Economic Clubs and European Commitments. A Business Cycles Race

MAURIZIO BOVI*

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. Starting from turning points chronologies, a binary measure of association for expansion and contraction regimes is used to perform a nonparametric analysis. This framework allows to address the relative groupwise synchronization, which is based on the comparison between the number of periods spent in the same cyclical phase within two groups of countries. Studying the relative cohesion among clusters is important in order to establish if and how much "europeanization" is a different phenomenon with respect to globalization, that is to see if the relative degree of coherence is greater inside than outside Europe. Under very few assumptions, data analysis lead to conclude that an English-speaking club 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. Since European commitments failed to pass the "English exam", some additional problem could arise should the UK adopt the Euro.

JEL Classification: C14, C33, E32, F47.
Key words: Business Cycles, Synchronization, Turning Points.

* Institute for Studies and Economic Analyses (ISAE), e-mail: m.bovi@isae.it., Fax +39.06.4448.2249, Tel +39.06.4448.2751. I would like to thank seminar participants held at ISAE for their helpful suggestions. All errors are solely those of author as are the opinion expressed herein.

1. Introduction

There are several reasons for taking an interest in the international business cycles. 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. 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), and little tendency towards increasing international synchronization of cyclical fluctuations (Doyle and Faust, 2002a, 2002b; Heathcoate and Perri, 2002; Kose, *et al.*, 2003). Instead, there appears to have been an emergence of at least one cyclically coherent group, the major countries in the Euro-zone (Artis *et al.*, 1997; Carvalho and Harvey, 2002; Del Negro and Otrok, 2003; Luginbuhl and Koopman, 2003), and possibly a second, English-speaking group, consisting of Canada, the UK, and the US (Helbling and Bayoumi, 2003; Stock and Watson, 2003).

I try to contribute to this strand of the literature. Essentially I deal with turning points chronologies, and my interest is in seeing whether there are any robust stylised facts, such as the presence of economic clubs and their coherence with the European commitments, that come through. In fact, since the aftermath of the second world war European countries tried to enhance their relationships through, *inter alia*, a sequence of economic arrangements. European integration started with the establishment of the narrowed European Coal and Steel Community in the early fifties, and has proceeded step by step until the recent enlargement of the European Union, which now counts twenty-five members. In particular, I focus on three potentially path-breaking events, the European Monetary System (March 1979, EMS), the Maastricht Treaty (January 1992) and the introduction of the euro (January 1999), to investigate whether the European countries business cycles have become more similar over time. In order to establish their relative cyclical affiliation, I compare groups of countries. Assessing the relative performance in the groupwise synchronization is important because evidence of greater concordance within a cluster over time could be partly due to a tendency of world business cycles. In other words, there could be an interest in studying the relative degree of "globalization" and "europeanization". Usually (*e.g.* Artis, 2003), the emergence of economic clubs is analysed by comparing over time within and across correlations among national business

cycles. If the within correlations are increasing while the across ones are decreasing, one concludes for the presence of different cyclical affiliations. But if the globalization is very strong, it could be hard to disentangle different groups because across correlations are not decreasing. The relative groupwise synchronization I propose can detect economic clubs even if the groups operate in a highly correlated world.

The statistical tool for analysing the relative groupwise synchronization is nonparametric and it is applied to the most industrialised countries business cycles as dated by the Economic Cycle Research Institute (ECRI). The relative cohesiveness measure is based on the comparison between the number of periods spent in the same cyclical phase within two groups of countries. Since most hypotheses in this field of research have so far been tested by evaluating pairwise correlations, the present study can be thought as complementing other approaches. Also, the analysis of the recent developments in international business cycles may face a problem of data scarcity. As a matter of fact, some experiments here presented are based on limited samples and, as known, nonparametric tests are usefully and validly applied when there are few observations. From the methodological point of view this paper follows 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 relative groupwise synchronization, I make use of the McNemar test (McNemar, 1947) to statistically analyse the marginal homogeneity of 2x2 contingency tables.

