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ECONOMIC CLUBS AND EUROPEAN COMMITMENTS. EVIDENCE FROM THE INTERNATIONAL BUSINESS CYCLES

BOVI, Mauricio*

Abstract

This paper examines the emergence of economic clubs and its coherence with the European commitments. To this end, it analyses business cycle comovements in six industrialised economies, which are pooled into several clusters. Results lead to conclude that an English-speaking club (Canada, UK, US) is emerging in the last decades, whereas explicit and formal commitments seem to have had a relatively weaker power in determining Euro-zone business cycles comovements. While the broad conclusions are consistent with the existing literature the proposed empirical framework is not based on correlations testing, under very few assumptions, the relative cyclical association via the marginal homogeneity in 2x2 contingency tables.

JEL Classification: C14, C33, E32, F47.

Key words: Business Cycles, Synchronization, Turning Points, Nonparametric test.

1. Introduction

There are several reasons for taking an interest in the international business cycles for both economists and politicians[1]. Just to mention a few issues, it is important to gather information about the relative contributions of domestic and international shocks to recessions, or about how synchronized cycles need to be for countries to form a monetary union. Artis and Zhang (1997, 1999) report evidence supporting the view that business cycles are more synchronized when exchange rate variability is low. However, Inklaar and De Haan (2001) and De Haan *et al*. (2002) suggest the opposite, while

* Mauricio Bovi, Institute for Studies and Economic Analyses (ISAE), e-mail: m.bovi@isae.it.,

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[1] See, for instance, "Is there an Anglo-Saxon cycle?" (Herald Tribune, January, 22 1997).

Baxter and Stockman (1989) conclude that there is no relationship between exchange rate regime and business cycle similarity. Also, over the last years there have been a number of studies focusing on the dynamics of their comovements. Results suggest widespread reduction in volatility (Carvalho and Harvey, 2002; Stock and Watson, 2003; Canova *et al.,* 2004), but not a clear tendency towards increasing international synchronization of cyclical fluctuations (Doyle and Faust, 2002a, 2002b; Heathcoate and Perri, 2002; Kose, *et al.*, 2003; Massmann and Mitchell, 2003). Instead, there appears to have been an emergence of at least one cyclically coherent group, the major countries in the Euro-zone (Carvalho and Harvey, 2002; Artis, 2003; Del Negro and Otrok, 2003; Luginbuhl and Koopman, 2003; Lumsdaine and Prasad, 2003), and possibly a second, English-speaking group, consisting of Canada, the UK, and the US (Helbling and Bayoumi, 2003; Stock and Watson, 2003; Bovi, 2005).

My aim is to shed light on the presence/emergence of economic clubs with a special focus on its relationship with the European commitments. My main contribution lies in analysing the *relative* groupwise synchronization within a new empirical framework. The cyclical affiliation has often been conceptualised by comparing over time *within* and *across* correlations among national business cycles. If the former are increasing while the latter are decreasing, one concludes for the emergence of different clubs (De Haan *et. al.*, 2002; Artis, 2003; Stock and Watson, 2003). In other words, the business cycles of different (groups of) countries are compared over different time periods. However, if globalization is strong (see Artis, 2003), it could be hard to disentangle different clubs because across correlations are not decreasing. I analyse the presence/emergence of a *relative* economic club by comparing the within groupwise synchronization between two clusters of countries over the same time period. Thus, I may detect an economic club even if across correlations are not decreasing. On the other hand, it has been emphasised (Mitchell and Mouratidis, 2002) that any reduction in the cyclical disparity between business cycles need not be associated with increased correlation. Not using correlations as a measure of association, the analysis I present appears to be particularly suitable for the questions of interest here. Moreover, I perform group by group comparisons without taking any of them as benchmark for the

others (as done, *e.g*., by Mitchell and Mouratidis, 2002). In addition, literature on globalization and/or on europeanization (Mansour, 2003; Del Negro and Otrok, 2003; Canova *et al.,* 2004 and, especially, Forni *et al.*, 2001, 2004), computes the world/European business cycle by assuming from the beginning that this cycle exist. Then, it tries to calculate if and how much the common cycle explains the country specific movements. I do not impose any kind of such *a priori* requirements. Finally, the nonparametric statistical tool I use can address both linear and non linear relationships (it is well known that the correlation coefficient may be not a good measure of association), it can be validly applied even to classical cycles (in that avoiding the issue of detrending), and it does not suffer from data scarcity (nonparametric tests are usefully and validly applied when there are few observations). Altogether it means that, under very few assumptions, the exercises I propose can offer additional insights that can be combined with those of earlier literature.

