Tunisian Business Cycle Synchronization with the Euro-Mediterranean Partner Countries

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Abstract

Throughout the scope of this paper, we are proposing synchronism estimation between Tunisian and some Northern Mediterranean countries industrial cycles. To note, several methods have been used to measure the business cycles synchronization, among which the concordance index constructed via a Markov switching model.

Using monthly industrial production data ranging from 1994:01 to 2007:12, empirical results indicate that, when taken into account the delay effect, there exists some kind of convergence between Tunisia and the Euro-Mediterranean countries. Consequently, the Tunisian industrial cycles seem to be closely linked to those of Euro-Mediterranean countries. Yet, the significant asymmetries prevailing among these countries, subject of our current study, we think that the process of the Barcelona Agreement has a great role to play in reinforcing bilateral trade in the region. Hence, the creation of a Mediterranean union is encouraged for the achievement of a closer convergence between Mediterranean countries.

Keywords: Business cycle synchronization, Markov switching models, Concordance index

1. Introduction

It is worth noting that the degree of business cycle synchronization can provide useful information on the necessity of independent fiscal and monetary policies, on the impact of regional unions as well as on the benefits of agreements. A noticeable fact depicted among those countries which have concluded association agreements is that business cycles turn out to be increasingly similar and external shocks tend to become more and more common. Inversely, however, whenever shocks are country-specific, the ability to conduct independent monetary and fiscal policies is usually regarded as being an important fact in helping an economy adjust properly to a new equilibrium.

Noteworthy as well, recent political debates have often talked about the Mediterranean Union highlighting with great interest and care the next steps to be put forward concerning the future of this Union. Yet, due to the differences existing between the two sides of Mediterranean region, policymakers do not usually share the same attitudes and points of views regarding the prospects of this Union. In fact, while some parties are proponents of the Union, others, mainly the developed countries' policymakers, have criticized it. As a matter of fact, the chief objective of this Union has been to reinforce the bilateral relationships and trade among the member countries so as to make their economies converge extensively. To note, the idea behind converging the Mediterranean economies is, mainly, that with more consolidated bilateral trade countries tend to have more common purposes and similar trends and interests. This allows for the harmonization of policies across these countries, thus, joint decisions tend to become easier to reach. If, however, integration does not make countries have a common approach as regards the business cycle position they might encounter, decision-making is likely to become more difficult to be achieved. Hence, the present paper's subject matter attempts to highlight the classical business cycle synchronization framework. Actually, we aim at verifying whether the association agreements of Barcelona 1995 concluded among the Mediterranean countries have led to more correlated business cycles in this region. Thus, this work can be directly associated with the more general political debate framework pertaining to the Mediterranean union, supported mainly by France. Consequently, if the region's business cycles are discovered to be alike and so close to each other, then there is ground to conclude that the union in the region is encouraged and strengthened. Inversely, however, we may deduce that the Mediterranean union does not seem to be optimal for all the member countries. In

fact, we are guided in dealing with such a subject by several insights. For instance, there is a great deal of noticeable bilateral trade flows prevailing in this region. Indeed, the European countries are considered as the most important partners of the southern Mediterranean ones (for instance, bilateral trade flows between Tunisia and the European countries exceed 70% of the Tunisian global world trade). Thus, bilateral trade flows with the European countries are considered to be one of the most promising activities prevailing in this region. Throughout the scope of this paper, we tend to focus, mainly, on studying the business cycle synchronization within the Mediterranean region, highlighting, essentially, the potential relationships existing between the cyclical patterns of the industrial activity. Worth noting, the proposed approach to be pursued throughout this work is based on the procedure developed by Harding and Pagan (2004), who have constructed the concordance index to measure the degree of business cycle synchronization between countries. According to these authors, an index between two countries close to 1 implies similar business cycles.