Within this framework 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 "measurement without theory" approach as well.

All in all, results show that troughs and peaks tend to take place at the same time with a greater frequency in the English-speaking countries (Canada, UK, US) than in the core Euro-zone ones (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 the European commitments (such as the EMS or the Maastricht Treaty), the core Euro-zone countries formed a less coherent club than the English-speaking ones. 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 Europe, despite (or because of? Cfr. Kontolemis and Samiei, 2000) the European arrangements.

The paper is organised as follows. In the next section I describe the data and their sources. 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 advance 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[1] as computed by the NBER-ECRI. The paper deals with the most industrialised countries[2], which can be grouped into two clusters:

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

[1] Available via the Internet http://www.businesscycle.com/research/intlcycledates.php
[2] I exclude Japan because it is outside the main purpose of this work.

Although the NBER method and dates have sometimes aroused controversy, they are widely accepted and frequently used. 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 the frequently used GDP. In the ECRI approach, the business cycle can not be defined by any single variable, but by the consensus of key measures of output, income, employment and sales. These coincident indexes 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, the cycle is determined from the turning points as identified by the Bry-Boschan method. According to this latter, 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 points, since it is based on objective criteria for determining cyclical peaks and troughs.

The two NBER-ECRI chronologies are different because one 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. Thus, the average expansion/recession probability (the fraction of time that the economy is in one or other phase) is roughly 0.5 in the growth rate case, while it is likely to be higher in the classical one. In fact, it has been observed (Stock and Watson, 1999) that in a trending series: (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. 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. Summing up, in this paper I use both concepts of the cycle because they can tell different stories about the economy and they could allow increasing 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. 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, with periods (months) within overall expansions taking the value unity:

$$\text{PEAK} \rightarrow \text{TROUGH} \Rightarrow S_{ti} = 0$$

$$\text{TROUGH} \rightarrow \text{PEAK} \Rightarrow S_{ti} = 1$$

where:

i=1,…,j;

j=number of countries;

t=1,…,N;

N=number of periods.

With j countries, we have j Nx1 binary column vectors. By pooling them an Nxj "macro-area-matrix" is generated, and the problem of the synchronization in the international business cycles can be seen as the degree of "horizontal disorder" in this matrix. In other words, an obvious way of measuring the degree of cohesion in business cycles is to ask what fraction of time the national cycles are in the same phase (expansion/recession). With respect to the macro-area-matrix, let us define *groupwise synchronization* as the situation in which all the countries

included in the cluster (*i.e.* in the macro-area-matrix) are in the same phase, that is all the rows contain only zeros or ones.

With this at hand, we can answer the questions of interest via a statistical analysis and better qualify them. An easy way to design a useful statistical framework is to compare the number of in-phase periods throughout different samples and across macro regions. This is the sense of the "cycles race" mentioned in the title. 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 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 groups of countries to form two macro-area-matrices; then I create a 2x2 contingency table according to the four possible combinations:

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	$N_{out,in} \equiv N_{21}$	$N_{out,out} \equiv N_{22}$

A useful test for comparing the proportions in table 1 is the McNemar test (McNemar, 1947). Basically, it is a very good nonparametric test when the data are dichotomic, and can be said that McNemar's test is a Sign-Test in disguise. It examines marginal homogeneity and consists in analysing the off-diagonal terms of table 1, because marginal homogeneity implies that row totals are equal to the corresponding column totals, or

$$(N_{11} + N_{12}) = (N_{11} + N_{21}) \quad (1)$$

$$(N_{21} + N_{22}) = (N_{12} + N_{22}). \quad (2)$$

This implies $N_{12} = N_{21}$, which is the basis of the McNemar test. In fact, with $(N_{12} + N_{21})>9$, McNemar offered a chi-square test with 1 degree of freedom[3]:

[3] 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).

