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ON BUSINESS CYCLES SYNCHRONIZATION: SOME DIRECTIONS FOR THE EURASIA†

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Abstract

The synchronization of business cycles is strictly related with the functioning conditions in the currency areas. Being a general requirement for membership in such an area, the synchronization of business cycles was probed by the view that, in any case, it would result from the very operation of the optimal currency zone. For Eurasia as a broad context, the European perspective seems to be important. For instance, the experience of a formal economic union such as the one that has existed in Europe since 1999 could be harnessed to better understand the challenges that a union of this kind might face in Eurasia, just as the one that has recently been constituted. The article considers this approach, through the analysis of the evolution of the synchronization of business cycles, as a relevant element in the (smooth) functioning of any economic and monetary union. Taking this into account, we consider a reasonably long time period (1990-2016) and a large sample of countries (50), i.e. all those integrated into some kind of formal economic union existing in this relevant geopolitical region, namely the European Union (EU) and the Eurasian Economic Union (EAEU), as well as 17 non-integrated countries, as a control group. In what concerns the results, during the 1990-1998 period, the degree of business cycles synchronization was, in general, fairly low, even for countries already integrated in an economic community. The degree of synchronization of business cycles has, generally, fairly increased in the period 1999-2007, notably in European countries (not in the EU alone). Finally, in the period 2008-2016, which includes the recent global financial crisis, there was a broad decline in the synchronization of business cycles, which was not so obvious for the countries integrated in a formal economic union. In fact, it seems to be possible to conclude that belonging to a union of this kind is a crucial prerequisite for the inexistence of evidently idiosyncratic business cycles.

Keywords: Business Cycles, Eurasia, Eurasian Economic Union, European Union

JEL Classifications: C38, F44, N14

1. Introduction

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The process of synchronization of business cycles seems to be firmly linked with the operational settings in the formal currency areas. Being a general requisite for participation in such an area, the synchronization of business cycles was disputed by the view that, in any case, it would result (*a posteriori*) from the suitable functioning of an optimal currency area. The European experience seems to be significant for a large and differentiated group of the countries we include in the broad designation of Eurasia. In this line, the experience of a formal economic union such as the one that has existed in Europe for about two decades could be harnessed to better understand the challenges that a union of this kind might face in Eurasia, just as the one that has recently been established. The article reflects this approach, through the analysis of the evolution of the synchronization of business cycles, as a relevant element in the smooth functioning of any economic and monetary union.

Taking this into account, we consider in the study a reasonably long time period (1990-2016) and a large sample of countries (50), i.e. all those integrated into some kind of formal economic union existing in this important geo-economics' and geopolitical region, namely the 28 European Union (EU) member-states and the 5 Eurasian Economic Union (EAEU) member-states, as well as 17 non-integrated countries, as a control group.

The time period covered in the article begins after the overthrow of the "Berlin Wall" in 1989, an event that marked the beginning of the gradual transition from a bipolar vision of the world global order to a world of multipolar nature. To the break-up of the USSR, it followed the emergence of the Commonwealth of Independent States (CIS) in 1991 and subsequent attempts to create an economic and political union, whose most recent progress led to the foundation of the EAUE in 2015.

The break-up of Yugoslavia after the military conflicts of the beginning of the nineties and the subsequent political and institutional adjustments led to the establishment of new sovereign states on the Balkan peninsula, two of which are already members of the EU (Slovenia and Croatia) while the others have submitted their candidature and are in the process of accession to the EU (Bosnia and Herzegovina, Macedonia, Montenegro, Serbia and Kosovo).

Meanwhile, in the period under consideration and due to the political reconfiguration of Europe after 1989, the EU has also undergone major structural changes. These changes have taken place in the composition of the EU, since the successive enlargement processes have led it to increase from 12 members in 1990 to the current 28 countries, and also in the existence of a progressive deepening of the integration process by the set-up of the European Single Market in 1993 (including the free circulation of goods, services, workers and capital) and the subsequent creation of the Monetary Union in 1999, with the Euro zone currently encompassing 19 EU Member-States.

At the global level, there were also profound changes in the multilateral trading system, in particular with the establishment of the World Trade Organization (WTO) in 1994 and the entrance of many countries in this organization, which has currently 164 countries as full members and 23 with the statute of observers, in which should be highlighted the entrance of China in 2001. At the WTO momentum, there were successive waves of trade and investment liberalization on a global scale, which allowed the development and the consolidation of Global Value Chains (GVC) under the control of large transnational firms, which spread their influence around the world, boosting intense trade flows at a global level, which are particularly significant for intermediate products and manufacturing components.

Finally, a brief reference should be made to the financial turbulence and the global economic downturn occurred after 2007, following the so-called subprime crisis succeeding the collapse of Lehman Brothers Bank in the US. The turbulence and volatility quickly spread to the rest of the world, especially affecting some countries of the Euro zone that, in view of the high public indebtedness, had difficulties in accessing international financing and had to resort to financial support from international institutions.

In sum, significant political, economic and financial changes took place during the period under review, confirming the acceleration of the globalization process, which naturally reflected the strengthening of economic interdependence among the Eurasian countries and, as a consequence, should be revealed by the trends in the synchronization of business cycles in the Eurasian countries. Thus, in our perspective, it seems to be relevant to scrutinize how markets,

institutions and policies reinforce regional economic integration processes. Hence, the main purpose of this article is, therefore, to identify the major trends in the business cycles synchronization among some European and Asian countries during the last decades.

The rest of the article is structured as follows: a brief review of the literature occupies Section 2; Section 3 presents the methodology; in Section 4, the data is presented and the methodology is applied; Section 5 concludes in the usual way.

2. Literature Review

Allegedly, the issue of the synchronization of business cycles would have been studied for the first time in the literature on optimal currency areas (Mundell, 1961; McKinnon, 1963; Kenen, 1969). In fact, the existence of sufficiently synchronized business cycles between the potential members of this currency union would be a necessary condition for the benefits (of a single monetary policy) to exceed the costs (of loss of national monetary policies) of accession to that area.

As it is well known, on 1 January 1999, with the official launch of the Euro as the single currency of the acceding countries, the Euro zone was put into practice, which was an undeniable prototype of a monetary union. Thus, it is not surprising that, between the mid-1990s (see, for instance, de Grauwe, 1996; Artis and Zhang, 1997) and the early 2000s (see, for instance, Altavilla, 2004), there was a great deal of interest (again) in the literature on the synchronization of business cycles, particularly in the candidate countries and (eventually) members of the Euro zone.[1]

Indeed, the need for the Euro zone candidate countries to meet, *ex ante*, a series of conditions for them to join the single currency demonstrates one of the approaches that has, right away, sparked some debate about the endogeneity (or not) of the eligibility criteria for the accession to the Euro zone (Frankel and Rose, 1997; Frankel and Rose, 1998). Indeed, one of the main reasons for arguing that the convergence of business cycles would be the natural consequence of the monetary union was based, in general terms, on another condition already identified in the seminal literature on the optimal currency areas (OCAs) *a la* Mundell. It states that the greater the degree of trade integration among the member countries of an OCA, the greater the benefits associated with the reduction of transaction costs as a result of the adoption of a single currency.

Thus, increased trade intensity, as a result of belonging to a formal economic area with those characteristics (Rose, 2000; Glick and Rose, 2002), would endogenously lead to the convergence of business cycles (Rose *et al.* 2000). In other words, greater trade intensity/linkages (among the members of a currency union, such as the Euro zone,) would lead to a higher correlation of their business cycles, this being a result that has received some clear empirical support (Fatas, 1997; Frankel and Rose, 1997; Frankel and Rose, 1998; Clark and van Wincoop, 2001).

As a result, trade integration, but also financial integration (Schiavo, 2008) and economic integration (Kalemli-Ozcan *et al*., 2001; Rose and Engel, 2002), in general, should play an important role in synchronizing business cycles. As a matter of fact, as these kinds of integration become possible only, or easier, in certain countries whose economic performance is sufficiently robust, the convergence of business cycles as a result of greater trade, financial or economic integration seems to be necessarily valid only for (more) industrialized/developed countries (Kose *et al*., 2003b; de Haan *et al*., 2008; Inklaar *et al*., 2008).