The present paper encompasses 5 sections. After the introduction, comes section 2 which is devoted to describing the level of agreement between the Southern Mediterranean countries and the EU ones. In section 3, we present a brief description of the methodology adopted by Harding and Pagan to characterize business cycles along with a brief description of the Markov switching models while proposing our modified version of the concordance index. As for section four, it is devoted to the empirical application in which a concordance index between Tunisia and four northern Mediterranean countries is calculated. Finally, section 5 depicts the conclusion.

2. The association agreement between Tunisia and the EU

For the purpose of enlarging the range of its business relationships and especially its economic horizons, comparatively to other regional integrations (ALENA, APEC), the EU has chosen to integrate its peripheral countries (Rhein, 1996). In fact, since the 1990s, many agreements have been concluded between the Southern Mediterranean countries and the European Union ones. These agreements aim at reinforcing bilateral trade, reducing the tariff barriers among the region's countries and thus reducing the discrepancies existing between the two banks of the Mediterranean. In this direction, Tunisia was one of the pioneering Southern Mediterranean countries to collaborate with the European countries without hesitation and, so, to conclude several agreements leading to the reinforcement of its relationships with the EU. As a matter of fact, since 1995, Tunisia has chosen to pursue a policy of economic transition open to towards the market economies favoring increasing trade liberalization. Furthermore, in July 1995, Tunisia has concluded an association agreement with the EU in a bid to establish the bases for a dynamic bilateral trade policy, consolidate its position and maintain good relationships with Europe. Table 1 shows the importance of the agreements notified between Tunisia and the EU and their impacts on the growth of bilateral exchange as compared to other world regions.

(Insert table 1 here)

As we may note, table 1 indicates the existence of solid business relationships between Tunisia and the EU in terms of exportation and importation over the last two decades. In addition, compared to the 1990's, the cover rate has witnessed an increase indicating some advantageous business relationships for the benefit of Tunisia particularly within the context of integrated European area. In fact, several factors have contributed to this business development among which are, mainly, the business traditions, geographic proximity as well as business structures. For the aim of promoting free trade exchanges among them, Tunisia and the EU have devised many pragmatic terms among which is an association agreement. Hence, we may notice that even after new members' adhesion to the EU (with the enlargement project from 15 to 27 member states), cooperation with Tunisia has remained important and preserved the same position as regards its European relationships. Moreover, the wide ranges of export transactions between Tunisia and the Central and Eastern European countries have made weak the impacts on Tunisian exports to the Euro-Mediterranean countries. Above all, France has maintained Tunisia as a classical partner in its business relationship transactions. Consequently, the economic integration of Tunisia with the EU zone, within the scope of various agreements, seems to be of paramount importance as Tunisia has established even closer economic partnerships with Europe (Note 1). Indeed, the Barcelona Agreement is considered as a further enhancing neighborhood policy providing a more confidential structure to the bilateral transaction relationships in various fields. To note, three major objectives characterize the Barcelona Agreement, namely:

- Economic and financial partnership in a bid to create more equilibrium between countries through a sustainable socioeconomic development.
- Political and security partnership aiming at maintaining stabilization and establishing peace in the region.
- Social, human and cultural partnerships.

Noteworthy, such a project tends to strengthen cooperation between the Southern Mediterranean and the EU countries and create a Euro-Mediterranean free trade zone by 2010. Accordingly, we estimate that if these

agreements have not greatly contributed to enhance bilateral trade in the region, they will allow to consolidate the old traditional relationships existing between the Southern Mediterranean and the EU countries and to curb the competition arising from the Eastern European (especially after their adhesion to the EU community) and Eastern Asian countries.

Hence, this economic integration has many benefits in that it contributes to bridge the gap of economic discrepancies between Tunisia and the European countries, thus leading these countries to converge even more firmly. Table 2 highlights the level of economic development reached by Tunisia during the two periods 1995-2000 and 2000-2007.