$$(\chi^2)_1 = (N_{12} - N_{21})^2 / (N_{12} + N_{21}) \quad (3)$$

Intuitively, when the focus is on different behaviours it seems logic to concentrate on situations in which the "subjects" behave differently. These situations are 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 in-phase periods in 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 $N_{12}=N_{21}$ the 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 "teams" have the same degree of groupwise synchronization. Thus, in the present context marginal homogeneity is a useful statistical concept to test the relative groupwise synchronization. Note that $N_{12}=N_{21}$ can be realised with very different proportions of out-of-phase periods, that is with a very low N_{11} or with a very low N_{22}. This is a noteworthy feature of this framework. In fact, since national classical business cycles will very often show $S_{ti} = 1$ (see section 2), frequencies are so heavily clustered on the upper left cell that a χ^2 test like the Pearsons' 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. Furthermore, we may have $N_{12}=N_{21}$ both when the two clusters are in the same cyclical regime, and when the countries of one group share an expansion while the countries of the other group share a contraction. In the latter case the present framework could give similar findings of an analysis based on rolling correlations. In fact, the emergence of economic clubs has been often rationalized by showing that within correlations have increased, while across correlations have decreased (Stock and Watson, 2003; Artis, 2003). In the former event this could be no more the case, because across correlations are not decreasing. In this sense, the metric here presented can give different and complementary information as compared to the frequently used correlations. In the present framework, a significant result implies that the two clusters are not homogeneous, *i.e.* that the probability[4] of being in the same phase within each cluster is statistically different across clusters. In particular,

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

when N_{12} is significantly larger (smaller) than N_{21}, one can conclude that the countries included in cluster 1 constitute a more (less) coherent group than those in cluster 2.

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 the binary measure can not distinguish between growth rates of +10% and +0.5%, thus countries in a cluster are recorded in the same cyclical phase even if the amplitude of their cycles is very different. However, the decreased volatility (Carvalho and Harvey, 2002; Stock and Watson, 2003) could reduce this issue. Furthermore, in European political circles the focus is often on "relative" behaviours just to be able to claim that, putting aside the quantitative aspects, "our country is moving side-by-side to our partners". On the positive side, the Mcnemar's test allows to deal with: i) linear and non linear relationships (as compared to correlation analysis); ii) relative groupwise synchronization, which can have a complementary information content with respect to relative groupwise correlations; iii) the issue of analysing limited samples. Furthermore, iv) it is designed for correlated proportions, thus it can be validly applied also to classical cycles while there is no need to remove trends and, v) the distribution-free nature of the test can give very robust outcomes. Summing up, it should be thought as complementing other approaches.

4. Empirical Results

I am now in a position to address the "cycles race" of interest here. By comparing over the entire period the number of periods spent in the same cyclical phase within each cluster, I test the presence of economic clubs among the most industrialised countries. To study the dynamics of convergence for the full sample of observations, I recursively replicate the experiment; whereas rolling tests are used to investigate the situation during different subsamples. The recursive analysis is led by adding five years each experiment starting from the first available decade. In the rolling analysis, the number of observations is kept constant and equal to ten years, while the starting date is shifted five years ahead each trial.

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), and to aid the detection of patterns in the data I

shaded the most important rows (matches between ES *vs* EZ) and columns (*e.g.* the "Maastricht Experiment"). To this end in reporting all the possible "races", I chose to focus especially on the UK and I do not report the recursive analysis which, anyway, confirms the results. Finally, I replicate the experiments for two tri-variate clusters[5] that are of particular interest here, the ES and the EZ. Comments are gathered in the concluding section.

[5] I do not examine other trivariate clusters because here I want to stress the relative performance between the English speaking countries and the Euro zone ones.

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

Clusters		Sample										
1	2	1956.01 1966.12	1960.12 1970.12	1965.12 1975.12	1970.12 1980.12	1975.12 1985.12	1980.12 1990.12	Maastr. (1992)	PRE EMS	POST EMS	Euro (1999)	1956 2003
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	–	–	=	=	=	=	+	–	+	+	=

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

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

Clusters		Sample										
1	2	1956.01 1966.12	1960.12 1970.12	1965.12 1975.12	1970.12 1980.12	1975.12 1985.12	1980.12 1990.12	Maastr. (1992)	PRE EMS	POST EMS	Euro (1999)	1956 2003
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.