From the methodological point of view I follow to some extent the suggestions of Artis *et al.* (1997), where a classical business cycle chronology is used to create a binary (expansion=1; contraction=0) time series variable for each country. Then, the scores are organised into 2x2 contingency tables recording pairwise expansion/contraction frequencies, which form the bases for Pearson's independence tests. Alike, in order to test the relative groupwise similarities in the most industrialised countries business cycles, I start from turning point chronologies. Then, I make use of the McNemar test (McNemar, 1947) to statistically analyse the marginal homogeneity of 2x2 contingency tables which, in the present context, allows to address the relative groupwise synchronization. I focus exclusively on *if* business cycles co-move, throughout several periods and across some macro area. This is an admittedly less ambitious target compared, *e.g*., to the "holy grail of business cycle research" (Harding and Pagan, 2002a, p. 2), *i.e*. understanding *why* there is (not) synchronization in the level of economic activity across countries. Hopefully, useful insights can emerge in this simple "measurement-without-theory" approach as well.

Results suggest that troughs and peaks tend to take place at the same time with a greater frequency in groups formed by English-

speaking countries (Canada, UK, US) than in clusters collecting core Euro-zone economies (France, Germany, Italy). These findings hold for different concepts of business cycles (classical and growth rate) and are not a constant feature in international business cycles, but are emerging in the last decades. *Ad hoc* experiments suggest that in the aftermath of three potentially path-breaking events (the European Monetary System (EMS), the Maastricht Treaty, and the euro's inception), the core Euro-zone countries formed a less coherent club than the English-speaking one. In other words it seems that the "treatment" does not matter, at least in the expected direction, because the UK seems belonging more and more to the North American continent than to the European one, despite (or because of? See Kontolemis and Samiei, 2000) the European arrangements. Then, loosely speaking, one can wonder whether a common language is a stronger attractor than a common currency.

The paper is organised as follows. In the next section I describe the data. The statistical framework and the empirical results are reported, respectively, in the third and in the fourth section. Concluding remarks close the paper.

2. Data

To test the coherence in the international business cycles in the present context (see section 3), I need a business cycle chronology for each country. There is a large amount of literature dealing with the problem of dating business cycles (Artis *et al.*, 2002), and it can roughly be grouped into two research approaches (Harding and Pagan, 2003). One (nonparametric) approach is the traditional way of distinguishing between different phases of the business cycle by picking peaks and troughs with the Bry and Boschan (1971) procedure. This approach is related directly to the methodology of Burns and Mitchell (1946) and the NBER Business Cycle Dating Committee. The other dominant (parametric) approach is stemming from the influential work of Hamilton (1989). It takes advantage of regime switching models that assume the economy is to be found in one of a number of different states, and where the probability of moving from the current state to another is contingent on the current state. As argued by Harding and Pagan (2002b), the traditional approach is more robust and transparent. I avoid the problem of

dating business cycles by using two different chronologies[2] as computed by the Economic Cycle Research Institute (ECRI). I deal with the most industrialised countries[3], which can be grouped into two clusters:

1. Euro-zone (EZ=France, Germany, Italy);
2. English-speaking (ES=Canada, UK, US).

Although the NBER-ECRI method and dates have sometimes aroused controversy, they are widely accepted and frequently used as a standard of comparison[4] (Boldin 1994; Artis *et al.*, 1997; Canova *et al.*, 2004; Ferguson, 2005). ECRI determines the reference cycle chronologies for several economies using the same methodology used to establish the official business cycle dates for the United States. The data are monthly, cover the period January 1956 - November 2003, and the reference aggregate variable is not a single one. In the ECRI approach, the business cycle can not be defined by any single variable (such as the GDP or the industrial output, just to mention the most frequently used), but by the consensus of key measures of output, income, employment and sales. These coincident indices define "the economy" and constitute ECRI's reference series for each country. To identify business cycle recessions and expansions and the turning points (peaks and troughs) that demarcate them, ECRI applies to the reference series an algorithm (Bry and Boschan, 1971) codifying the judgmental procedures used by classical business cycle analysts. Basically, according to this routine each cyclical movement (peak-to-peak or trough-to-trough) should not be less than 15 months, each phase (peak-to-trough or trough-to-peak) should have a minimum of 6 months, and troughs always follow peaks and *vice versa*. As Watson (1994) has pointed out, the Bry-Boschan procedure provides a good way to define turning

[2] Available via the Internet
http://www.businesscycle.com/research/intlcycledates.php

[3] I exclude Japan because it is outside the main purpose of this work.

[4] ECRI claims that its international chronologies can be used for international comparisons, because they are based on the same standard approach applied to analogous sets of variables across countries. They use a proprietary procedure to incorporate any quarterly data, but no lower-frequency data than quarterly are used. I thank Lakshman Achuthan (ECRI) for support in the interpretation of the ECRI data.

points, since it is based on objective criteria for determining cyclical peaks and troughs.