(Insert Table 2 here)

With regard to table 2, we can notice that there is a relatively solid growth in Tunisia accompanied by an increase in the level of economic development indicators twelve years after the association agreement with EU has been concluded. For instance, GDP per capita has increased to attain an annual average growth rate of about 6,65% (Note 2). GDP has reached 23% of the European GDP (EU-15) in recent years. As for the exportation, there is a significant increase in the growth rate which attained 13% in 2008 (Note 3). Compared to the European indicators, we can conclude that there is a faster economic growth in Tunisia during the last two decades. Thus, the Agreement Associations with Europe have greatly led to a significant reduction of the economic discrepancies between Tunisia and the EU. In addition, the process of convergence between Tunisia and the EU can be explained by the close economic partnerships between the two sides (especially between Tunisia and France, Italy, Spain and Germany), although this process of economic convergence is weak and the gap is still large. Nevertheless, if we compare the Tunisian economic growth levels to those of the EU new members, we can deduce that Tunisia is on the right track of cooperation with Europe even after the latter's enlargement process (passing from 15 to 25 and then 27 member states since 2007). In this respect, Chevallier, Lemoine and Nayman (1999) have demonstrated that competition found to be more important among the countries located in the same region (Tunisia-Morocco, Poland-Czec Repunlic-Hungary). They have shown that given the similarity of exports bound to the EU, the competition tends to be more intra-regional than inter-regional. Consequently, they have concluded that the integration of the Central European Countries, in particular, do not seem to be greatly affected by Euro-Mediterranean trade. In addition, they have explained the slow progress of the Southern Mediterranean Countries by their inability to satisfy the European demand. However, competition between the two groups appears more obviously in the exports of textile products to the EU.

3. Measuring business cycle synchronization

First thing to start with is defining comovement which is generally described as the unconditional correlation coefficient between series which describe the same cycle measure pertaining to a certain set of countries. It implies the correlations stability of stationary business cycles time series following an exogenous date. The examination of this comovement enables us to study business cycle synchronization among different countries. To note, various studies have been presented in the literature dealing with the issue of business cycle synchronization in various world regions, especially concerning the developing countries. Different conclusions have been drawn on this subject. Part of these depicted differences can be related to discrepancies in variables used, diverging business cycle measures and methods to assess synchronization. For instance, Artis et al. (1997) found that the degree of concordance between business cycle dates pertaining to industrial production for the G7 and some European countries is high (near one), which implies that the cycles are synchronous and that the evidence of the existence of regional cycles is found to be the strongest amongst North American and European economies. In their turn, Bodman and Crosby (2000) have also discovered an obvious business cycles synchronization across the G7 countries.

In addition, numerous authors have focused their attention on analyzing business cycles synchronization between the European Union and European peripheral countries. As for the case of Euro-Mediterranean integration, several works have been examining the cycles' convergence of the Mediterranean and European Union countries. To mention but a few, Gallegati and al. (2004) have identified a cyclical dispersion among the Euro-Mediterranean area cycles, especially, among the Northern and Southern Mediterranean countries. Praussello (2004) has identified a lower degree of synchronization pertaining to this zone even after the conclusion of the association agreements between the European Union and the Southern Mediterranean countries.

Within the framework of this section, we are going to center the focus of our subject matter on studying the relationships between the cyclical patterns of the Mediterranean industrial activity. In particular, we resort to apply the industrial production index relevant to some Mediterranean countries to explore their business cycle synchronization. Thus, parametric and non parametric measures of assessing the business cycle synchronization

were developed in the literature (Note 4). In this paper, however, we only consider a parametric approach to measure synchronization among the Mediterranean countries: we are applying above all the concordance index developed by Harding and Pagan (2002).

3.1. Concordance index

The concordance index consists of the fraction of time during which both countries in the comparison undergo the same cycle phase (either contraction or expansion). This index is clear between 0 and 1. A high degree of concordance (value close to 1) indicates that the business cycles of both countries are synchronized, while a value near 0 indicates non-synchronous cycles (Note 5). According to Harding and Pagan (2002), the following formula is applied to calculate the concordance index between two countries i and j:

$$C_{ij} = \frac{1}{T}\sum_{t=1}^{T} S_{it}\, S_{jt} + (1 - S_{it})(1 - S_{jt}) \quad (1)$$

Where,

$S_t = 0$ when the economy is in a recession phase and 1 when it is in an expansion phase.