An obvious consequence of this well-established statement is that the existence of an integrated economic area, such as the European Union, eventually related with a currency or monetary union, such as the Euro zone, does not guarantee a rapid convergence of business

[1] This does not mean that this subject does not continue to be of interest in the literature (on the European Union and, in particular, on the Euro zone). Some recent references include Matesanz and Ortega (2016), Lukmanova and Tondl (2017), and Caetano *et al.* (2018). Other references, less recent, but which attest to how this subject has deserved continuous attention by that literature, include Camacho *et al.* (2006), Montoya and de Haan (2008), Papageorgiou *et al*. (2010), Aguiar-Conraria and Soares (2011), and Caleiro (2012).

cycles when, as it seems to be the case, that area is composed by several countries with relatively different economic performances[2].

Obviously, the increasing of economic globalization process, through its effects on world trade (Kose and Yi, 2001) and investment flows, has meant that the issue of the synchronization of business cycles is not limited to formal integrated economic regions, much less the European Union or the Euro zone.[3]

From a global point of view, the phenomenon of globalization has raised the question of the existence of a world business cycle, towards which economies would tend to converge. This would mean that the, so-called, 'border effect(s)' would be less evident (Clark and van Wincoop, 2001; Montoya and de Haan, 2008). The existence of a global business cycle has received some empirical support (Kose *et al*. 2008) through the existence of a common global factor, allegedly associated with common (but distinct, in accordance to the historical moment) shocks (Kose *et al.* 2003a).

More recently, this view has been challenged by a phenomenon associated with the clustering of business cycles. For instance, Kose *et al*. (2012), by considering three groups of countries: industrial, emerging markets, and other developing economies, showed that there would have been convergence of business cycles within each of those groups, but divergence between groups. On reflection, this is not a surprising result when one thinks of the existence of a core and a periphery within the European Union itself.

From a specific point of view, the globalization process has raised the question of the increased importance of (notably some) Asian economies. Again calling the attention for the importance of trade integration on business cycles synchronization, Shin and Wang (2003) considered five East Asian countries (China, Hong Kong, Japan, Korea and Taiwan), five ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore and Thailand) and two other Asian countries (Bangladesh and India), during the period 1976-1997. Intra-industry trade in nature was found to be the major channel through which business cycles became (more) synchronized among those Asian economies, during that period. It is important to note that it is clearly acknowledged that an increase in trade linkages does not necessarily lead to an increase on business cycles synchronization. In fact, an increase in inter-industry trade, as a synonymous of specialization, may mean a decrease on the synchronization of business cycles (Krugman, 1993).

As the authors themselves acknowledged, the main conclusion of Shin and Wang (2003) in turn, would be relevant to an eventual currency union in the area. This prospect (on the monetary side), as well the consolidation of an East Asian economic community (on the trade side) were identified by Rana (2007), even if only on the long-run. By considering the, so-called, ASEAN+3 countries (i.e. the 10 members of the Association of Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam; plus People's Republic of China, Japan, and Republic of Korea), it is concluded that, in general, the business cycles of those economies became more synchronized (during the period 1989-2003).

More recently, Allegret and Essaadi (2011) examined again the viability of a monetary union in East Asia by putting the focus on business cycles synchronization. It is shown that the increase on the synchronization of the business cycles of the economies of that region as the consequence of the increase in bilateral trade inside that region, as expected, is only

[2] Just as an illustration, almost a decade after the implementation of the Euro zone, the question remained: will (ever) the business cycles of the Euro zone converge, in order to being possible to identify a European business cycle? (Camacho *et al*. 2008; de Haan *et al*. 2008). In fact, after some indications of increased synchronization in the 1990s, there was indeed a marked increase in the synchronization (of business cycles) during the period 1999-2007, but with the onset of the financial crisis of 2008, there was a reduction of the synchronization, particularly in some countries notably affected by this serious economic crisis (Caetano *et al.* 2018).

[3] For instance, Torres and Vela (2003) and Burstein *et al*. (2008) considered the US-Mexico case, Calderon *et al.* (2007) examined the developing countries case, Canova *et al.* (2007) analyzed the G-7 case, Koopman and Azevedo (2008) looked at the Euro area, UK and US case, Inklaar *et al*. (2008) re-examined the OECD countries case, Fidrmuc and Korhonen (2010) inspected the emerging Asian economies and the OECD case, whereas Caleiro and Caetano (2017) focused on the Mercosul case.

unambiguous from a long-run perspective. From a short-run standpoint, the nature of the economic shocks and the kind of policy measures assume a critical role on business cycles. On reflection, this seems to be a perfectly expected result. Indeed, for instance taking into account what has happened in the European Union, in general, and in the Euro zone, in particular, after the 2008 crisis, the asymmetry of shocks, as well as the different fiscal policies of the Member-States have played a key role in the de-synchronization of (some) business cycles (Caetano *et al.* 2018).

In what concerns the Eurasia, the literature on the matter is, to the best of our knowledge, (very) scarce. An exception of this shortage of analysis is the study developed by Vymyatnina and Antonova (2014), which considered the business cycles synchronization of the former Soviet republics, Russia, Belarus and Kazakhstan, considered to be decisive in the creation of the Eurasian Economic Union.

3. Methodology

By definition, business cycles correspond to the evolution of the main economic aggregates, notably GDP, around their trend. Thus, to measure the synchronization of business cycles, it is first necessary to determine the time points in which the economy was expanding or contracting, i.e. its GDP was above or below its trend.

Clearly, a simple observation of data evolution does not, in general, allow, with the necessary rigor, to detect the phases of expansion and of contraction of the economy. In this sense, the simplest approach consists on the determination of the time periods where the GDP was above/below its average.

Given the usual nature of the GDP data, a moving average (over time) is more adequate than the simple average for the whole period under analysis. In this case, in order to calculate that average, understood as the tendency/trend, it is usual to consider the well-known filter of Hodrick and Prescott (1997) [4].

The Hodrick and Prescott (HP) filter computes the trend or average, g_t, of a time series, f_t, as the solution to the minimization problem:

$$\min_{\{g_t\}} \left[\sum_{t=1}^{T}(f_t - g_t)^2 + \lambda \sum_{t=2}^{T}\left((g_{t+1} - g_t) - (g_t - g_{t-1})\right)^2\right] \quad (1)$$

The HP filter therefore considers the trend of a time series as the one such that the cyclical component ($f_t - g_t$) subject to a 'smoothing' condition, which is reflected in the second term of the above expression, is minimized. Plainly, the higher the λ parameter, the smoother the trend and the less deviations from the trend will be 'penalized'. At the limit, as λ tends to ∞, the filter will choose ($g_{t+1} - g_t$) = ($g_t - g_{t-1}$), which means a linear trend. If, on the other hand, λ = 0, the original series is obtained.

Clearly, a key issue, when decomposing the data into a trend a cyclical component, using the HP filter is the value of the smoothing parameter, λ, to be used. For quarterly frequencies, the value mostly chosen is 1600, as originally suggested by Hodrick and Prescott (1997). For annual data, there is some controversy. Backus and Kehoe (1992) proposed a smoothing parameter of 100, which has been widely used in the literature since then.

However, Baxter and King (1999) showed that a value around 10 is much better, while Ravn and Uhlig (2002) show that λ = 6.25 produces almost exactly the same trend as when defining the smoothing parameter of 1600 for quarterly data.

In what follows, we applied the HP filter to the annual data, f_t, and computed the cyclical component, ($f_t - g_t$), for that using a value[5] of λ = 6. After that, following a standard approach, a

[4] Although the Hodrick-Prescott (HP) filter has been subject to some criticism and other, (apparently) more sophisticated, methods have been developed and applied (Baxter and Kouparitsas, 2005), we decided to use the HP filter as others studying the synchronization of business cycles have considered (Artis and Zhang, 1997; Christiano and Fitzgerald, 2003; Clark and van Wincoop, 2001; Montoya and de Haan, 2008).

