North Africa and the Middle East countries considered separately, the G7 cycle seems the most significant. Common shocks and idiosyncratic cycles of MENA are tightly associated to the G7 experience, specially, at long term.

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

Appendix

Figure1: Cyclical components (CC) of MENA countries (1970-2010)

Notation of North Africa and Middle East countries: : (**TN**) Tunisia ; (**ALG**) Algeria ; (**MAR**) Morocco ; (**LIB**) Libya ; (**LEB**) Lebanon ; (**EGY**) Egypt ; (**SYR**) Syria ; (**SAO**) Arab Saudi; (**TUR**) Turkey ; (**KUW**) Kuwait ; (**JOR**) Jordan ; (**IRA**) Iran ; (**QAT**) Qatar ; (**BAH**) Bahrain ; (**UAE**) United Arab Emirate.

Figure 2: MENA aggregate fluctuations

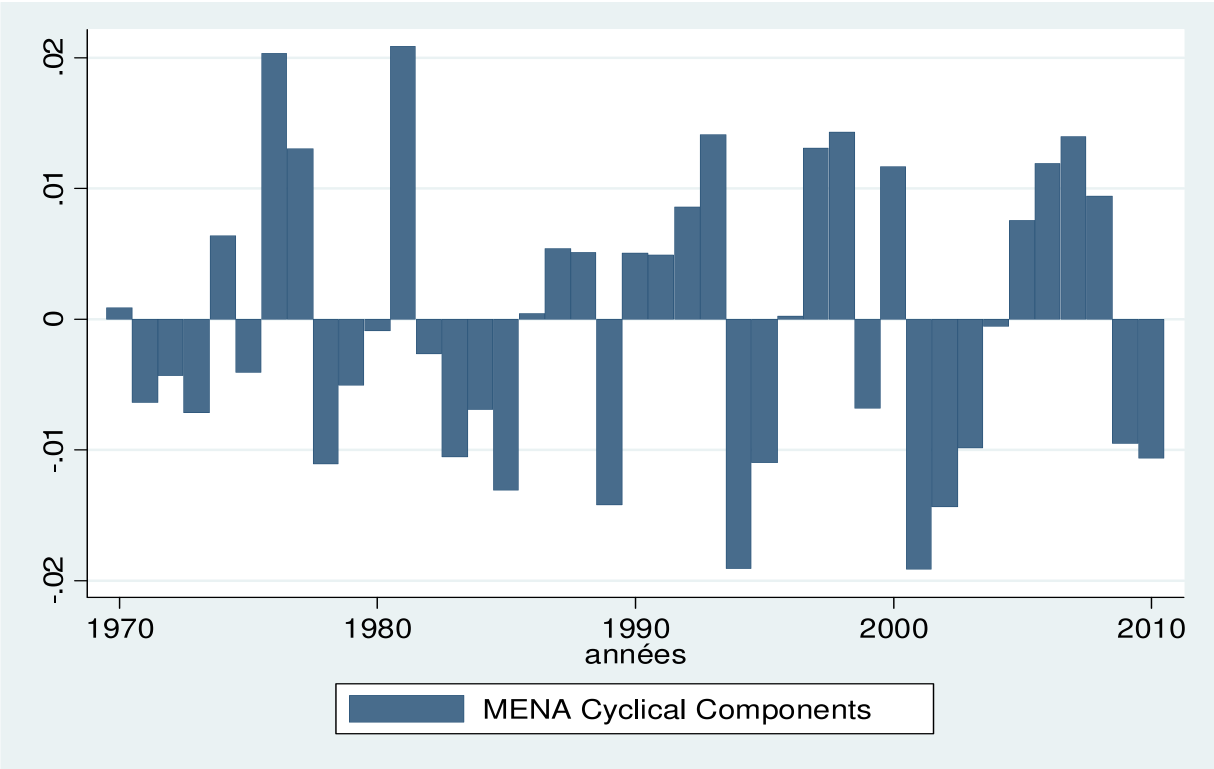


Table 1: Correlation of MENA cyclical components

	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 3: MENA individual volatilities (fluctuations)