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 subsample 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 subsample 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.

CONCLUDING REMARKS

The picture emerging from the empirical exercises leads to conclude that in the last fifty years, the major Euro-zone countries (France, Germany, Italy) show a lower internal cohesion than the English-speaking countries (Canada, UK, US) - comparing over the entire sample pairs of EZ *vs* pairs of ES countries all the resulting signs are "-" or "="(see the shaded cells in the last column of table 2 and 2a). In words it means that the probability of the event "the ES bivariate clusters are groupwise synchronized" is significantly greater than the probability of the event "the EZ bivariate clusters are groupwise synchronized". In terms of the cycles race mentioned in the title, we can say that the EZ bivariate clusters are never winning against the ES couples. This result is even stronger when the concept of cycle used is the growth rate (table 2a), where the ES couples are always more internally consistent than the EZ ones. As already pointed out in literature (Artis, 2003), the less synchronized couple appears to be Germany and France (GE&FR), which shows nine minus signs and three "=" in the twelve experiments (six for each concept of cycle, some of them not reported). On the other side, somewhat surprisingly, the most "winning team" is the couple UK&US, which seems to be even more mutually adherent than the "benchmark" North American pair (US&CA). In the twelve cycle races, UK&US is relatively superior to nine couples and equally homogeneous in three cases; the numbers for US&CA are, respectively, eight and four. UK&CA seems to be the less exclusive ES couple, although it never looses a match.

There are several reasons to expect that the cyclical affiliations of the economies might have changed over time (the end of world-wide shocks, international agreements etc.). As a matter of fact, the subsample analysis shows periods during which the cycles of GE&IT were more synchronized than ES pairs and UK&US was relatively a less strong contender (see the several "+" signs in the left-hand-side part of tables 2 and 2a). Perhaps because of the world-wide oil shocks, the seventies show the greater degree of homogeneity with the 66% of "=". While the aim of this paper is to establish the facts rather than to explain them, one is strongly tempted to speculate about the influence of international agreements on business cycles synchronization. For instance, a frequently asked question is if the Maastricht Treaty and/or the introduction of the Euro, have induced a common cycle in the Euro-zone. *Ad hoc* experiments confirm that despite (or because of?) their formal commitments, Euro-zone countries constitute a less coherent club

than the English-speaking ones. This finding can be drawn once again by 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 matches. In the "tournament" (twenty-seven races for each definition of cycle) the ES pairs loose just twice and, especially referring to the growth rate business cycles, they win the most part of the races. Also UK&IT and UK&FR, if anything, do not seem to be affected by the EMS, while UK&GE results even less coherent than "mixed couples" such as FR&US (see the lower-right side of tables 2 and 2a). The relative cohesion of UK&IT and UK&FR classical cycles seems to be reinforced in the aftermath of the Maastricht Treaty and of the Euro, while this can not be said for the growth rate concept. Once again, UK&GE seems to be the relatively weaker pair.

The outcomes are confirmed by contrasting altogether the three Euro-zone countries against the three English-speaking economies (table 3-4a). Recursive experiments show that classical cycles were homogeneous until the end of the 70s, while henceforth troughs and peaks have tended to take place at the same time with a significant greater frequency in the ES countries than in the core Euro-zone countries. The behaviour of growth rate cycles supports the stronger adherence of the English-speaking 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 "treatment" does not matter, at least in the expected direction.