ECRI offers two kinds of chronologies. The first deals with the classical business cycle, the other with the growth rate cycle. As Harding and Pagan (2004) pointed out, the latter is a special case of the cycle identified from the detrended (*e.g.* by band pass filters) reference series. The dating procedure is the same except that it is applied to the levels, in the former case, and to the growth rates of the same time series, in the latter case. It implies that classical cycles refer to alternating periods of expansion and contraction, while growth rate cycles refer to alternating periods of rising and declining growth rates. The average expansion probability (the fraction of time that the economy is in expansion) is roughly 0.5 in the growth rate case, while it is likely to be higher in the classical one. This is so because in a trending series (Stock and Watson, 1999): (i) classical cycle peaks come later in time than growth rate cycle peaks; (ii) classical cycles become more and more asymmetric over time: a long period of positive growth is followed by a short downturn; and (iii) classical cycles tend to vanish over time if the trend growth rises steadily from zero: in the long run the length of the classical contractions become shorter and shorter compared to the expansions so classical turning points will ultimately disappear. As a matter of fact, in many political circles the main focus seems to be on declines in the growth rate of aggregate economic activity as the primary way to monitor cyclical fluctuations in the economic system. On the other hand, even if many countries saw long periods of virtually uninterrupted growth, in the recent years there have been a number of instances of absolute decline in GDP, which have renewed the conceptual appeal of classical business cycle contractions (Banerji, 2002). Finally, an important difficulty with any growth cycle analysis is that it is based on a definition of trend and such definitions are essentially arbitrary and can affect the results (Canova, 1998a; 1998b). For instance, Baxter and Stockman (1989) found that cyclical synchronization and monetary regimes were unrelated for linear trend adjusted data but not for first log difference data, where synchronization was higher when exchange rate volatility was low. Summing up, in this paper I use both concepts of

the cycle because they can tell different stories about the economy and can increase the robustness of the findings.

3. The Statistical Procedure

In this section I broadly follow the methodology suggested by Artis, *et al.* (1997) to study the synchronous nature of business cycles[5]. Given that my cycles are defined by the ECRI turning points, my business cycle phases are simply 0, 1 (recession, expansion) binary series, S_{ti} for each country "i", with periods within overall expansions taking the value unity. With i=1,…,j and t=1,…,N, I have j Nx1 binary column country-vectors. By pooling them I generate an Nxj "macro-area-matrix" (or macro-area-cluster), and the degree of groupwise synchronization in the international business cycles can be measured by the fraction of time the national cycles are in the same phase (expansion/recession). With this macro-area-matrix/cluster in mind, I define *groupwise synchronization* as the situation in which all the countries included in a cluster are in the same phase. That is, a group is synchronous in the periods in which the relative macro-area-matrix show rows with only zeros or only ones.

It is worth noting that even if an economic club is emerging, in the sense that its groupwise synchronization is increasing, one must control whether there is globalization, *i.e.*, a tendency of world business cycle. In other words, it is important to study the internal coherence of a group as compared to the rest of the world (or to other groups). To this end, I select a period and two sets of countries to form two macro-area-matrices. Then, I create a 2x2 contingency table according to the four possible combinations:

A useful test for comparing the proportions in table 1 is the McNemar test (McNemar, 1947). Basically, it examines marginal homogeneity and consists in analysing the off-diagonal terms of

[5] Harding and Pagan (2002b) is another work on synchronization based on binary variables. As in the present work, they test the null of no synchronization, but their method is based on the pairwise correlation while I focus on groupwise comparisons. Moreover, as known, pairwise correlation does not imply groupwise correlation.

table 1, because marginal homogeneity implies that row totals are equal to the corresponding column totals, or

$$(N_{11}+ N_{12}) = (N_{11} + N_{21});$$
$$(N_{21}+ N_{22}) = (N_{12}+ N_{22}).$$

This implies $N_{12} = N_{21}$, which is the basis of the test. In fact, with $(N_{12}+ N_{21})>9$, McNemar offered a chi-square test with 1 degree of freedom[6]:

$$(\chi^2)_1 = (N_{12}- N_{21})^2 / (N_{12}+ N_{21})$$

Table 1		Cluster 2	
		In-phase	Out-of-phase
Cluster 1	In-phase	$N_{in,in} \equiv N_{11}$	$N_{in,out} \equiv N_{12}$
	Out-of-phase	$N_{out,in} \equiv N_{21}$	$N_{out,out} \equiv N_{22}$