S_t is a binary latent variable which can be determined by means of several methods. Throughout the literature review, some parametric or non-parametric methods can be used to construct the variable S_t. For the non parametric method, for instance, we can consider the algorithm of Bry and Boschan (1971) in trying to localize the different phases of the series and, thereby, determine the variable S_t. We can also apply the Markov switching models as a parametric method to construct the variable S_t. Hence, our next section is allocated to the presentation and application of the Markov switching models.

3.2. Markov switching models

As previously mentioned, a great panoply of techniques pertaining to the non linear time series have been used for the modelling of the different economic cycle characteristics, as the linear models cannot capture the cyclical asymmetries. A great stress has recently been attached to the non linear specifications according to which we have been able to introduce a significant distinction between both the expansion and the recession phases. These models are so flexible that they enable us to take into consideration the different specifications and relationships corresponding to each phase as well as the various extensions proposed in the literature. Among these non-linear models, we can mention the autoregressive threshold models (Tiao and Tsay 1993), the SETAR models (Terasvirta and Anderson, 1992) and the regime switching models (Hamilton 1989). However, the subject matter of our study is going to be wholly centred on the application of the Markov switching models (Note 6). Noteworthy, the Markov switching models have been applied in several domains (economics, finance, biology, medicine, forecasting,, etc). Actually, they have been applied in economics and finance for the purpose of analyzing the U.S business cycle characteristics (Hamilton 1989), as well as of the Euro-zone (Krolzig 1998), explaining the different features of the foreign exchange rates (Engel and Hamilton 1990), along with the stock market volatility (Hamilton and Susmel 1994), etc.

In fact, Hamilton (1989) was the first to develop the Markov switching model in order to capture business cycles in real GNP. He observed that the mean GNP growth-rate switches between two states: the recession phase and the expansion phase. In other words, the two-state Markov Switching model applied to the output growth Δy_t can be expressed as follows:

$$\Delta y_t = \mu_{S_t} + \sum_{i=1}^{q} \varphi_i \left(\Delta y_{t-i} - \mu_{S_{t-i}}\right) + \varepsilon_t \quad (2)$$

4

$$\mu_{S_t} = \begin{cases} \mu_1 \ if\ S_t = 0 \\ \mu_2 \ if\ S_t = 1 \end{cases}$$

Where μ_{St} represents the mean growth rate corresponding to the state S_t and ε_t stands for the disturbance term that can be considered state dependent. S_t is the unobservable state governed by a first order Markov process with fixed transition probabilities that are expressed in the following way:

$$P[S_t = 1/S_{t-1} = 1] = p_{11}$$
$$P[S_t = 2/S_{t-1} = 2] = p_{22}$$

And that satisfy: $\sum_j p_{ij} = 1$

Clements and Krolzig (2003) have proved that the two-regime switching model cannot capture the steepness business cycle asymmetry. Hence, the three-regime switching model has been developed. This implies that, theoretically, the model can be written as follows:

In what follows is the economic interpretation of these three regimes:

- A low growth regime: this regime is characterized by a negative growth rate, and is therefore associated to the classic recession phases.
- An intermediate growth regime or a regime of moderate expansion: for this phase, we suppose that the economic growth rate is below the trend associated to the growth rate (a growth cycle weak phase) without recession.
- A high-growth or high-expansion regime: for this regime, we suppose that the economic growth rate is above the trend associated to the growth rate (a strong phase of the growth cycles).