This paper presented a nonparametric analysis of the international business cycles as identified by the NBER-ECRI and processed in search of some stylized facts. In particular, the focus was on testing the relative convergence in some economic clubs, whose presence has been pointed out by recent works. As elsewhere (Stock and Watson, 2003; Artis, 2003), data suggest to conclude that the English-speaking group is more internally congruent than the core Euro-zone one. This outcome holds for different concept of cycles (classical and growth rate) and it is enforced in the last decade, thus we can say that European commitments failed to pass the "English exam". Using the words of Helbling and Bayoumi (2003), there are emerging two different "boats", in the sense that the Anglo-Saxon countries appear to sail more often in the same direction than the core Euro-zone economies. Unlike mainstream literature, in this paper

relative groupwise synchronization is not evaluated by means of correlations, but it is addressed by testing marginal homogeneity in 2x2 contingency tables. The proposed non parametric statistical tool deals only with the cyclical synchronization, but it can be applied to short samples and can discover even non linear relationships under very few assumptions. Taken together, it means that the reported findings are very robust and complementing previous outcomes.

References

Artis, M.J. (2003). Is there a European business cycle? *mimeo.*

Artis, M.J., Z.G. Kontolemis, & D.R. Osborn (1997), Business Cycles for G7 and European Countries, *Journal of Business* 70, 249-279.

Artis, M.J. & Zhang, W. (1997). International business cycle and the ERM: is there a European business cycle? *International journal of Finance and Economics,* 2, 1-16.

Artis, M.J. & Zhang, W. (1999). Further evidence on the international business cycle and the ERM: is there a European business cycle? *Oxford Economic Papers*, 51, 120-132.

Artis, M.J., Z.G., Marcellino, M. & T. Proietti (2002), Dating the Euro Area Business Cycle, *EIU Working paper*, ECO N. 24.

Backus, D.K., & Kehoe, P.J. (1992). International Evidence of the Historical Properties of Business Cycles, *American Economic Review*, 82, 864–88.

Banerji, A., (2001). The Resurrection of Risk, *ECRI Working Paper* No. 2001/11A.

Basu, S. & Taylor, A.M. (1999). Business Cycles in international historical perspective, *Journal of Economic Perspectives,* 13, 72-76.

Baxter M. & King R.G. (1999). Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series, *The Review of Economics and Statistics*, 81, 575-593.

Bergman, U.M., Bordo, M.D. & Jonung, L. (1998). Historical Evidence on Business Cycles: The international Experience, in Beyond Shocks: What Causes Business Cycles? Ed. by J.C. Fuhrer and S. Schuh Federal Reserve Bank of Boston, Boston Ma.

Bry, G. & Boschan C., (1971). *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*, New York: Columbia University Press.

Burns, A.F. & W.C. Mitchell (1946). *Measuring Business Cycles*, NBER Studies in Business Cycles No.2, New York: Columbia University Press.

Canova, F. (1998a). Detrending and business cycle facts, *Journal of Monetary Economics*, 41, 475-512.

Canova, F. (1998b). Detrending and business cycle facts: A user's guide, *Journal of Monetary Economics*, 41, 533-540.

Carvalho, V.M. & Harvey, A.C. (2002). Convergence and Cycles in the euro-zone, Paper presented at the Colloquium on Modern Tools for Business Cycle Analysis, 28-29 November, Luxemburg.

Dalsgaard, T., J. Elmeskov, & C-Y Park (2002), Ongoing Changes in the Business Cycle – Evidence and Causes, *OECD Economics Department Working Paper* no. 315.

Del Negro, M. & C. Otrok (2003), Time-Varying European Business Cycles," mimeo, University of Virginia.

Diebold, F.X. & Rudebusch, G.D. (1990). A nonparametric investigation of duration dependence in the American business cycle, *Journal of Political Economy*, 98, 596-616.

Diebold, F.X. & Rudebusch, G.D. (1992). Have Postwar Economic Fluctuations Been Stabilized?, *American Economic Review*, 82, 993–1005.

Doyle, B. & J. Faust (2002a), An Investigation of Co-movements among the Growth Rates of the G-7 Countries, *Federal Reserve Bulletin*, October 2002, 427 – 437.

Doyle, B. & J. Faust (2002b), Breaks in the Variability and Co-Movement of G-7 Economic Growth, mimeo, Federal Reserve Board.

Frankel, J.A. & Rose, A.K. (1997). Is EMU more justifiable ex post than ex ante?, *European Economic Review*, 41, 753-760.