Intuitively, when the focus is on different behaviours it seems logic to concentrate on situations in which the "subjects" behave differently. The frequency of these situations is mirrored in the magnitude of the off-diagonal terms, namely $N_{in,out} \equiv N_{12}$ and $N_{out,in} \equiv N_{21}$. The latter is the number of periods spent in the same phase by the countries forming the cluster 2 when the cluster 1 is out-of-phase. *Vice versa*, N_{12} is the number of groupwise synchronized periods in the cluster 1 when the cluster 2 is internally asynchronous. The more the two clusters are relatively homogeneous, the more the off diagonal terms are similar. If $N_{12}=N_{21}$, McNemar's statistic is zero and one can not reject the null of marginal homogeneity. Otherwise stated, a zero McNemar's statistic implies that the two groups have the same degree of intra-cluster synchronization. Thus, in the present context the marginal

[6] When $(N_{12}+ N_{21})<10$, a two-tailed exact test, based on the cumulative binomial distribution with p=q=0.5, can be used instead. A continuity correction, reflected in the numerator as $(|N_{12} - N_{21}| - 1)^2$, could be included to improve the approximation (Sheskin, 2000).

homogeneity is a useful statistical concept in order to analyse the relative groupwise synchronization. A significant result implies that the two clusters are not homogeneous, *i.e.* that the probability[7] of groupwise cyclical similarity is statistically different across clusters. In particular, when N_{12} is significantly larger (smaller) than N_{21}, one can conclude that the countries included in the cluster 1 constitute a more (less) coherent group than those into the cluster 2. Note that $N_{12}=N_{21}$ can be realised with very different values of N_{11}. It is an interesting feature of this framework. In fact, since national classical business cycles will very often show $S_{ti} = 1$ (see section 2), frequencies will be so heavily clustered on the upper left cell that a χ^2 test like the Pearson's contingency coefficient will likely reject the null of independence. A test of marginal homogeneity focusing only on the off-diagonal proportions does not suffer from this. Thus, it can be validly applied to classical cycles as well. Also, mainstream literature on globalization and/or on europeanization (Mansour, 2003; Del Negro and Otrok, 2003; Forni *et al.*, 2001, 2004; Canova *et al.*, 2004), computes the world/European business cycle by assuming from the beginning that this cycle exist. Then, it tries to calculate if and how much the common cycle explains the country specific movements. For instance, Canova *et al.*, (2004) find that this common business cycle explains about 30% of the fluctuations in each country. I do not impose any kind of such *a priori* requirements. Furthermore, the emergence of economic clubs has often been conceptualized by showing that, over time, *within* correlations increase, while *across* correlations decrease[8] (De Haan *et. al.*, 2002; Stock and Watson, 2003; Artis, 2003). In other words, the business cycles of different (groups of) countries are compared over different time periods. However, if globalization is strong (see Artis, 2003), it could be hard to disentangle different clubs because across correlations are not

[7] It is easily seen that the contingency table is made up by proportions based on 0/1 data.

[8] In the literature this approach leads to distinguish between core and periphery countries, where the core countries have higher synchronized business cycles.

decreasing. I analyse the presence/emergence of a *relative* economic club by comparing the within groupwise synchronization between two clusters of countries over the same time period. Thus, I may detect an economic club even if across correlations are not decreasing. On the other hand, it has been emphasised (Mitchell and Mouratidis, 2002) that any reduction in the cyclical disparity between business cycles need not be associated with increased correlation. Not using correlations as a measure of association, the analysis I present appears to be particularly suitable for the questions of interest here. Finally, I perform group by group comparisons without taking any of them as benchmark for the others (*e.g.*, Mitchell and Mouratidis, 2002; IMF, 2002).

Admittedly, the empirical design ignores the magnitude of change, considering only the direction of underlying movement implied by the chronologies, and can offer only qualitative answers. Regarding to the former, the problem is that even if the timing of business cycles is similar, the magnitude may differ and countries in a cluster could be recorded in the same cyclical phase even if their economic performances are very different. However, the decreased volatility shown by the GDP of the G7 countries (Carvalho and Harvey, 2002; Stock and Watson, 2003; Canova *et al.,* 2004) could somewhat reduce this issue. Furthermore, in European political circles the focus is often on relative behaviours and, regardless quantitative aspects, the manthra seems to be "our country is moving side-by-side to our partners". On the positive side and to sum up, the McNemar test is not based on correlations and it allows to deal with: i) group by group comparisons without imposing any benchmark; ii) linear and non linear relationships; iii) short samples. Moreover, iv) it can be validly implemented to classical cycles (in that avoiding the issues of detrending) and, most importantly, because of its features and its distribution-free nature, v) it works under very few assumptions. Taken together, the proposed analysis can offer additional and complementing evidence on the presence/emergence of economic clubs.