[5] This task was done using the software Gretl (freely available at http://gretl.sourceforge.net), which, to the best of our knowledge, only allows integer numbers for the parameter λ.

correlation analysis of that cyclical component is performed in order to study the degree of business cycle synchronization[6].

4. Business Cycles Synchronization

4.1. The Data

The data, whose source is the World Bank national accounts data, and OECD National Accounts data files, correspond to the values of GDP (constant 2010 US$), for the period 1990 to 2016.[7]

With regard to countries (see the Table A1 in the Appendix), we consider all those integrated into some form of formal (economic) union existing in the relevant geographical area, namely the European Union (EU) and the Eurasian Economic Union (EAEU). In this sense, we consider all the current member states of the EU, i.e., Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom, which makes up 28 countries,[8] as well as the 5 current member states of the EAEU, i.e. Armenia, Belarus, Kazakhstan, the Kyrgyz Republic, and the Russian Federation, are also considered. As a control group, we also consider 17 non-integrated countries, namely Norway, Switzerland, Albania, Bosnia and Herzegovina, Iceland, Kosovo, Macedonia, Montenegro, Serbia, Turkey, Azerbaijan, Georgia, Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan (see Table 1).

Table 1. Eurasia countries in the sample (ISO codes)

European Union (28)	AUT BEL BGR CYP CZE DEU DNK ESP EST FIN FRA GBR GRC HRV HUN IRL ITA LTU LUX LVA MLT NLD POL PRT ROU SVK SVN SWE
EU candidates (7)	ALB BIH MKD MNE SRB TUR XKX
CIS (12)	ARM AZE BLR GEO KAZ KGZ MDA RUS TJK TKM UKR UZB
Other countries (3)	CHE ISL NOR

Note: we use different colors for the four groups of countries considered in the study.

In what concerns the time periods under analysis, the segmentation of the whole period (1990-2016) into three sub-periods of equal temporal duration, i.e. 9 years, seems to be desirable. Therefore the first one corresponds to the years from 1990 until 1998. The subsequent second period goes from 1999 until 2007. The last time period runs from 2008 to 2016. In addition to these reasons, the first sub-period corresponds to the years prior to the adoption of the Euro, the subsequent second period goes from the creation of the Euro zone until the beginning of the financial and economic crisis.

4.2. The Results

Considering the whole period under review, i.e., 1990 to 2016, Figure 1 plots the correlation coefficients between the cyclical components of the GDPs, added with some clusters.[9] From its inspection, it is evident that, even when considering a high number of clusters, in the case 10, most of the countries, i.e. 29, are grouped in 3 clusters (with a large number of countries, representing 58% of the sample), which are characterized by a fairly high degree of business

[6] This analysis was done mostly using some R packages (http://www.r-project.org).
[7] Data are available at https://data.worldbank.org/indicator/NY.GDP.MKTP.KD (accessed on March 02, 2018).
[8] As is well-kwon, of these, 9 of them are not (currently) part of the Euro zone, namely Bulgaria, Croatia, the Czech Republic, Denmark, Hungary, Poland, Romania, Sweden, and the United Kingdom.
[9] For an easier reading of this and the other figures, see the list of corresponding ISO codes for each country in the Annex.

cycle synchronization. This is basically so because there are some countries whose business cycles, in the period under review, are significantly out of synchronization with the rest, in particular Kosovo, Azerbaijan, the Kyrgyz Republic, Tajikistan, Belarus and Turkmenistan (see Table A2 in the Appendix).

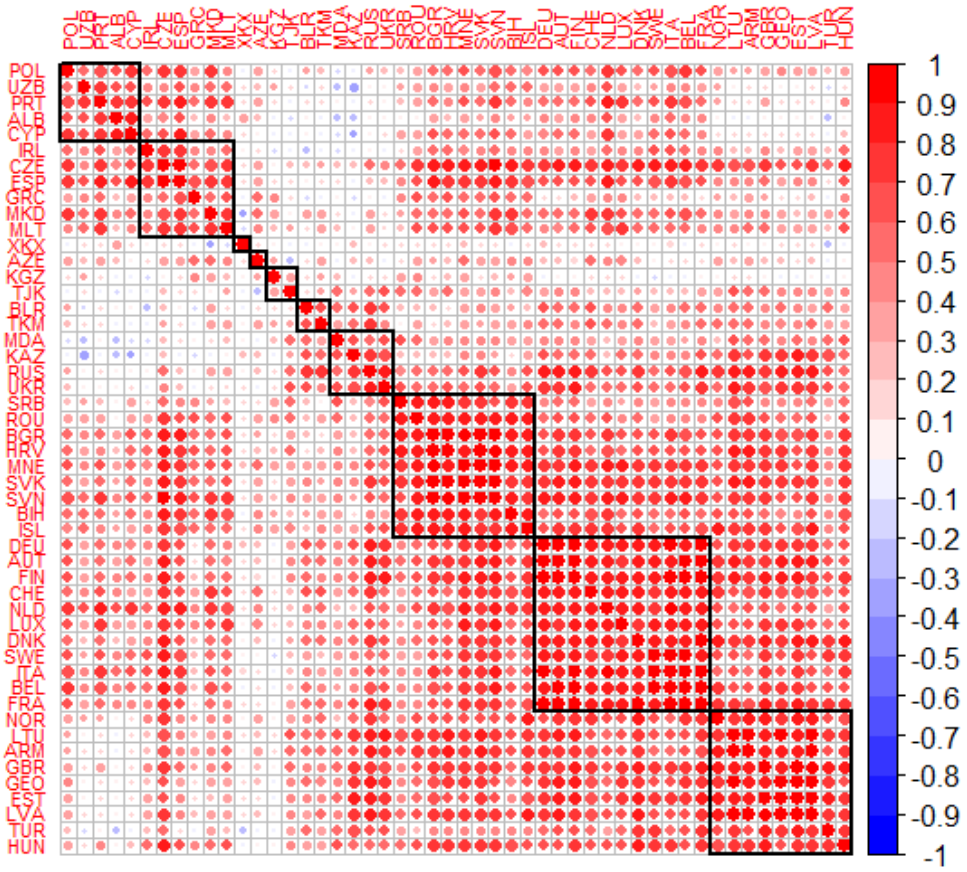

Figure 1. Correlations (with 10 clusters) for 1990-2016

The existence of major clusters with particular importance is also emphasized in Table 2, although their composition is due to diverse reasons. First, it should be highlighted the cluster composed by countries whose business cycles are similar, but that are not necessarily integrated in the same formal economic union. This cluster, which, in fact is the largest, is composed of 11 countries, namely Germany, Austria, Finland, Switzerland, Netherlands, Luxembourg, Denmark, Sweden, Italy, Belgium and France. Second, also a cluster of countries is composed, fundamentally, by geographically/culturally close country. This cluster includes Serbia, Romania, Bulgaria, Croatia, Montenegro, the Slovak Republic, Slovenia, Bosnia and Herzegovina, and Iceland.

Table 2. Five major clusters on GDP correlations for 1990-2016

Clusters	Countries
1.st (11)	DEU AUT FIN NLD LUX DNK SWE ITA BEL FRA CHE
2.nd (9)	SVK SVN ROU BGR HRV SRB MNE BIH ISL
3.rd (9)	HUN LTU GBR EST LVA ARM GEO TUR NOR
4.th (6)	IRL CZE ESP GRC MLT MKD
5.th (5)	POL PRT CYP UZB ALB

Considering the first sub-period, i.e. 1990 to 1998.[10] As Figure 2 clearly displays that during this time, the degree of business cycles synchronization was, in general, fairly low, even for countries already integrated in a formal economic community, namely the European Union.