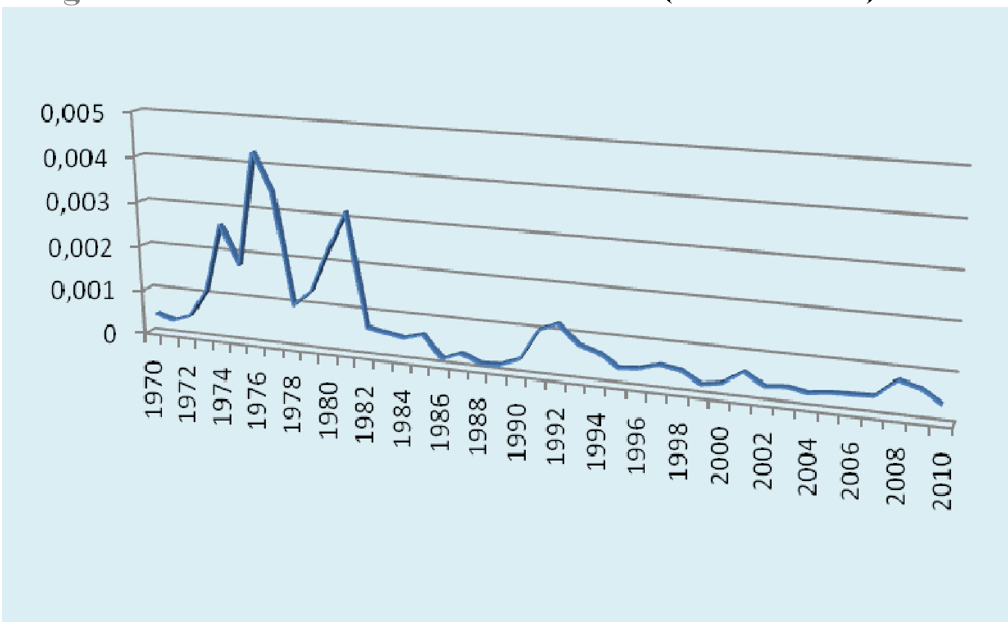


Figure 4 : MENA Co-variations (synchronisations)