4. Empirical Results

The following tables are organised according to the concept of cycle (tables 2, 3, 4 and 2a, 3a, 4a respectively for classical and

growth rate cycle). To aid the detection of patterns in the data I shade the most important rows (involving ES countries *vs* EZ ones) and columns (*e.g.* the "Maastricht Experiment"). Also, in reporting all the possible trials I focus especially on the UK[9] because of its pivotal role in the present context being both an European and an English-speaking country. This is why I replicate the experiments for the two tri-variate clusters that are of particular interest here, the ES and the EZ.

Following the logic of table 1, if $(N_{12}-N_{21})<0$ then I write "-" as, *e.g.*, in the lower left cell. This means that the number of periods spent in the same phase by the countries included in the cluster 2 (UK&GE=the UK and Germany), when the countries included in the cluster 1 (IT&US=Italy and the US) are not in the same phase (N_{21}), is significantly larger than the number of in-phase periods in the cluster 1, when the cluster 2 is out-of-phase (N_{12}). That is, the cluster 2 is more homogeneous (at the 5% significance level) than the cluster 1. A similar logic holds for "+" ("="), which means that the cluster 2 is less (equally) homogeneous relatively to the cluster 1. The cutting date for "EMS" (European Monetary System) is 1979:03; the sample period for "Maastr." (The Maastricht Treaty) is 1992:01-2003:11, and for "Euro" is 1999:01-2003:11.

The sample periods considered in tables 2 and 2a are as follows:

Sample	Months	Sample	Months	Sample	Months	Sample	Months
(1)	56.01 66.12	(4)	70.12 80.12	(7)	Maastr. (92)	(10)	Euro (99)
(2)	60.12 70.12	(5)	75.12 85.12	(8)	Pre EMS	(11)	56 03
(3)	65.12 75.12	(6)	80.12 90.12	(9)	Post EMS		

Consistent with recent findings, the picture emerging from the empirical exercises leads to conclude that over the last fifty years, the major Euro-zone countries (France, Germany, Italy) formed less

[9] The goal here is to stress the relative performance between the English speaking countries and the Euro zone ones.

coherent economic clubs than those made up by combinations of English-speaking economies (Canada, UK, US).

Table 2. Analysis of relative homogeneity in NBER-ECRI classical business cycles.

Clusters		Sample Period										
1	2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GE&IT	US&CA	=	~	=	=	=	=	~	=	~	~	=
FR&IT	US&CA	=	=	+	=	~	~	=	=	=	=	=
GE&FR	US&CA	=	=	=	=	~	~	~	=	~	~	~
GE&UK	US&CA	+	=	=	=	~	~	~	+	~	~	~
FR&UK	US&CA	=	+	+	=	~	~	=	+	~	=	=
IT&UK	US&CA	=	=	=	=	~	~	=	=	~	=	=
GE&IT	UK&CA	=	~	~	=	+	+	~	~	=	=	=
FR&IT	UK&CA	~	~	=	=	~	~	+	~	=	+	=
GE&FR	UK&CA	=	~	~	=	~	~	~	~	~	=	~
GE&US	UK&CA	=	~	~	+	+	+	~	~	=	=	=
FR&US	UK&CA	~	=	~	~	=	=	=	~	=	=	~
IT&US	UK&CA	~	~	~	=	+	=	=	~	=	=	~
GE&IT	UK&US	=	~	=	=	+	+	~	=	=	~	=
FR&IT	UK&US	~	=	+	=	~	=	=	=	=	=	=
GE&FR	UK&US	=	=	=	=	~	~	~	=	~	~	~
GE&CA	UK&US	=	=	=	=	+	+	~	=	=	=	=
FR&CA	UK&US	=	+	+	=	~	~	~	=	~	~	~
IT&CA	UK&US	~	=	=	=	+	=	~	=	~	~	~
GE&FR	UK&IT	=	=	=	=	~	=	~	=	~	~	~
GE&CA	UK&IT	=	=	~	=	+	+	~	-	+	~	=
FR&CA	UK&IT	~	+	+	+	-	-	~	=	~	~	~
GE&US	UK&IT	=	=	=	+	+	+	~	=	=	~	=
FR&US	UK&IT	=	=	=	+	=	=	=	=	=	~	=
GE&IT	UK&FR	=	~	~	=	+	+	~	~	=	~	=
GE&CA	UK&FR	=	~	~	~	+	+	~	~	+	~	=
IT&CA	UK&FR	~	~	~	~	+	+	~	~	=	~	~
GE&US	UK&FR	=	~	~	=	+	+	~	~	=	~	~
IT&US	UK&FR	~	~	~	-	+	+	~	~	+	~	=
FR&IT	UK&GE	~	=	+	=	~	=	+	=	=	+	=
FR&CA	UK&GE	~	+	+	=	~	~	=	=	~	~	~
IT&CA	UK&GE	~	=	=	=	=	=	=	~	=	~	~
FR&US	UK&GE	~	=	=	=	~	~	+	~	+	+	=
IT&US	UK&GE	~	~	=	=	=	=	+	~	+	+	=

Table 2a. Analysis of relative homogeneity in NBER-ECRI growth rate business cycles.