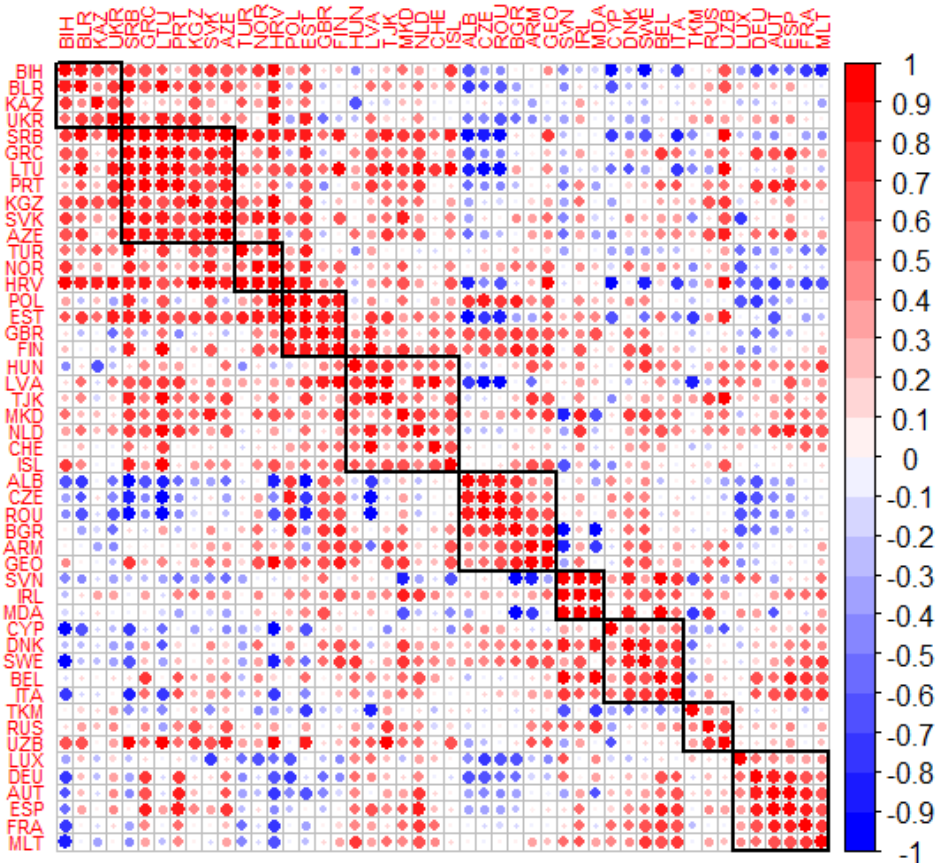

Figure 2. Correlations (with 10 clusters) for 1990-1998

In this period of commonly low synchronization of business cycles, it is nonetheless noteworthy that, despite this, almost all countries in individual terms was extremely well correlated with another country, which may indicate the existence of strong relations between these pairs of countries (more detailed information is available in Table A3 in the Appendix).

Although not so evident, as shown in Figure 2, there are also, even in this period, some clusters of countries whose business cycles were reasonably well synchronized (see Table 3), for no apparent reason, such as belonging to a (the same) formal economic union or mere geographic distance and neighborhood relationships.

We recall that this period coincides with the break-up of the Soviet Union and with the phase of military conflicts in the Balkans and the subsequent emergence of new independent states. Hence, it is not surprising that there has been a sturdy turbulence in the bilateral economic relations of those countries, as well as a sharp fall in economic growth of some of these economies. These facts determined that some countries have shown a low degree of synchronization of their business cycles.

[10] Given that the data for Kosovo is available only for 2000 onwards, this country was excluded from the analysis corresponding to this sub-period. Montenegro was also excluded from the analysis for this period due to the fact that, for this country, data is available only for 1997 onwards, i.e. only 2 observations, which means that a perfect negative/positive correlation would arise.

Table 3. Five major clusters on GDP correlations for 1990-1998

Clusters	Countries
1.st (7)	GRC LTU PRT SVK KGZ AZE SRB
2.nd (7)	HUN LVA NLD CHE ISL TJK MKD
3.rd (6)	CZE ROU BGR ARM GEO ALB
4.th (6)	LUX DEU AUT ESP FRA MLT
5.th (5)	CYP DNK SWE BEL ITA

As is well recognized, for the second sub-period, 1999-2007, it would have been of particular importance for some of the sampled countries, their formal accession to the European Union and, in other way, the set-up of the European Monetary Union, involving 12 EU Member-States at the moment. In fact, either a priori or a posteriori, it was expected that the business cycles of the countries adhering to the EU and the others entering in the Euro zone would be more synchronized in their business cycles (Caetano *et al*. 2018). Furthermore, as anticipated, this increase in synchronization would spread to other countries, particularly in a period of widespread economic expansion.

Figure 3 is evidently in clear concordance with the previous stylized facts; see also Table A4 in the Appendix.

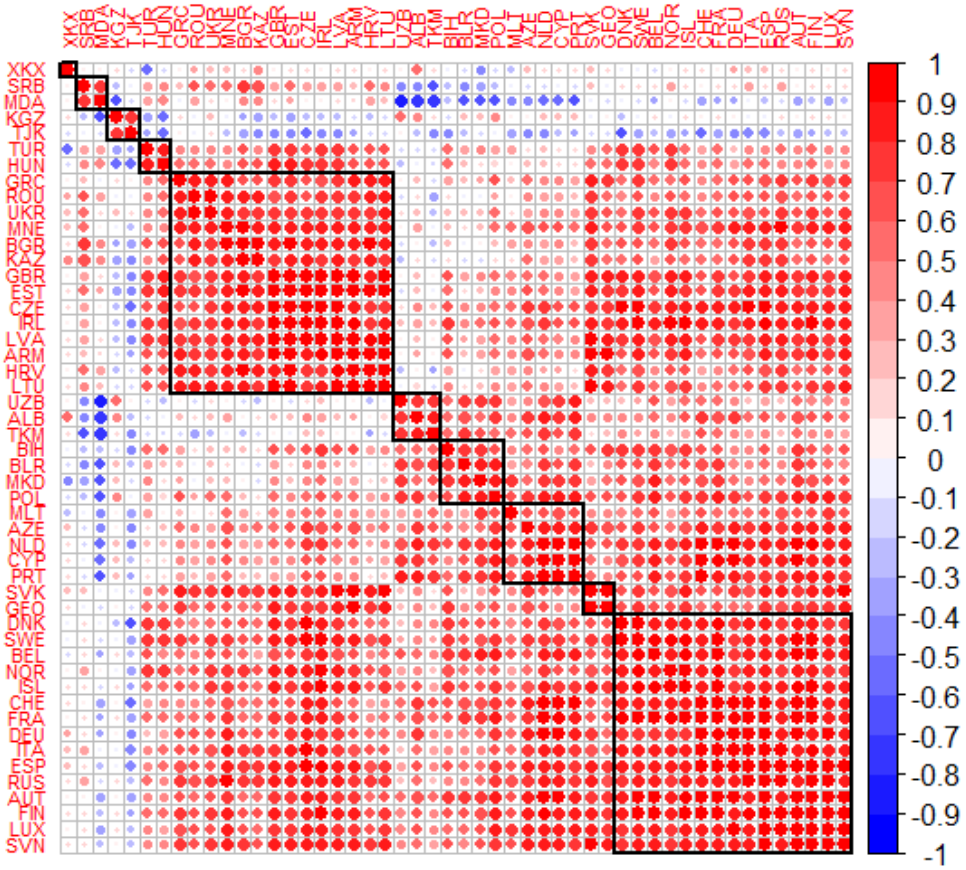

Figure 3. Correlations (with 10 clusters) for 1999-2007

As Figure 3 shows, the period 1999-2007, was characterized by a substantial increase in the synchronization of the business cycles of the countries in the sample. However, there was some remarkable exceptions to this considerable increase as displayed for Moldova, the Kyrgyz Republic, Tajikistan, Albania, Uzbekistan and Turkmenistan.

A visual inspection of Figure 3 and Table 4 shows also the existence of two particularly important clusters, covering almost 60% of the countries in the sample (one of them made of 14 countries and the other composed by 15 countries). In either case, the general lesson seems to be that belonging to the same formal economic union seems to be a condition conducive to greater synchronization of business cycles.