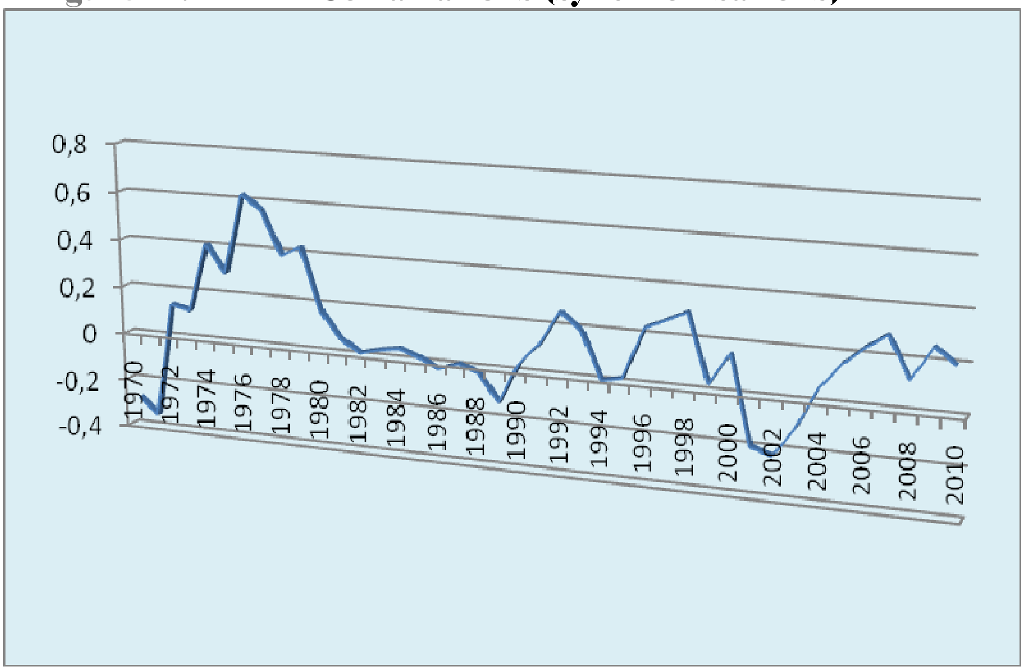


Figure 5: Superposed evolution of MENA co-variation and variability

