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Revisiting business cycle synchronisation in the European Union

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WORKING PAPERS

Revisiting business cycle synchronisation in the European Union[*]

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2010

Abstract

We assess the business cycle synchronization features of aggregate output in the 27 EU countries using annual data for the period 1970-2009. In particular, we compute measures of synchronisation for private consumption, government spending, gross fixed capital formation, exports and imports. Our results show a rise in synchronization over the full period, and although private consumption is the biggest component of GDP, external demand tends to be a more important determinant of business cycle synchronization.

JEL: E32; F15; F41; F42
Keywords: EU, business cycle synchronization.

1. Introduction

In the context of the European and Monetary Union (EMU) and of the broader setting of the European Union (EU) itself, the existence of a higher degree of business cycle synchronisation seems to be an expected outcome of European integration. An increase in the correlation of the cyclical fluctuations may reduce the potential costs of the inexistence of country-specific monetary policies, in the case of the EMU. Moreover, the presence of high business cycle correlation between countries and the EMU aggregates also helps the implementation of monetary policy conducted by the European Central Bank. Indeed, the theory of the Optimum Currency Area, first developed by Mundell (1961), McKinnon (1963) and Kenen (1969), stresses the importance of international linkages between the members of a monetary union to deal with the loss of the country-specific monetary policy to address the economic business cycle.

In this paper we analyse business cycle synchronization in the EU, notably by assessing how it has evolved over time, using annual data for the period 1970-2009. Specifically we look at business cycle synchronisation of both GDP and of aggregate demand components: private consumption, final consumption expenditure of general government, gross fixed capital formation, and exports and imports of goods and services. We also determine which aggregated demand component sector mostly drives GDP business cycle synchronization.

In a nutshell, the results show that the level of business cycle synchronization for the 27 EU countries has increased between 1970 and 2009. Notably, it has been higher after the introduction of the single currency. In the most recent 1993-2008 sub-period, some of the new Member States (Cyprus, Latvia and Slovenia) already presented business cycle synchronization similar to that of some EU-15, namely comparing to Greece and Portugal.

The remainder of the paper is organized as follows. Section Two provides a brief review of related literature. Section Three explains the empirical methodology used to compute business cycle synchronization. Section Four reports the results obtained, and Section Five summarises the paper's main findings.

2. Related literature

Previously related studies have addressed business cycle synchronization in the EU. Analyzing the cyclic correlations between euro area economies, Angeloni and Dedola

(1999) describe the rise of the output correlation between Germany and the other European countries, particularly in the period 1993-1997. Furceri and Karras (2008) focus on business cycle synchronization for GDP components, using data for the period 1993-2004 (EU with 12 member states), and conclude the countries observed are better synchronized with the EMU-wide economy after joining the Euro. Moreover, the aggregate demand components best synchronized are exports and imports.

Afonso and Furceri (2009) evaluate the sectoral business cycle synchronization in the EU (27 member states) for the period 1980-2005 and conclude that, in general, Industry, Building and Construction and Agriculture, Fishery and Forestry give the best contribution to aggregate output business cycle synchronization, while Services show low business cycle synchronization.

Several authors have also investigated the evolution of business cycle synchronization in North-America. Lopes and Pina (2008) use fuzzy clustering and rolling window techniques to compare Europe with two other currency unions - Canada and the USA - for what business cycle synchronization and core-periphery patterns are concerned. This study reveals that EMU is economically viable, once the average cyclical correlations among European countries have developed in a positive and significant way (assuming very near or superior values to those found for North American regions). On the other hand, Wynne and Koo (2000) compare the business cycle in the European Union (15 member states) with the business cycle in twelve Federal Reserve districts in the U.S., concluding that synchronization in the USA is higher than in Europe, for the period 1963-1992. Clark and Wincoop (2001) try to understand the border effect analyzing the US-Canada border and inter-European borders, concluding that it not only exists in Europe, but is also statistically significant in this case.