Table 4. Five major clusters on GDP correlations for 1999-2007

Clusters	Countries
1.st (15)	DNK SWE BEL FRA DEU ITA ESP AUT FIN LUX SVN NOR ISL CHE RUS
2.nd (14)	GRC ROU BGR GBR EST CZE IRL LVA HRV LTU ARM KAZ UKR MNE
3.rd (5)	NLD CYP PRT MLT AZE
4.th (4)	BIH MKD BLR POL
5.th (3)	UZB TKM ALB

This condition may, however, not be a necessary requirement for two ways. There are countries that, belonging to that formal economic union, do not appear so well synchronized (for example, Cyprus, Malta, and Portugal), just as there are countries that do not formally belong to that economic union but present themselves reasonably well correlated with the generality of the Member-States of that formal economic area (for instance, the Russian Federation and Switzerland).

It is also relevant to note down that the larger cluster involves the core countries of the Euro zone (Germany, France, Italy, Spain), but also of the Western European countries not EU members and, curiously, the Russian Federation. Thus, membership of a monetary area does not seem to be the essential reason for the synchronization of business cycles, which is confirmed by the fact that the Euro zone countries were divided among the three main clusters in this period.

As it is well known, around 2008, a financial crisis broke out at (almost) global level. Indeed, this crisis has particularly affected certain countries, some of which have, even in the context of economic contraction, had to apply austerity and contractionary economic policies. Consequently, the degree of synchronization of business cycles would be expected to decline.

By comparison with the preceding period, Figure 4 shows that in the period 2008-2016, there was a widespread decrease in the grade of synchronization of business cycles, in particular for those countries that, in the previous period, were already less synchronized (see also Table A5 in the Appendix).

From Figure 4 and Table 5, it is also possible to verify the existence of a number of clusters with more homogeneous dimensions, which, in the end, is consistent with what was said above, with respect to the evolution of the synchronization of the business cycles in 2008-2016 vis-a-vis 1999-2007.

We also point out that the largest cluster has 11 countries and most of them are Balkan countries, reflecting the strengthening of regional integration after the end of military and political turmoil in that region. A final reference to the fact that the Euro zone countries that displayed greater adjustment capacity in the tough period of the Sovereign Debt crisis are part of the 4th largest cluster (especially Germany, France Austria and Finland), while the EU countries mostly affected by this crisis share the same cluster (as the case of Portugal, Ireland and Spain, lacking only Greece), thus demonstrates that there were distinct effects on the economic growth of countries integrated in the same monetary union (Caetano *et al*. 2018).

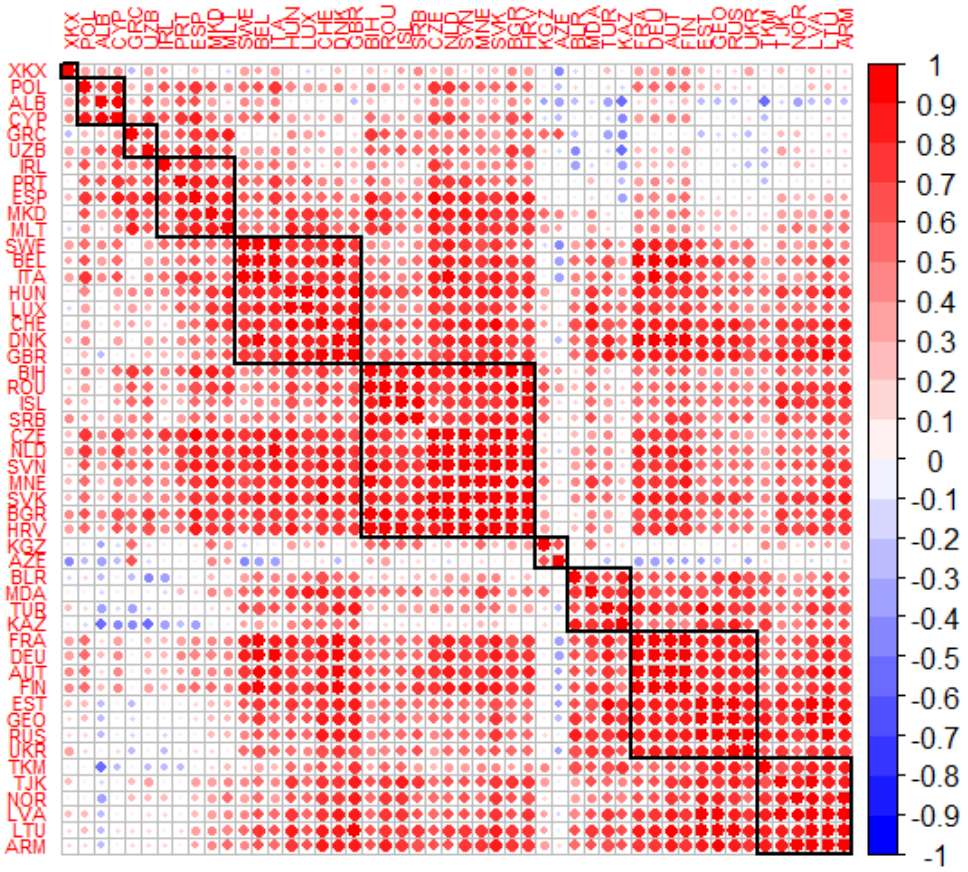

Figure 4. Correlations (with 10 clusters) for 2008-2016

Table 5. Five major clusters on GDP correlations for 2008-2016

Clusters	Countries
1.st (11)	ROU CZE NLD SVN SVK BGR HRV BIH MNE SRB ISL
2.nd (8)	SWE BEL ITA HUN LUX DNK GBR CHE
3.rd (8)	FRA DEU AUT FIN EST GEO RUS UKR
4.th (6)	TKM TJK ARM LVA LTU NOR
5.th (3)	IRL PRT ESP MLT MKD

Following the presentation and brief discussion of the overall results, we will now address two aspects that we consider relevant to assess the trends of regional integration in Eurasia. In this way, we will successively analyze the evolution of the synchronization of business cycles within the EAEU and then focus on the assessment of the business cycle trajectories of the countries that are candidates for EU membership. The choice of these cases, apart from the specific interest of each one, shows the robustness of the results of this methodology that can be replicated and exploited in different situations.

After the dissolution of the Soviet Union, the Commonwealth of Independent States (CIS) was founded in 1991, integrating 12 of the former USSR republics with the purpose of strengthening economic ties and creating a political union. Several forms of regional integration have been developed over time (Kirkham, 2016) despite without great success in strengthening economic interdependence among members and with very different performances. The Eurasian Economic Union (EAEU) is the latest organization emerging from the original CIS, constituting a customs union since 2011 and an economic union since 2015. In this way, we consider relevant for the objectives of this work to analyze the synchronization of business cycles in 5 countries that make up this economic community.

Table 6 presents the results of the bilateral synchronization between the countries that make up the EAUE. From its brief analysis, we emphasize two issues: first, the average correlation levels are noteworthy for Armenia, Kazakhstan, Belarus and Russia and only Kyrgyzstan presents low degree of synchronization; second, the bilateral perspective shows some very high correlations, especially in the RUS-ARM, KAZ-BLR, RUS-BLR and RUS-KAZ pairs, which indicates that the Russian economy is a fundamental reference point, perhaps hegemonic (Vinokurov, 2017), in the relations with the other members of the community.

Table 6. Bilateral GDP correlations in Eurasian Economic Union (2008-16)

Countries	ARM	BLR	KAZ	KGZ	RUS
ARM	1	0.59	0.60	0.34	0.90
BLR	0.59	1	0.82	0.08	0.40
KAZ	0.60	0.82	1	0.15	0.80
KGZ	0.34	0.08	0.15	1	0.19
RUS	0.90	0.81	0.80	0.19	1
Average	0.61	0.58	0.59	0.19	0.57

Another avenue for exploring the results which seem to us very stimulating is the verification of the degree of synchronization of the business cycles of the applicant countries to the EU, with this community as a whole and with its individual Member States.

The observation of Figure 5 shows that all candidate countries have made progress over the periods under consideration in synchronizing their business cycles with that of the EU (as the average of its 28 Member States). The countries that have the greatest synchronization with the EU are Montenegro, Bosnia and Herzegovina and Serbia, while in opposite terms Kosovo displays a low degree of synchronization.