3.3. Modified concordance index:

To analyze the business cycle synchronization, Harding and Pagan have used the concordance index described earlier previously. This index was applied to the two-phase business cycle (expansion and recession). For this reason, we propose in this paper a modified concordance index applied to the case of three-phase business cycle. We propose a concordance index applied to each phase of business cycle and that takes also into account the effect delay on the transmission of the internal and external shocks from one country to another. The modified concordance index is expressed as follows:

$$C_{ijk}(h) = \frac{1}{T-h}\sum_{t=1}^{T-h} S_{ik,t}\, S_{jk,t\pm h} + (1 - S_{ik,t})(1 - S_{jk,t\pm h}) \quad (3)$$

Here, k is the business cycle phase (recession, expansion or high growth recovery phase) in countries i and j, and h (Note 7) is the delay that corresponds to the maximum value of correlation between the binary cycle phase indicator state variables $S_{ik,t}$ and $S_{jk,t\pm h}$

4. Data and empirical results

4.1. Data

As far as our analysis is concerned, we deploy the industrial production index as a representative factor of the economic activity. In effect, industrial production is taken as a proxy for real GDP owing to the fact that, until now, we do not have regular for GDP series provided for Tunisia on monthly bases. Moreover, the following Mediterranean countries are considered for the purpose of measuring synchronization in the region: France, Italy, Greece, Spain and Tunisia. We also consider monthly data that are seasonally adjusted, covering, respectively, the period 1994:01-2007:12. We have intentionally chosen these periods in order to verify the effect of the Barcelona 1995 association agreements concluded among the Mediterranean countries on their business cycle synchronization and the convergence between both sides of the region.

4.2. Results

4.2.1. Concordance index

At first, we start by determining the turning points of the industrial production index corresponding to the selected countries (Note 8). To do this, we estimate the three regime switching model (Note 9) for each country and, following the smoothing probabilities, we estimate the unobservable state variable St from which we calculate the concordance index. We accord to the economic activity the regime j (j = 1, 2, 3) when the smoothed probability $P[S_t = j] > 0{,}5$(Note 10). Secondly, we go on with calculating the concordance index. In our work, and for the aim of providing the effect of delay on the analysis of business cycle synchronization, both concordance indexes with and with no-delay effects were considered. The following table presents the empirical results:

(Insert table 3 here)

Thus, the results of both concordance indexes shown in table 3 indicate that the scores of business cycle synchronization differ from one phase to another. In fact, this degree is high between Tunisia and northern Mediterranean countries (France, Greece, Italy and Spain) during the high recovery phase. We also remark that the values of concordance indexes have increased on considering the delay effect. This implies that there exists a transmission of shocks among the Mediterranean countries that varies in time differently from one phase to another. This increase in the concordance index, noticed when taking into account the delay effect, implies that the transmission of external shocks from the Northern Mediterranean to the Southern Mediterranean countries is an

important feature in measuring the business cycle synchronization in the region, owing to the prevailing of very close relationships among them, namely the Euro-Mediterranean Association Agreements and free agreements between Mediterranean partners such as the process of Barcelona 1995. Moreover, we notice that the shock transmissions do not appear to be alike between Tunisia and the different European countries selected in this work.

As a matter of fact, table 3 indicates a weak synchronization between the cycles of Tunisia and those of northern Mediterranean countries during the recession and expansion phases when the delay effect is not taken into account. For instance, we discover the existence of a concordance index of about 0,29 between the Tunisian and Greek industrial cycles corresponding to the expansion phase (not near one, indicating a low synchronization) and an index of about 0,5 between the French and Tunisian industrial cycles during the recession phase indicating the absence of any concordance between the two series. We can also conclude that there exists a downturn during the period 2001- 2003 in every country, considering the global world recession of 2001 resulting from the military action taken in many parts of the world. This implies that the economy in the Mediterranean region is strongly affected by the external crises and shocks (especially the negative ones), which leads us to conclude that the southern Mediterranean countries remain in a perpetual dependence to Europe.