Other studies document the evolution of business cycle synchronization over time. Gayer (2007) analyzes industrial production and GDP, and verifies that business cycle synchronization in the euro area has been rising since the euro introduction (although inferior to the synchronization level showed in the early 1990s). Fatás (1997), using annual data for the period 1966-1992, studies the evolution of business cycle synchronization between EU countries or regions. Calculating the correlations of growth rates of employment, he identifies a rise in cross-country correlations and a fall between same-country regions. In addition, Peiró (2004) studied the existence of asymmetries in industrial production in European countries for the period 1957-1998.

Mink et al. (2007) expose a new cycle co-movement measure which allows them to determine the synchronization of cycles and the differences between their amplitudes. Applying it to euro area data for the period between 1970 and 2005, they argue that business cycle synchronization and co-movement do not show an upward trend, and countries presenting the lowest values for these variables are Finland, Greece and Italy.

Some other papers study business cycle correlation between the euro area and acceding countries. Korhonen (2003) uses an econometric study to gauge the integration level of nine country-candidates with the euro area, concluding that Greece and Portugal are as integrated as some of the most advanced country-candidates, namely Hungary and Slovenia. Artis et al. (2004) examine the evolution of the business cycle in the accession countries and find evidence of a weak synchronization, excluding the cases of Poland and Hungary.

Using a model-based clustering, Crowley (2008) shows that macroeconomic variables evolved in a divergent way within the euro area and reports the existence of a geographical core-periphery pattern. Normalizing distances between the leading country and the rest of countries, and afterward generating values using a bivariate uniform distribution, as well as a bivariate normal distribution, Camacho et al. (2006) conclude that there is no evidence proving the existence of any attractor or common driving force in economic cycles of European countries. Finally, Inklaar and Haan (2001) do not find any evidence of a connection between exchange rate stability and business cycle synchronization in Europe.

3. Methodology

We compute our business cycle measures for GDP as the correlation between the country's GDP cyclical component, c_i, and the EU's GDP cyclical component, c_{EU}:

$$corr\left(c_i, c_{EU}\right). \tag{1}$$

In addition, and to assess which aggregate demand component j for each country i is mainly responsible for the aggregate output business cycle synchronization, we compute the country's aggregate demand cyclical components, c_i^j, and then calculate the correlation between these components and the EU's GDP cyclical component:

$$corr\left(c_i^j, c_{EU}\right). \tag{2}$$

We used the HP filter (Hodrick and Prescott, 1980) with the smoothness parameters equal to 100 and 6.25 to compute the cyclically adjusted components of aggregate demand as well as the corresponding component of GDP.

As a robustness measure, and given some of the critics to different de-trending techniques, as the HP filter (see Canova (1998), we also calculate the Business Cycle Synchronization using a so-called Business Cycle Synchronization Index (BSCI). According to Kalemli-Ozcan et al. (2010) e Giannone et al. (2008), this new measure evaluates the cross-country synchronization (between countries i and j) to the same variable. Considering S_{ijt} a negative of the divergence in growth rates, defined as the absolute value of GDP (or other aggregate demand components), growth differences between countries i and j in year t are given by:

$$S_{ijt} = -\left|(\ln Y_{it} - \ln Y_{it-1}) - (\ln Y_{jt} - \ln Y_{jt-1})\right|. \tag{3}$$

where Y_{it} is real GDP of country i in period t.

In our analysis we will apply this measure to study synchronization between the real GDP of country i and the real GDP of the euro area. Since we will report the results per period of time, each value will match to the average of obtained values for each one of these periods.

4. Empirical analysis

4.1. Data

Our data come from the European Commission *Annual Macro-economic Database* (AMECO) and covers the EU 27 countries from 1970 to 2009, as far as data availability allows for.[1] We use real GDP at 2000 constant prices to compute output business cycle synchronization, and we consider as well the following aggregate demand components: private consumption, final consumption expenditure of general government, gross fixed capital formation, and exports and imports of goods and services.

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[1] See the Annex for a description of the data.

4.2. Output Business Cycle Synchronization

In order to analyze the business cycle synchronization across a set of European countries, we first computed the correlation coefficient between the cyclical component of real GDP in country *i*, and the cyclical component of real GDP in the euro area (defined for this purpose as the 12 "old" initial euro area countries). We used the HP filter with the smoothness parameter equal to 100 to disentangle between cycle and trend. Naturally, the higher the correlation coefficient the higher the business cycle synchronization.