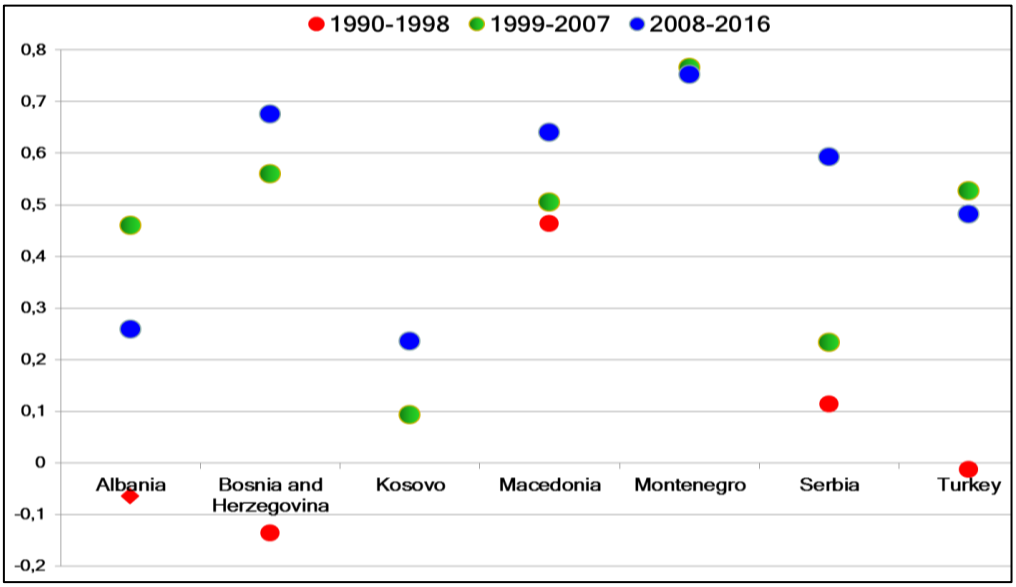

Figure 5. Average GDP correlation of EU candidates with EU

Additionally, Figure 6 allows us to argue that the trend of synchronization with the EU has revealed some homogeneity with respect to all its individually considered members. Thus, the reduction of the standard deviation of the degree of synchronization of the business cycles of the candidates with the current members of the EU is evident, suggesting that there has been an approximation of the trajectories of the cyclical components of economic growth between the two groups of countries.

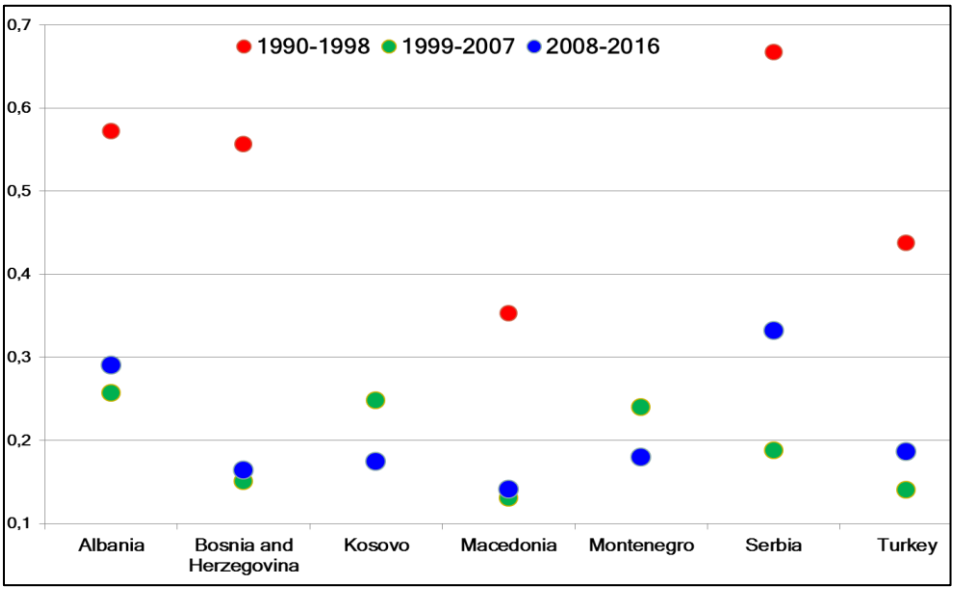

Figure 6. Standard deviation of GDP correlation of EU candidates with EU members

In sum, the growing synchronization of business cycles between EU candidates and its current Member-States suggests a gradual strengthening of the interdependence and integration of economies, and we can therefore conclude that essential conditions are being created so that the full accession of these countries to the EU can take place in a relatively short time and would be successful.

5. Conclusion

Summing up, during the 1990-1998 period, the degree of business cycles synchronization was, in general, fairly low, even for countries already integrated in a formal economic community as is the case of the European Union. We recall that the first half of that decade was marked by high exchange rate volatility and financial instability in the EU, which contributed to modest economic growth.

In addition, with respect to the countries that resulted from the collapse of the USSR and which integrated the CIS[11] and the new states that emerged from the military conflict in the former Yugoslavia, this period was influenced by the instability caused by the transition from planned to market economy systems, which severely reduced the GDP of those countries. Naturally, such instability, linked to the breakdown of economic relations of neighborhood and between countries that fought back in the military conflict, caused a reduced degree of business cycles synchronization between these countries.

In a different trend, we find that in the subsequent period of 1999-2007, the degree of synchronization of business cycles has, generally, fairly increased, notably in European countries (not in the EU alone). Indeed, the recovery of normality in bilateral economic relations that have been restored in a climate of peace, the rapid insertion of central planned economies into global markets, coupled with the good economic performance of the EU, which has since extended to the countries of Central and Eastern Europe, as well as the notable behavior of the Euro zone, which led to a rapid decline and convergence of interest rates and inflation, led to robust economic growth and high synchronization of business cycles in Eurasia.

[11] It should be noted that the Baltic States (Estonia, Lithuania and Latvia) which at the time were part of the USSR did not join the CIS. These states, together with the so-called Eastern European countries with centrally planned economies (Poland, Czech Republic, Slovakia, Hungary, Romania and Bulgaria) joined the EU during the first decade of this century, together with the two states which comprised ex-Yugoslavia (Slovenia and Croatia) and the independent Mediterranean island states Cyprus and Malta.

Finally, in the period 2008-2016, which includes the recent global financial crisis, there was a broad decline in the synchronization of business cycles, which was not so marked for the countries integrated in a formal economic union. In fact, it seems to be possible to conclude that belonging to a union of this kind is a crucial prerequisite for the inexistence of evidently idiosyncratic business cycles.

This is a work that, obviously, presents some limitations, which we intend to eliminate or at least mitigate in future research. In particular, the determination of the explanatory factors – for example, intensity and the nature of trade flows, foreign direct investment flows, or even economic policy measures – of the evolution of the synchronization of business cycles here presented seems to be a promising avenue for future analysis.