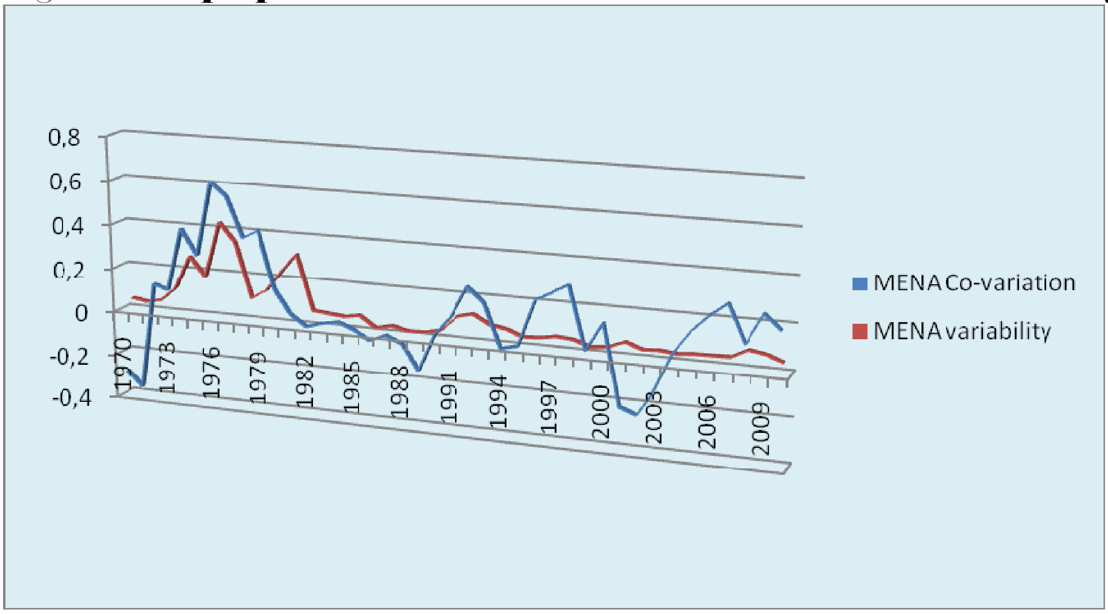


Figure 6: North Africa and Middle East fluctuations