Clusters		Sample Period										
1	2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GE&IT	US&CA	~	~	=	=	=	~	~	~	~	~	~
FR&IT	US&CA	~	=	=	=	~	~	~	~	~	~	~
GE&FR	US&CA	~	~	=	=	~	~	~	~	~	~	~
GE&UK	US&CA	~	=	=	+	~	~	~	=	~	~	~
FR&UK	US&CA	~	~	=	+	~	~	~	=	~	~	~
IT&UK	US&CA	~	=	=	=	~	~	~	=	~	~	~
GE&IT	UK&CA	~	=	=	=	=	~	~	~	~	~	~
FR&IT	UK&CA	=	+	+	~	~	~	~	=	~	~	~
GE&FR	UK&CA	=	+	+	=	~	~	~	=	~	~	~
GE&US	UK&CA	+	+	+	=	~	~	~	+	~	=	=
FR&US	UK&CA	=	+	+	+	~	=	~	+	~	~	=
IT&US	UK&CA	=	+	+	~	=	+	~	=	~	~	~
GE&IT	UK&US	~	~	~	=	+	~	~	~	~	=	~
FR&IT	UK&US	=	=	~	~	~	~	~	=	~	=	~
GE&FR	UK&US	=	=	~	=	=	~	=	=	~	=	~
GE&CA	UK&US	+	=	~	=	+	~	~	=	~	=	~
FR&CA	UK&US	=	+	~	=	=	=	~	=	~	=	~
IT&CA	UK&US	=	=	~	=	+	+	~	~	~	~	~
GE&FR	UK&IT	=	~	=	=	=	~	=	~	=	~	~
GE&CA	UK&IT	=	=	+	=	~	~	=	=	~	=	=
FR&CA	UK&IT	=	=	=	=	=	=	=	~	=	=	=
GE&US	UK&IT	+	=	=	=	=	~	=	=	=	=	=
FR&US	UK&IT	=	~	=	+	=	=	-	=	=	~	=
GE&IT	UK&FR	~	~	~	=	+	~	+	~	=	=	~
GE&CA	UK&FR	=	~	~	=	+	~	=	=	=	=	=
IT&CA	UK&FR	=	~	~	~	+	+	~	~	=	~	~
GE&US	UK&FR	+	=	=	=	=	~	=	=	=	=	=
IT&US	UK&FR	~	~	~	~	=	+	~	~	~	~	~
FR&IT	UK&GE	=	=	=	~	~	+	-	=	=	~	=
FR&CA	UK&GE	=	=	=	~	=	+	=	=	+	=	=
IT&CA	UK&GE	=	~	~	~	+	+	=	~	+	~	=
FR&US	UK&GE	=	~	=	+	=	+	=	=	+	~	=
IT&US	UK&GE	~	~	=	~	=	+	~	~	=	~	=

See table 2.

Comparing over the entire sample pairs of EZ countries *vs* pairs of ES ones, all the resulting signs are "-" or "=" (see the shaded cells in the last column of tables 2 and 2a). In the former case, it means that the probability of the event "the ES bivariate clusters are synchronized" is significantly greater than the probability of the event "the EZ bivariate clusters are synchronized".

Table 3. Recursive analysis of relative homogeneity in NBER-ECRI classical business cycles.

Clusters*	Sample	N_{12}	N_{21}	P-Value	Sign*
1=EZ; 2=ES	Jan. 1956 – Dec. 1960	21	12	0.12	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1965	23	26	0.67	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1970	33	41	0.86	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1975	43	52	0.36	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1980	45	52	0.48	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1985	51	77	0.02	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1990	57	77	0.08	=
1=EZ; 2=ES	Jan. 1956 – Dec. 1995	58	87	0.02	-
1=EZ; 2=ES	Jan. 1956 – Dec. 2000	58	87	0.02	-
1=EZ; 2=ES	Jan. 1956 – Nov. 2003	63	87	0.05	-

* Clusters and frequencies follow the logic of table 1. EZ=cluster 1=(France, Germany, Italy); ES=cluster 2=(Canada, UK, US). Other details under table 2.

Table 3a. Recursive analysis of relative homogeneity in NBER-ECRI growth rate business cycles.