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Appendix

Table A1. The list of countries and their ISO codes

ALB	Albania	KAZ	Kazakhstan
ARM	Armenia	KGZ	Kyrgyz Republic
AUT	Austria	LTU	Lithuania
AZE	Azerbaijan	LUX	Luxembourg
BEL	Belgium	LVA	Latvia
BGR	Bulgaria	MDA	Moldova
BIH	Bosnia and Herzegovina	MKD	Macedonia
BLR	Belarus	MLT	Malta
CHE	Switzerland	MNE	Montenegro
CYP	Cyprus	NLD	Netherlands
CZE	Czech Republic	NOR	Norway
DEU	Germany	POL	Poland
DNK	Denmark	PRT	Portugal
ESP	Spain	ROU	Romania
EST	Estonia	RUS	Russian Federation
FIN	Finland	SRB	Serbia
FRA	France	SVK	Slovak Republic
GBR	United Kingdom	SVN	Slovenia
GEO	Georgia	SWE	Sweden
GRC	Greece	TJK	Tajikistan
HRV	Croatia	TKM	Turkmenistan
HUN	Hungary	TUR	Turkey
IRL	Ireland	UKR	Ukraine
ISL	Iceland	UZB	Uzbekistan
ITA	Italy	XKX	Kosovo

Table A2. Some results on synchronization [1990-2016]

Country	Average Correlation	Highest Synchronization		Lowest Synchronization	
		Country	Correlation	Country	Correlation
Albania	0.256	Cyprus	0.816	Moldova	-0.279
Armenia	0.599	Lithuania	0.974	Albania	-0.077
Austria	0.665	Finland	0.978	Kyrgyz Republic	0.063
Azerbaijan	0.257	Switzerland	0.545	Tajikistan	-0.272
Belarus	0.345	Russian Federation	0.747	Ireland	-0.238
Belgium	0.630	France	0.952	Kosovo	-0.050
Bosnia and Herzegovina	0.572	Bulgaria	0.857	Kosovo	-0.008
Bulgaria	0.630	Croatia	0.976	Kyrgyz Republic	-0.056
Croatia	0.613	Bulgaria	0.976	Kosovo	0.123
Cyprus	0.354	Albania	0.816	Kazakhstan	-0.314
Czech Republic	0.652	Slovenia	0.920	Kyrgyz Republic	0.041
Denmark	0.628	France	0.933	Kyrgyz Republic	-0.056
Estonia	0.576	Latvia	0.963	Kyrgyz Republic	-0.091
Finland	0.675	Austria	0.978	Kyrgyz Republic	0.078
France	0.640	Finland	0.956	Kyrgyz Republic	0.036
Georgia	0.574	Estonia	0.947	Kyrgyz Republic	-0.002
Germany	0.636	Finland	0.954	Kyrgyz Republic	-0.002
Greece	0.322	Spain	0.698	Belarus	-0.165
Hungary	0.578	United Kingdom	0.879	Kosovo	-0.037
Iceland	0.616	Bulgaria	0.840	Kosovo	0.176
Ireland	0.365	Czech Republic	0.756	Belarus	-0.238
Italy	0.628	Sweden	0.953	Kyrgyz Republic	-0.051
Kazakhstan	0.361	Georgia	0.765	Uzbekistan	-0.347
Kosovo	0.083	Albania	0.399	Macedonia	-0.314
Kyrgyz Republic	0.143	Romania	0.481	Sweden	-0.149
Latvia	0.599	Estonia	0.963	Albania	0.010
Lithuania	0.609	Armenia	0.974	Albania	-0.039
Luxembourg	0.610	Belgium	0.845	Kyrgyz Republic	0.174
Macedonia	0.492	Malta	0.794	Kosovo	-0.314
Malta	0.482	Macedonia	0.794	Kosovo	-0.149
Moldova	0.332	Hungary	0.664	Albania	-0.279
Montenegro	0.662	Slovenia	0.938	Kosovo	0.210
Netherlands	0.650	Italy	0.906	Kyrgyz Republic	0.187
Norway	0.568	Latvia	0.865	Kosovo	0.055
Poland	0.459	Netherlands	0.797	Moldova	-0.117
Portugal	0.448	Spain	0.854	Kazakhstan	-0.057
Romania	0.550	Croatia	0.898	Albania	0.100
Russian Federation	0.561	Ukraine	0.896	Ireland	0.015
Serbia	0.456	Romania	0.849	Albania	0.067
Slovak Republic	0.658	Slovenia	0.944	Kyrgyz Republic	0.154
Slovenia	0.677	Slovak Republic	0.944	Kosovo	0.107
Spain	0.559	Czech Republic	0.912	Kazakhstan	-0.009
Sweden	0.589	Belgium	0.922	Kyrgyz Republic	-0.149
Switzerland	0.638	Netherlands	0.899	Kosovo	0.107
Tajikistan	0.311	Ukraine	0.680	Azerbaijan	-0.272
Turkey	0.436	Estonia	0.820	Kosovo	-0.281
Turkmenistan	0.354	Russian Federation	0.709	Greece	-0.089
Ukraine	0.494	Russian Federation	0.896	Azerbaijan	-0.065
United Kingdom	0.614	Estonia	0.930	Albania	0.018
Uzbekistan	0.317	Portugal	0.711	Kazakhstan	-0.347

Table A3. Some results on synchronization [1990-1998]

Country	Average Correlation	Highest Synchronization		Lowest Synchronization	
		Country	Correlation	Country	Correlation
Albania	-0.117	Czech Republic	0.892	Estonia	-0.897
Armenia	0.205	Georgia	0.956	Slovenia	-0.864
Austria	0.097	Spain	0.919	Croatia	-0.778
Azerbaijan	0.356	Slovak Republic	0.940	Slovenia	-0.584
Belarus	0.218	Serbia	0.990	Albania	-0.719
Belgium	0.330	Moldova	0.968	Turkmenistan	-0.495
Bosnia and Herzegovina	0.082	Croatia	0.931	Cyprus	-0.979
Bulgaria	0.126	Romania	0.862	Moldova	-0.963
Croatia	0.220	Norway	0.993	Cyprus	-0.954
Cyprus	-0.063	France	0.591	Bosnia and Herzegovina	-0.979
Czech Republic	-0.021	Romania	0.935	Lithuania	-0.949
Denmark	0.264	Slovenia	0.879	Lithuania	-0.617
Estonia	0.281	Poland	0.910	Albania	-0.987
Finland	0.389	Latvia	0.947	Luxembourg	-0.425
France	0.162	Spain	0.809	Croatia	-0.743
Georgia	0.363	Armenia	0.956	Luxembourg	-0.402
Germany	0.073	Austria	0.879	Bosnia and Herzegovina	-0.762
Greece	0.360	Serbia	0.999	Albania	-0.663
Hungary	0.282	Latvia	0.799	Kazakhstan	-0.680
Iceland	0.299	Lithuania	0.925	Slovenia	-0.690
Ireland	0.397	Moldova	0.993	Bosnia and Herzegovina	-0.230
Italy	0.212	Belgium	0.828	Serbia	-0.836
Kazakhstan	0.092	Croatia	0.863	Hungary	-0.680
Kosovo	--	--	--	--	--
Kyrgyz Republic	0.326	Croatia	0.982	Albania	-0.400
Latvia	0.271	Tajikistan	0.961	Czech Republic	-0.938
Lithuania	0.282	Portugal	0.989	Romania	-0.956
Luxembourg	-0.057	Slovenia	0.611	Czech Republic	-0.739
Macedonia	0.430	Slovak Republic	0.868	Slovenia	-0.838
Malta	0.213	France	0.764	Bosnia and Herzegovina	-0.782
Moldova	0.042	Ireland	0.993	Bulgaria	-0.963
Montenegro	--	--	--	--	--
Netherlands	0.388	Lithuania	0.931	Slovenia	-0.340
Norway	0.322	Croatia	0.993	Luxembourg	-0.630
Poland	0.241	Croatia	0.991	Germany	-0.603
Portugal	0.327	Lithuania	0.989	Albania	-0.564
Romania	-0.022	Czech Republic	0.935	Lithuania	-0.956
Russian Federation	0.252	Uzbekistan	0.757	Lithuania	-0.385
Serbia	0.285	Greece	0.999	Albania	-0.932
Slovak Republic	0.349	Serbia	0.958	Luxembourg	-0.722
Slovenia	-0.026	Ireland	0.967	Bulgaria	-0.906
Spain	0.288	Austria	0.919	Bosnia and Herzegovina	-0.525
Sweden	0.245	Denmark	0.857	Bosnia and Herzegovina	-0.941
Switzerland	0.239	Latvia	0.916	Turkmenistan	-0.217
Tajikistan	0.379	Latvia	0.961	Cyprus	-0.406
Turkey	0.101	Croatia	0.982	Luxembourg	-0.599
Turkmenistan	-0.120	Russian Federation	0.439	Latvia	-0.853
Ukraine	0.164	Serbia	0.985	Romania	-0.638
United Kingdom	0.250	Finland	0.895	Germany	-0.576
Uzbekistan	0.356	Serbia	0.996	Cyprus	-0.613