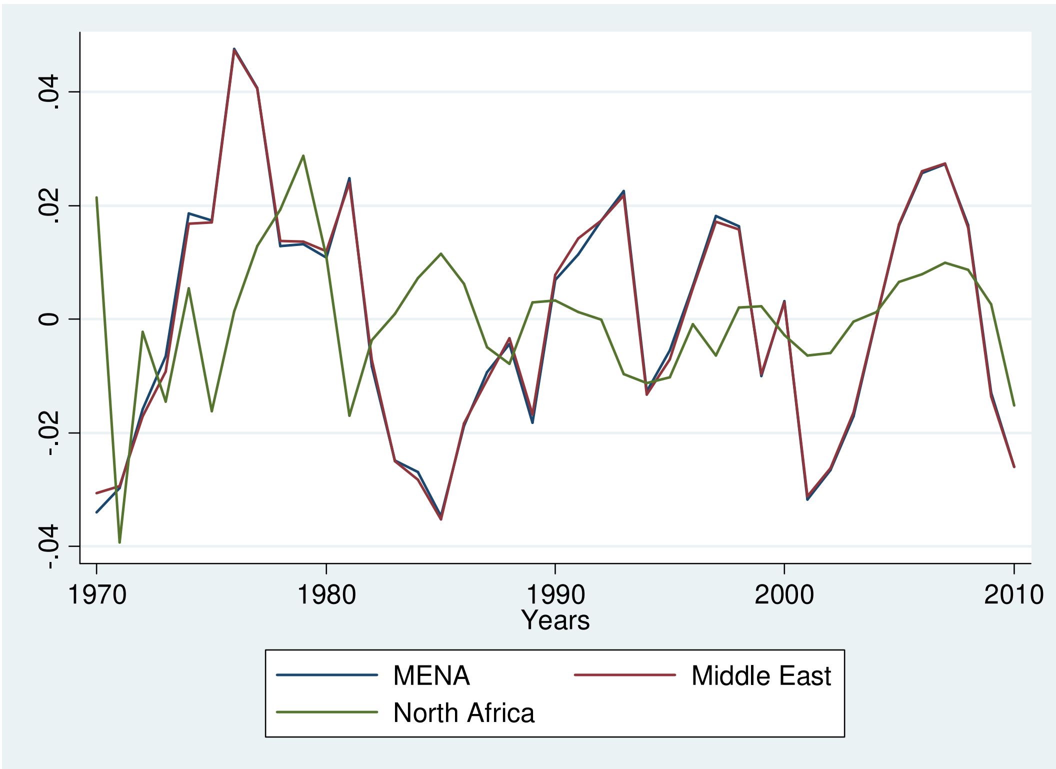
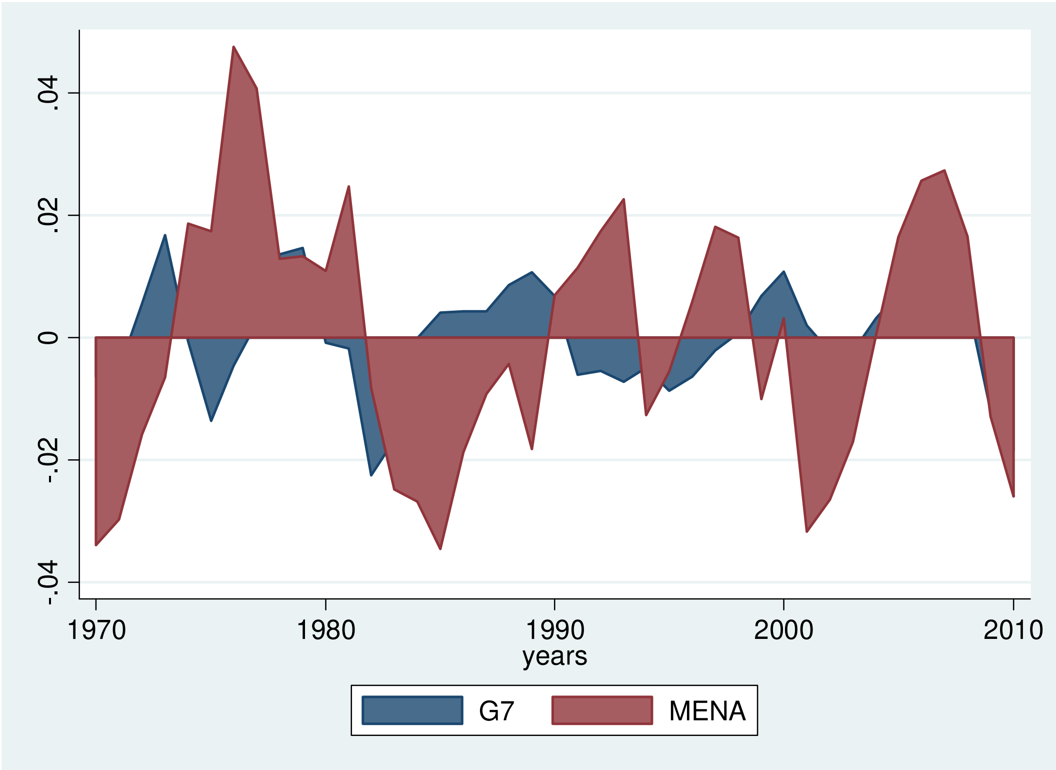
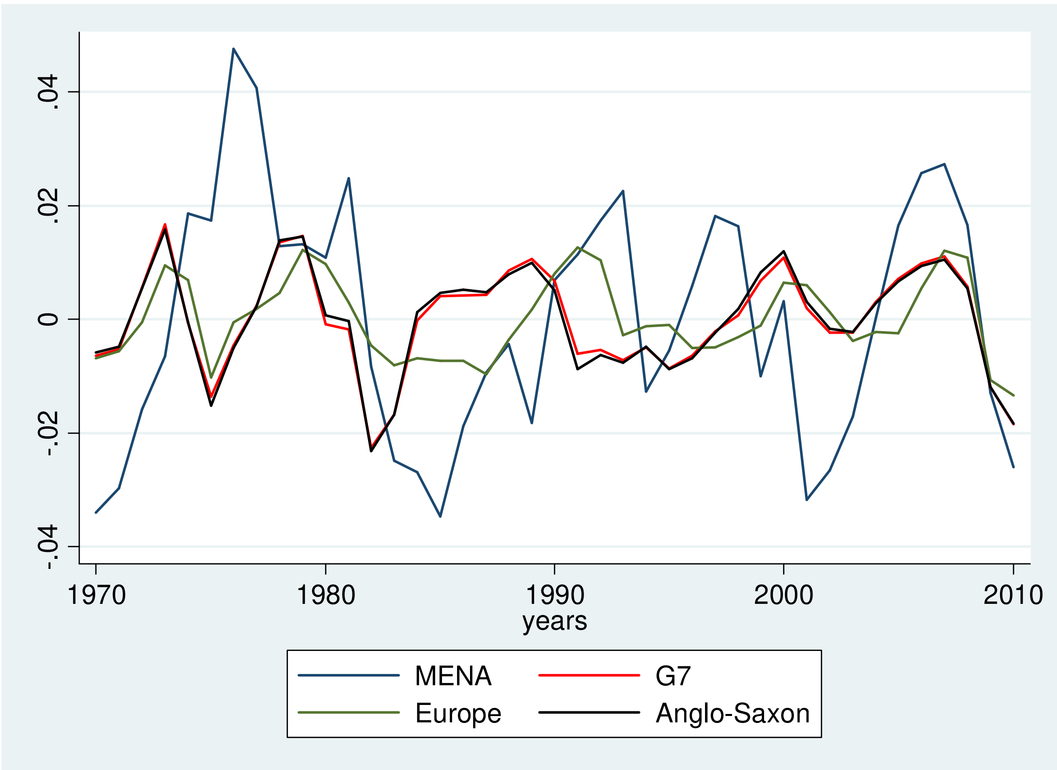