Clusters*	Sample	N_{12}	N_{21}	P-Value	Sign*
1=EZ; 2=ES	Jan. 1956 – Dec. 1960	0	35	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1965	1	40	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1970	8	48	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1975	23	62	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1980	29	80	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1985	32	108	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1990	33	144	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 1995	41	159	0.00	-
1=EZ; 2=ES	Jan. 1956 – Dec. 2000	55	182	0.00	-
1=EZ; 2=ES	Jan. 1956 – Nov. 2003	58	191	0.00	-

* See table 3.

Table 4. A sub sample analysis of relative homogeneity in NBER-ECRI classical business cycles.

Clusters*	Sample	N_{12}	N_{21}	P-Value	Sign*
1=EZ; 2=ES	Jan. 1956 – Dec. 1966	23	26	0.67	=
1=EZ; 2=ES	Dec 1960 – Dec. 1970	13	29	0.01	-
1=EZ; 2=ES	Dec 1965 – Dec. 1975	20	26	0.38	=
1=EZ; 2=ES	Dec 1970 – Dec. 1980	12	12	1.00	=
1=EZ; 2=ES	Dec 1975 – Dec. 1985	8	25	0.00	-
1=EZ; 2=ES	Dec 1980 – Dec. 1990	12	25	0.03	-
1=EZ; 2=ES	Dec 1985 – Dec. 1995	7	10	0.47	=
1=EZ; 2=ES	Dec 1990 – Nov. 2003	6	10	0.32	=
1=EZ; 2=ES	Pre-EMS	43	52	0.36	=
1=EZ; 2=ES	Post-EMS	20	35	0.04	-
1=EZ; 2=ES	Maastricht	6	8	0.59	=
1=EZ; 2=ES	Euro	5	0	0.02[a]	+

* See table 3. **[a]**The cumulative binomial (see section 3) gives a similar exact probability.

Table 4a. A sub sample analysis of relative homogeneity in NBER-ECRI growth rate business cycles.

Clusters*	Sample	N_{12}	N_{21}	P-Value	Sign*
1=EZ; 2=ES	Jan. 1956 – Dec. 1966	1	40	0.00	-
1=EZ; 2=ES	Dec 1960 – Dec. 1970	8	14	0.20	=
1=EZ; 2=ES	Dec 1965 – Dec. 1975	22	22	1.00	=
1=EZ; 2=ES	Dec 1970 – Dec. 1980	22	32	0.17	=
1=EZ; 2=ES	Dec 1975 – Dec. 1985	9	46	0.00	-
1=EZ; 2=ES	Dec 1980 – Dec. 1990	4	65	0.00	-
1=EZ; 2=ES	Dec 1985 – Dec. 1995	9	52	0.00	-
1=EZ; 2=ES	Dec 1990 – Nov. 2003	25	44	0.01	-
1=EZ; 2=ES	Pre-EMS	28	68	0.00	-
1=EZ; 2=ES	Post-EMS	30	123	0.00	-
1=EZ; 2=ES	Maastricht	23	46	0.01	-
1=EZ; 2=ES	Euro	13	16	0.58	=

* See table 3.

As should be clear, it does not imply that the EZ couples are not synchronized at all, but only that they constitute a *relatively* less coherent group than that formed by an Anglo-Saxon pair. This result is even stronger when the employed concept of cycle is the growth rate (table 2a). In this case the ES couples seem to share a stronger gravitational force than that linking the EZ ones with no exemptions. Validating what already pointed out in a different empirical framework (Artis, 2003), the less synchronized couple appears to be GE&FR (Germany and France), which takes home nine minus[10] signs and three "=" in the twelve experiments (six for each concept of cycle, some of them unreported)[11]. On the other side, somewhat surprisingly, the most "winning" couple is UK&US, which seems to be at least as mutually adherent as the North American block (US&CA). In the twelve competitions, UK&US is relatively superior to nine couples and equally homogeneous in three cases; the numbers for US&CA are, respectively, eight and four. As expected, UK&CA seems to be the less exclusive ES couple, although it never looses a match against EZ clusters.

There are several reasons to expect that the cyclical affiliations of the economies might have changed over time (world-wide shocks, international agreements etc.). Working with monthly data on industrial production over the last forty years, Doyle and Faust (2002) and Massmann and Mitchell (2003) suggest that the degree of synchronization is not constant over time and that the particular sub periods used in the analysis can affect the results. The sub sample analysis here performed corroborates their hint. There were periods during which the cycles of GE&IT were more synchronized than those of ES pairs, while UK&US was a less strong contender (see the several "+" signs in the left-hand side of tables 2 and 2a). These findings are congruent with those of somewhat comparable exercises reported by Stock and Watson (2003), despite these authors analyse

[10] GE&FR is in the column "Cluster 1" thus, as should be clear, the sign "-" implies that GE&FR is a less similar cluster than the corresponding couple in the column "Cluster 2".