Yet, based on this concordance index, we cannot check and make sure whether there does exist any synchronization among these cycles and, then, verify the existence of convergence among the region's countries. To do this, we have to consider a tool through which we can test whether these cycles are synchronous. In the coming section, we are considering the works of Harding and Pagan (2006) to ultimately require a test statistic for measuring the concordance index.

4.2.2. Statistical index for concordance index

It is worth highlighting that different methods have been applied in literature to test the significance of the concordance index and, thus, test the business cycle synchronization of two series. For instance, Harding and Pagan (2005 b) used the following regression to test this synchronization property:

$$\frac{S_{j,t}}{\sigma_{S_j}} = \nu + \rho_S \left(\frac{S_{i,t}}{\sigma_{S_i}} \right) + \varepsilon_t \tag{4}$$

The null hypothesis of no concordance between series S_{it} and S_{jt} corresponds to the acceptance of ρ_S =0. Due to the problem of autocorrelation and heteroscedasticity, we tend to overreject the null hypothesis of no concordance. Instead, we would rather apply the heteroscedastic autocorrelation procedure as suggested by Newey and West (1987) in the econometric literature.

In order for the delay effect to be considered, as has been the case in the previous section, we propose to introduce into the above regression a lag value h to the variable $S_{i,t}$. We also consider the same lag order h as in the modified concordance index. Hence, the following regression is achieved:

$$\frac{S_{j,t}}{\sigma_{S_j}} = \nu + \rho_S \left(\frac{S_{i,t-h}}{\sigma_{S_i}} \right) + \varepsilon_t \tag{5}$$

(Insert table 4 here)

Thus, by comparing equations (4) and (5), we reach the conclusion that on taking into account the delay effect, the business cycle synchronization between the Tunisian and Euro-Mediterranean countries is significant. This implies that the transmission of external shocks from the European countries to Tunisia is significant and that the relationships and interdependences between them are important. Table 4 shows a statistically significant concordance between the Tunisian and European industrial cycles during the three different phases considered in this work. Therefore, we can ultimately conclude that the relationships existing between Tunisia and the European countries are generally significant. As clearly shown throughout this paper, it has become obvious that business cycles are transmitted from Europe to Tunisia, although this transmission needs quite a long time to be transferred (about one year). When we take into account the delay effect, we notice that, for the recovery phase, the business cycles are significantly synchronized (in this same phase and without taking the delay effect into account, the cycles appear to be desynchronized). Thus, the delay effect appears to be an important feature in explaining business cycles synchronization. Eventually, the convergence of the Tunisian industrial cycle is more clearly explained by the composition of exportation structure concentrated mainly on complementary products, and based on important shares of inter-branch products in its trade with the EU. Particularly, consumption products achieve the highest share

of exports (about 47.39%), contrary to the manufactured products (about 5.29%). We may also note that the Tunisian exports represent 45% of the GDP of which 80% are bound to the EU. In addition, the weak synchronization occurring during the expansion and recession phases is better explained by the protection policy applied on some industrial activities as well as the regulation of the financial market.

Due to the high level of trade transmissions' intensities between Tunisia and the European Union, as well as the significant European foreign direct investment in Tunisia (along with the rest of the southern Mediterranean countries in general), there exits some kind of convergence between both parties' cycles. Add into that, the association agreements of Barcelona 1995 have had a positive impact on the correction phenomenon between Tunisia and the European countries. Owing to its strategy as well as political and economic stability, Tunisia is considered as a trust worthy guide model to be followed by the rest of the southern Mediterranean countries so as to ensure synchronization between the cycles of the two sides of Mediterranean countries; only then can the Barcelona agreements achieve their goals.

5. Conclusion

Throughout the scope of this paper, we have analyzed the highlights of business cycle characteristics and comovements found to be established between Tunisia and some Northern Mediterranean countries over the period 1994:1 – 2007:12. To this end, different measures have been applied: the concordance index developed by Harding and Pagan (2002), a modified concordance index taking into account the delay effect in transmission of shocks from one country to another along with the notion of correlation using a regression that significantly tests the concordance index. Add into these, we have similarly used the Markov switching regimes in a bid to estimate the smoothing probabilities for each regime and construct the binary-cycle phase indicator state variable S_t.