Table A4. Some results on synchronization [1999-2007]

Country	Average Correlation	Highest Synchronization		Lowest Synchronization	
		Country	Correlation	Country	Correlation
Albania	0.416	Netherlands	0.864	Moldova	-0.709
Armenia	0.620	Latvia	0.976	Tajikistan	-0.305
Austria	0.679	Finland	0.974	Moldova	-0.397
Azerbaijan	0.572	Germany	0.899	Moldova	-0.482
Belarus	0.393	Macedonia	0.860	Moldova	-0.614
Belgium	0.640	France	0.950	Moldova	-0.325
Bosnia and Herzegovina	0.474	Bulgaria	0.772	Tajikistan	-0.449
Bulgaria	0.537	Kazakhstan	0.936	Tajikistan	-0.331
Croatia	0.526	Lithuania	0.967	Turkmenistan	-0.304
Cyprus	0.574	Portugal	0.979	Moldova	-0.549
Czech Republic	0.670	Ireland	0.957	Tajikistan	-0.573
Denmark	0.615	Sweden	0.944	Tajikistan	-0.622
Estonia	0.617	Latvia	0.975	Tajikistan	-0.467
Finland	0.708	Austria	0.974	Tajikistan	-0.312
France	0.667	Switzerland	0.972	Tajikistan	-0.392
Georgia	0.579	Armenia	0.930	Tajikistan	-0.172
Germany	0.637	Spain	0.942	Tajikistan	-0.439
Greece	0.544	Ukraine	0.888	Turkmenistan	-0.121
Hungary	0.423	Turkey	0.863	Kyrgyz Republic	-0.561
Iceland	0.682	Finland	0.956	Tajikistan	-0.302
Ireland	0.679	Czech Republic	0.957	Tajikistan	-0.482
Italy	0.655	Germany	0.934	Tajikistan	-0.496
Kazakhstan	0.494	Bulgaria	0.936	Tajikistan	-0.433
Kosovo	0.086	Albania	0.526	Turkey	-0.508
Kyrgyz Republic	0.012	Tajikistan	0.707	Moldova	-0.626
Latvia	0.642	Armenia	0.976	Tajikistan	-0.410
Lithuania	0.574	Croatia	0.967	Turkmenistan	-0.154
Luxembourg	0.675	Slovenia	0.970	Moldova	-0.345
Macedonia	0.429	Poland	0.897	Moldova	-0.672
Malta	0.416	Luxembourg	0.738	Moldova	-0.427
Moldova	-0.140	Serbia	0.766	Uzbekistan	-0.808
Montenegro	0.625	Russian Federation	0.918	Tajikistan	-0.230
Netherlands	0.607	Switzerland	0.963	Moldova	-0.569
Norway	0.645	Iceland	0.940	Tajikistan	-0.366
Poland	0.558	Macedonia	0.897	Moldova	-0.664
Portugal	0.540	Cyprus	0.979	Moldova	-0.608
Romania	0.495	Ukraine	0.921	Turkmenistan	-0.347
Russian Federation	0.671	Spain	0.943	Tajikistan	-0.292
Serbia	0.155	Moldova	0.766	Turkmenistan	-0.649
Slovak Republic	0.629	Armenia	0.970	Tajikistan	-0.186
Slovenia	0.686	Luxembourg	0.970	Tajikistan	-0.263
Spain	0.693	Finland	0.960	Tajikistan	-0.492
Sweden	0.678	Denmark	0.944	Tajikistan	-0.386
Switzerland	0.632	France	0.972	Tajikistan	-0.525
Tajikistan	-0.279	Kyrgyz Republic	0.707	Denmark	-0.622
Turkey	0.411	Hungary	0.863	Kosovo	-0.508
Turkmenistan	0.228	Albania	0.825	Moldova	-0.777
Ukraine	0.551	Romania	0.921	Turkmenistan	-0.207
United Kingdom	0.624	Latvia	0.971	Tajikistan	-0.420
Uzbekistan	0.269	Portugal	0.800	Moldova	-0.808

Table A5. Some results on synchronization [2008-2016]

Country	Average Correlation	Highest Synchronization		Lowest Synchronization	
		Country	Correlation	Country	Correlation
Albania	0.111	Cyprus	0.903	Kazakhstan	-0.597
Armenia	0.601	Lithuania	0.975	Albania	-0.275
Austria	0.653	Finland	0.979	Azerbaijan	-0.304
Azerbaijan	-0.040	Kyrgyz Republic	0.642	Kosovo	-0.468
Belarus	0.342	Kazakhstan	0.818	Uzbekistan	-0.477
Belgium	0.628	Germany	0.975	Azerbaijan	-0.348
Bosnia and Herzegovina	0.608	Romania	0.960	Kazakhstan	0.002
Bulgaria	0.654	Croatia	0.993	Azerbaijan	0.013
Croatia	0.663	Bosnia and Herzegovina	0.945	Azerbaijan	0.043
Cyprus	0.331	Albania	0.903	Kazakhstan	-0.479
Czech Republic	0.638	Netherlands	0.968	Azerbaijan	-0.036
Denmark	0.665	France	0.969	Azerbaijan	-0.265
Estonia	0.552	Georgia	0.979	Azerbaijan	-0.321
Finland	0.660	Denmark	0.979	Azerbaijan	-0.312
France	0.634	Germany	0.993	Azerbaijan	-0.372
Georgia	0.546	Estonia	0.979	Albania	-0.245
Germany	0.634	France	0.993	Azerbaijan	-0.348
Greece	0.235	Malta	0.815	Kazakhstan	-0.436
Hungary	0.665	Luxembourg	0.925	Albania	0.029
Iceland	0.567	Romania	0.941	Albania	0.037
Ireland	0.272	Spain	0.724	Kazakhstan	-0.369
Italy	0.603	Belgium	0.974	Azerbaijan	-0.366
Kazakhstan	0.265	Turkey	0.854	Albania	-0.597
Kosovo	0.188	Serbia	0.475	Azerbaijan	-0.468
Kyrgyz Republic	0.219	Azerbaijan	0.642	Albania	-0.301
Latvia	0.579	Lithuania	0.969	Azerbaijan	-0.101
Lithuania	0.635	Armenia	0.975	Albania	-0.203
Luxembourg	0.583	Hungary	0.925	Kosovo	-0.113
Macedonia	0.536	Montenegro	0.881	Kazakhstan	-0.031
Malta	0.511	Macedonia	0.871	Kosovo	-0.185
Moldova	0.507	Switzerland	0.833	Ireland	-0.185
Montenegro	0.677	Slovenia	0.936	Azerbaijan	0.161
Netherlands	0.676	Slovenia	0.971	Azerbaijan	-0.115
Norway	0.514	Armenia	0.944	Albania	-0.351
Poland	0.386	Cyprus	0.858	Azerbaijan	-0.255
Portugal	0.381	Spain	0.882	Kazakhstan	-0.296
Romania	0.612	Bosnia and Herzegovina	0.960	Albania	0.069
Russian Federation	0.532	Georgia	0.959	Albania	-0.252
Serbia	0.574	Bosnia and Herzegovina	0.904	Ireland	0.148
Slovak Republic	0.695	Slovenia	0.955	Azerbaijan	0.040
Slovenia	0.679	Netherlands	0.971	Azerbaijan	0.064
Spain	0.500	Czech Republic	0.904	Kazakhstan	-0.345
Sweden	0.550	Italy	0.971	Azerbaijan	-0.401
Switzerland	0.660	United Kingdom	0.913	Kosovo	-0.020
Tajikistan	0.559	Latvia	0.910	Albania	-0.161
Turkey	0.464	Estonia	0.903	Greece	-0.332
Turkmenistan	0.392	Russian Federation	0.833	Albania	-0.570
Ukraine	0.500	Russian Federation	0.924	Azerbaijan	-0.321
United Kingdom	0.627	Lithuania	0.922	Albania	-0.206
Uzbekistan	0.326	Spain	0.851	Kazakhstan	-0.542