Figure 7: Aggregate G7 and MENA Fluctuations



Figures 8-9: G7, Anglo-Saxon, European, and MENA cycles



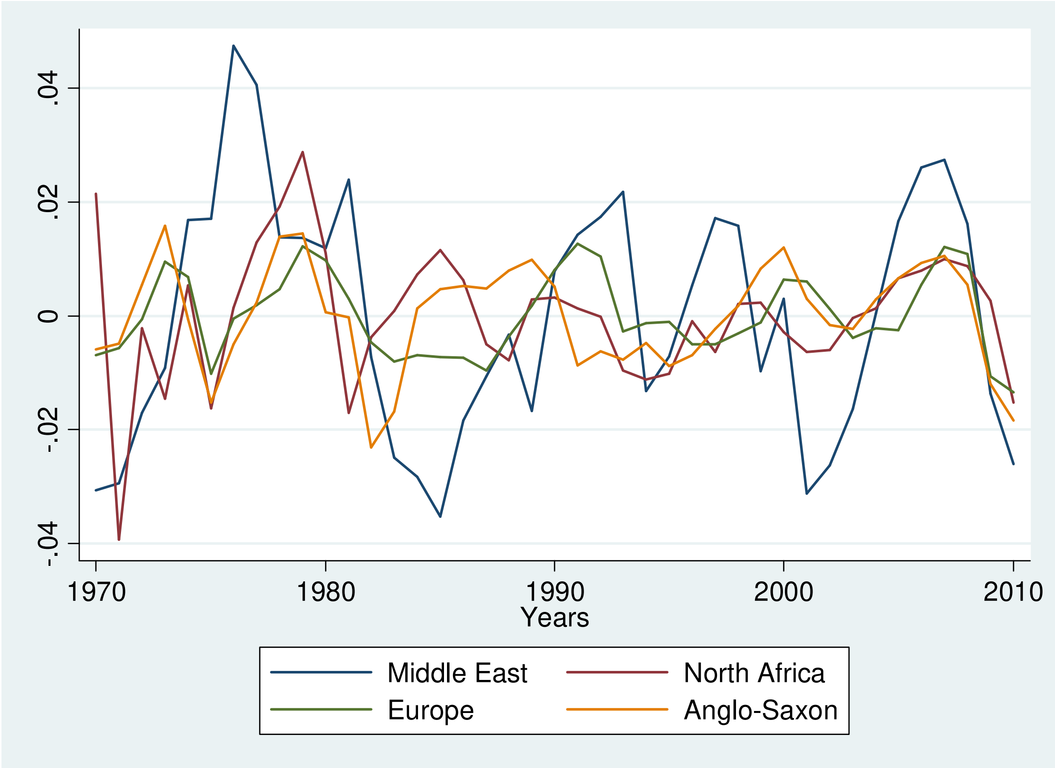
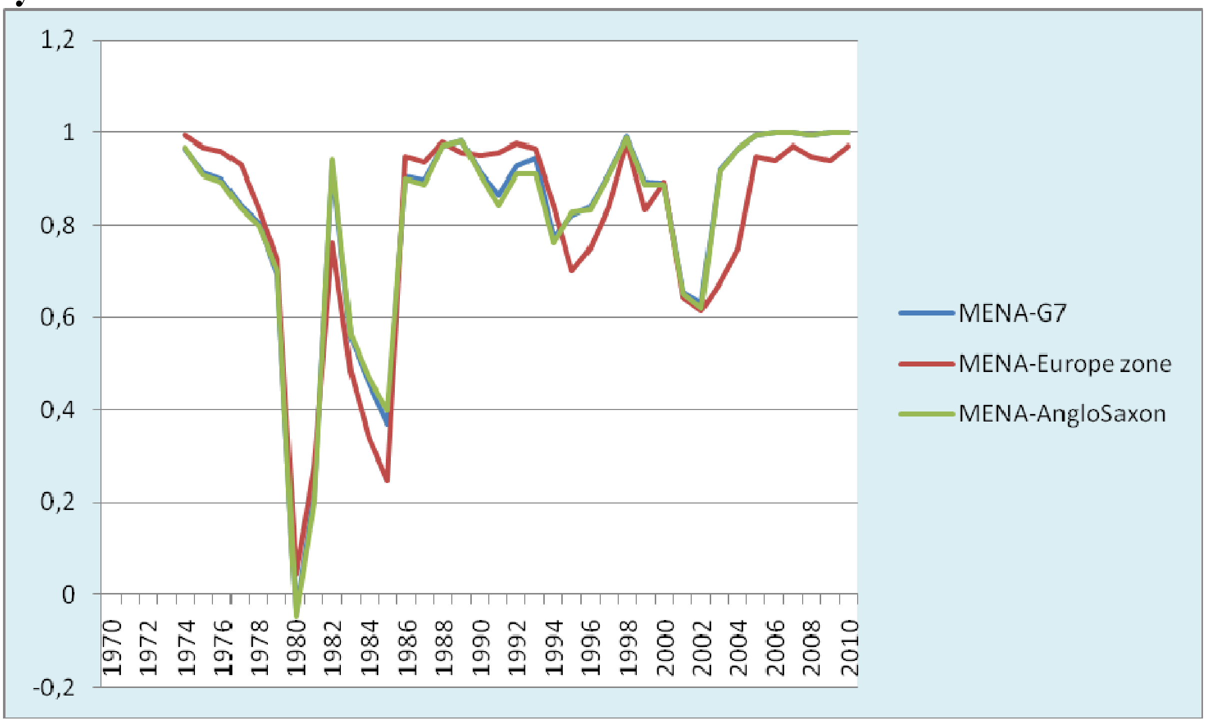


Figure 10: Correlations of MENA with G7, Anglo-Saxon, and European cycles.



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 2: Correlation of aggregate business cycles

	G7	MENA	Anglo-Sax	Europe	Nord.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.