On considering seasonally adjusted industrial production and taking into account the shocks transmission related delays, we have been able to conclude that there does exist some kind of convergence between Tunisia and the northern Mediterranean countries. As a matter of fact, the modified concordance statistics have shown a significant link between the Tunisian and Euro-Mediterranean industrial cycles. This implies that the association agreements of Barcelona 1995 notified among the Mediterranean countries have led the Tunisian business cycles to become more correlated with the northern Mediterranean ones; thus, the creation of a Mediterranean union is even more encouraged and further enhanced.

Ultimately, an interesting topic for future research seems to us worth studying; it consists in determining the relationship between trade intensity and business cycle synchronization in the Mediterranean area by considering variables related to bilateral trade flows among the concerned countries.

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Notes

Note 1. Yet, we can notice that intra regional trade among the Southern and an Eastern Mediterranean countries covers less than 5% of the world trade.

Note 2. GDP per capita in Tunisia was grumping from 6005$ in 2000 to 8082 $ in 2008.

Note 3. Due to the financial crisis in 2009, like all the countries of the world, economic indicators are expected to decrease this year. The Tunisian exportation to EU will be increasing in the next decade particularly in renewable energy activities.

Note 4. As a non parametric method to analyze business cycle synchronization, we use the correlation between the cyclical component of the series (we consider real economic activity variable such as GDP or industrial production index). Den Haan (2000) has used the correlations of the VAR forecast errors at different horizons as a measure of business cycle synchronization. Dynamic correlation in frequency domain was proposed by Forni, Reichlin and Croux (2001) to analyze synchronization between series. Beine, Candelon and Hecq (2000) use simultaneously common trends and common cycles, while Breitung and Candelon (2001) use a frequency domain common cycle test to analyze synchronization at different business cycle frequencies.

Note 5. A concordance index score of 0.5 indicates no concordance between the two series.

Note 6. In fact, our ultimate objective is to analyse the business cycle synchronization. The Markov switching models are known for their empirical success in analysing and dating turning points from which we have constructed the concordance index.

Note 7. Like in the analysis of leading indicator, we have chosen a maximum delay of about two years (h= 0, 1, 2, …, ±24).

Note 8. See annex 1.

Note 9. In testing the business cycle asymmetries, we had found a steepness test asymmetry for all series. Then, according to Clements and Krolzig (2003), we have chosen the three regime switching model to measure the degree of business cycle synchronization.

Note 10. We mention that we have $P[S_t = 1] + P[S_t = 2] + P[S_t = 3] = 1$ and 1 corresponds to the recession phase, 2 to the expansion phase and 3 to the high growth recovery phase.

Table 1. Major Tunisian trade indicators

	1990	1995	2001	2007
Openness rate (Import+Export /GDP)	73%	74%	79%	98%
Exports rate	63%	79%	80%	79%
To EU				
To SMC	5%	6%	4%	5%
Rest of the world	32%	15%	16%	16%
Imports rate	58%	71%	70%	63%
To EU				
To SMC	5%	6%	4%	6%
Rest of the world	37%	23%	26%	31%
Export concentration index	0.21	0.22	0.22	0.18
World				
EU	0.26	0.27	0.26	0.23
Cover rate (exports / imports)	0.69	0.77	0.82	0.87
EU				
Rest of the world	0.56	0.46	0.46	0.59

Source : Cnuced

Sources : Comtrade and Eurostat, Medstat program – Mediterranean Institute calculation

Table 2. Evolution of economic indicators in Tunisia

	1995-2000	2000-2007
Growth Rate (%an.average)	5,6	4,8
Groth GDP PPP per Capita (in %)	5,48	6,65
Openness rate (in %)	74	89
Growth Rate of Exports (in %)	3,6	11,9
Investment Rate (in %)	24,7	24,9
Inflation Rate (in %)	3,7	3,0