Harding D. & Pagan, A.R. (2001), Some Econometric Problems with Regressions Using Constructed State Variables, *mimeo*.

Harding D. & Pagan, A.R. (2002a). Dissecting the Cycle: A Methodological Investigation, *Journal of Monetary Economics*, 49, 365-381.

Harding D. & Pagan, A.R. (2002b). Synchronisation of Cycles, *mimeo.*

Harding D. & Pagan, A.R. (2003). A Comparison of Two Business Cycle Dating Methods, *Journal of Economic Dynamics and Control,* Vol. 27, N. 9.

Harding D. & Pagan, A.R. (2004). A Sugested Framework for classifying the Modes of Cycle Research, *mimeo.*

Heathcoate, J. & F. Perri (2002), Financial Globalization and Real Regionalization, *NBER Working Paper*, 9292.

Helbling, T. & T. Bayoumi (2003), Are They All in the Same Boat? The 2000-2001 Growth Slowdown and the G-7 Business Cycle Linkages, mimeo, International Monetary Fund.

IMF, (2002). World Economic Outlook. Trade and Finance, September, Ch. 3, Washington.

Inklaar R. & de Haan, J. (2001). Is there really a common euro-zone business cycle? A comment, *Oxford Economic Papers*, 53, 215-220.

Jacobs, J (1998). *Econometric Business Cycle Research*, Kluwer Academic Publishers, Boston.

Kontolemis, Z. & Samiei, H. (2000) The UK business cycle, monetary policy and EMU entry, IMF *Working Paper* WP/00/210.

Kose, M.A., E.S. Prasad, & M.E. Terrones (2003), How Does Globalization Affect the Synchronization of Business Cycles?, *IZA Discussion Paper* no. 702.

Luginbuhl, R. & S.J. Koopman (2003), Convergence in European GDP Series: A Multivariate Common Converging Trend-Cycle Decomposition, *Tinbergen Institute Discussion Paper* 2003-031/4.

Massmann, M., Mitchell, J. & Weale, M. (2003), Business cycles and turning points: a survey of statistical techniques, *National Institute Economic Review*. No. 183.

McNemar, Q (1947). Note on the sampling error of the difference between correlated proportions or percentages, *Psychometrika*, 12, 153-157.

Mitchell, J. & Mouratidis, K. (2002). Is there a common euro-zone business cycle? Paper presented at the Colloquium on Modern Tools for Business Cycle Analysis, 28-29 November, Luxemburg.

OECD, (2002). Economic Outlook, 71, July, Ch. V, Paris.

Pagan, A. (1997). Towards an understanding of some business cycles characteristics, *The Australian Economic Review*, 30, 1-15.

Romer, C.D. (1995), Remeasuring business cycles, *NBER Working Paper*, 4150, 573-609.

Selover, D.D. & Jensen, R.V., (1999). 'Mode-locking' and the international business cycles trasmission. *Journal of Economic Dynamics and Control*, 23, 591-618.

Sheskin, D.J. (2000). *Handbook of Parametric and Nonparametric Statistical Procedures,* 2nd edition*,* CRC Press.

Smith, P.A. & Summers, P.M. (2001). Synchronization of Business Cycles in the G7 Countries: Evidence from Bayesian Analysis of Markov Switching Models, mimeo, The University of Melbourne.

Stock, J.H. & Watson, M.W. (1999). *Business cycle fluctuations in U.S. macroeconomic time series*, in: J.B. Taylor and M. Woodford, editors, Hanbook of Macroeconomics, Volume 1, pp. 3-64, Elsevier, Amsterdam.

Stock, J.H. & Watson, M.W. (2003). Understanding Changes in International Business Cycle Dynamics. *NBER Working Paper*, No. w9859.

Watson, M.W. (1994). Business Cycle Durations and Postwar Stabilization of the U.S. Economy." *American Economic Review*, 84, 24-46.

Zarnovitz, V. (1992). *Business Cycles: Theory, History, Indicators, and Forecasting*, University of Chicago Press, for NBER.