[11] Even if this could be due to the German (re)unification, it remains to be explained why GE&IT result a stronger contender. These considerations are beyond the focus of this paper.

correlations and employ national GDPs as reference series. The seventies, characterised by two world-wide oil shocks, show the greatest degree of homogeneity (66% of "="). This result broadly supports Canova *et al.*, (2004, p. 9), which claim that "declines in economic activity tend to have common timing and similar dynamics, both within and across countries." Also, Massmann and Mitchell (2003) note that all the countries experiencing the first recession of the 70s, showed the peak in 1974. Using the words of Helbling and Bayoumi (2003), all these countries were in the same boat. The other question of interest here is if the European agreements, such as the EMS, the Maastricht Treaty, and the euro's inception, have induced a common cycle in the Euro-zone. *Ad hoc* experiments suggest that in the aftermath of their formal commitments, Euro-zone countries constitute less coherent clubs than those of the linguistically-homogeneous economies. This finding can be drawn once again by looking at the signs reported in the shaded cells corresponding to the three European appointments (post-EMS, Maastr., Euro in tables 2 and 2a) and to the EZ *vs* ES trials. In the fifty-four contests (twenty-seven for each definition of cycle) the Anglo-Saxon groups loose just twice and, especially referring to the growth rate business cycles, they appear to be unbeatable as compared to EZ competitors. Moreover UK&IT and UK&FR, if anything, do not seem to be affected by the EMS, while the affinity of UK&GE results even smaller than that of "mixed couples" such as FR&US (see the lower-right side of tables 2 and 2a). The relative similarity of UK&IT and UK&FR classical cycles seems to be reinforced in the aftermath of the Maastricht Treaty and of the euro's inception, while this can not be said for the growth rate concept. Once again, UK&GE seems to be the relatively weaker pair. All the outcomes achieved so far are ratified by contrasting altogether the three Euro-zone countries against the three English-speaking economies (tables 3-4a). Recursive experiments show that classical cycles were relatively homogeneous until the end of the seventies. Henceforth troughs and peaks have tended to take place at the same time with a statistically significant greater frequency in the ES circle. The behaviour of growth rate cycles supports the stronger adherence of this group, but the result is even more extreme because of the uninterrupted tendency of English-speaking countries to

comove more closely than the EZ ones. Rolling tests point out that the greater tendency of ES countries to form a more consistent club is not monotonic over time. A common feature of both concepts of cycles is the systematically superior Anglo-Saxon interaction as compared to the Euro-zone situation, especially in the last decades. In other words it seems that the "European treatment" did not attract the UK towards European countries.

5. Concluding Remarks

This paper presented a nonparametric analysis of the most industrialised countries business cycles as identified by the NBER-ECRI and processed in search of some stylized facts. A non conventional statistical design adds new evidence on the cyclical affiliation in some economic clubs, whose emergence has been pointed out by recent works. Data suggest that the English-speaking countries business cycles are more synchronous than the core Euro-zone ones. This outcome is enforced in the last decades, thus one can say that the recent European commitments failed to pass the "English exam" and can wonder whether a common language is more important than a common currency in establish the cyclical affiliation.

It is worth noticing that since the unit of observation is the cycle (lasting several years), findings based on very few years must be seen as fragile. Another matter of concern is that the proposed empirical design can offer only qualitative answers about the cyclical affiliation, which is based entirely on synchronization evidence. For instance, in the recent assessment by HM Treasury (2003), the prospect of UK entry into the Eurozone is significantly favoured by the recent experience of lower-amplitude cycles.

In this paper synchronization is the situation in which *all* countries share the *same* cyclical phase (recession or growth). This definition is extreme as compared to what is sometimes proposed in the literature and it is verified by an unusual nonparametric test, which works under very few assumptions. Moreover, the empirical framework can be validly applied to short samples, to classical "non-detrended" cycles, and can discover even non linear relationships. This is so because it is not based on correlations and as well known the correlation coefficient may be not a good measure of association

in the presence of outliers and/or of non linear relationships. Also, the reference series is not a single series such as the frequently used GDP, but the ECRI index which tries to capture the economic activity as a whole. The group by group comparisons are performed without imposing any leading country nor assuming from the beginning that a common cycle exist. Finally, while this paper offers some new result the comparable findings are coherent with mainstream literature suggestions. Taken together, it means that the reported results are robust and can be thought of as complementing earlier evidence on the presence/emergence of economic clubs.

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