Table 3. Concordance index between Tunisia and some Euro-Mediterranean countries

	TUNISIA					
	Regime 1: Recession phase		**Regime 2: Expansion phase**		**Regime 3: High growth recovery phase**	
	h = 0	***h***	***h = 0***	***H***	***h = 0***	***h***
France	0.57	0.6(2)	0.62	0.68(0)	0.63	0.7(16)
Greece	0.47	0.58(13)	0.29	0.56(5)	0.76	0.89(24)
Italy	0.5	0.7(12)	0.65	0.66(3)	0.64	0.76(15)
Spain	0.49	0.73(13)	0.61	0.66(13)	0.7	0.83(18)

The bracketed values represent the number of monthly delay effects.

Table 4. Concordance index significance between Tunisia and some Euro-Mediterranean countries

	TUNISIA					
	Regime 1: Recession phase		**Regime 2: Expansion phase**		**Regime 3: High growth recovery phase**	
	h = 0	***h***	***h = 0***	***H***	***h = 0***	***H***
France	0.248*	0.298**(2)	0.23*	0.23* (0)	-0.185*	0.567**(16)
Greece	0.04	0.268***(13)	-0.47***	-0.501***(5)	-0.129*	0.563***(24)
Italy	0.025	0.44***(12)	0.19	0.248*(2)	-0.183*	0.597***(15)
Spain	0.038	0.512***(13)	0.20	0.312**(13)	-0.154	0.93***(18)

The bracketed values represent the number of monthly delay effects.

*, ** and *** imply that coefficient is significant respectively at 10%, 5% and 1% levels.

Annex 1: Turning points dating

France		
	Begin of the phase	End of the phase
Regime 1	1995 :10 2001 :07 2005 :05	1996 :09 2003 :09 2005 :10
Regime 2	1995 :05 1997 :01 1998 :10 2001 :03 2003 :10 2005 :11	1995 :09 1997 :03 1999 :08 2001 :06 2005 :04 2007 :12
Regime 3	1994 :04 1997 :04 1999 :09	1995 :04 1998 :07 2001 :02
Greece		
	Begin of the phase	End of the phase
Regime 1	1999 :03 2001 :03 2005 :02	1999 :10 2002 :12 2005 :07
Regime 2	1994 :01 1999 :11 2003 :01 2005 :08	1997 :12 2000 :06 2005 :01 2007 :12
Regime 3	1998 :01 2000 :07	1999 :02 2001 :02
Italy		
	Begin of the phase	End of the phase
Regime 1	1996 :02 1998 :08 2001 :06 2004 :07 2007 :10	1997 :01 1999 :07 2003 :11 2005 :10 2007 :12
Regime 2	1995 :09 1997 :02 1999 :08 2001 :03 2003 :12 2005 :11	1996 :01 1997 :03 1999 :11 2001 :05 2004 :06 2007 :09
Regime 3	1994 :04 1997 :04 1999 :12	1995 :08 1998 :03 2001 :02
Spain		
	Begin of the phase	End of the phase
Regime 1	1995 :11 2001 :02 2004 :10 2007 :11	1996 :12 2003 :01 2005 :09 2007 :12
Regime 2	1995 :07 1997 :01 1998 :07 2000 :06 2003 :02 2005 :10	1995 :10 1997 :02 2000 :01 2001 :01 2004 :09 2007 :10
Regime 3	1994 :01 1997 :03 2000 :02	1995 :06 1998 :06 2000 :05
Tunisia		
	Begin of the phase	End of the phase
Regime 1	1994 :01 1997 :04 2001 :08 2004 :04	1995 :12 1998 :01 2003 :11 2006 :10
Regime 2	1998 :02 2003 :12 2007 :02	2001 :08 2004 :03 2007 :12
Regime 3	1996 :01 2006 :11	1996 :12 2007 :01