In this study we use annual data and cover the period time between 1970 and 2009. In order to segment and deepen our analysis, we have divided the overall period in three sub-periods: the first one from 1970 to 1992 – where we hardly observe values for the last group of countries that joined the EU; the second one from 1993 to 1998 – allowing us to check the possible Maastricht treaty's effects on synchronization; and the last one, from 1999 to 2009 – where we analyze the consequences of the adoption of the single currency. For the last two sub-periods, we are already able to present values regarding the current 27 members of EU.

We report in Table 1 the results for business cycle synchronisation for the 27 EU countries, vis-à-vis the euro area (EA12).[2] It is possible to observe that the level of business cycle synchronization has increased, notably between 1970-1992 and 1999-2009. Analyzing column four of Table 1, for the full period, we can conclude that most countries are relatively well synchronized with the euro area, being that of the fifteen initial EU countries, only four (Denmark, Finland, UK and Sweden) have correlations below the average.

In the sub-period of 1970 to 1992, we notice that although there were already countries with a high level of business cycle synchronization (such as Austria, Belgium, France and Luxembourg), in some cases business cycle synchronization was extremely low (Ireland, Sweden, U.K.) or even negative (Denmark, Finland).

Comparing the values obtained in the two sub-first periods, we notice a decrease in synchronization from the first one to the second one. Only Spain and France present positive variations. However, we should take into account that the period between 1993 and 1998 covers only six years.

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[2] Similar results vis-à-vis the EU15 with λ=100 and λ=6.25 are reported in Appendices 1 and 2.

Table 1 – GDP Business cycle synchronization (vis-à-vis EA12)

	Business Cycle Synchronization				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.86***	0.625***	0.921***	0.892***	2.039	0.709	4.043	2.625
Belgium	0.859***	0.081	0.964***	0.905***	2.9	1.324	4.152	3.222
Bulgaria		0.609*	0.56**	0.552***		1.554	1.351	1.405
Cyprus		0.009	0.844***	0.541***		0.16	0.152	0.15
Czech Republic		-0.772	0.702***	0.368***		60.991	88.901	89.064
Denmark	-0.308	-0.446	0.943***	0.376***	17.427	19.101	30.317	21.594
Estonia		0.447	0.78***	0.696***		3.328	10.455	8.493
Finland	-0.069	-0.296	0.991***	0.48***	3.178	3.291	4.386	3.887
France	0.835***	0.918***	0.971***	0.887***	16.308	6.812	20.859	18.482
Germany	0.799***	0.715*	0.946***	0.765***	45.262	19.157	39.624	40.192
Greece	0.657***	0.649*	0.67**	0.674***	2.785	0.304	2.808	2.677
Hungary		0.886***	0.733***	0.801***		154.828	536.725	479.879
Ireland	0.107	-0.174	0.884***	0.666***	0.806	1.261	6.184	3.57
Italy	0.751***	-0.275	0.958***	0.859***	14.258	5.756	22.989	16.696
Latvia		-0.438	0.84***	0.682***		0.286	0.649	0.724
Lithuania		-0.387	0.789***	0.723***		3.339	5.141	5.783
Luxembourg	0.864***	0.784**	0.964***	0.883***	0.368	0.516	0.739	0.528
Malta		-0.428	0.677**	0.474***		0.037	0.097	0.076
Netherlands	0.764***	-0.062	0.898***	0.825***	4.076	3.082	9.947	6.301
Poland		-0.464	0.338	0.188		16.935	19.705	21.047
Portugal	0.782***	0.265	0.793***	0.763***	2.604	1.412	2.357	2.472
Romania		-0.652	0.505*	0.213*		4.734	5.277	5.509
Slovakia		-0.673	0.554**	0.318**		0.503	1.752	1.454
Slovenia		-0.442	0.905***	0.624***		0.251	0.724	0.746
Spain	0.72***	0.863**	0.941***	0.837***	11.179	3.169	15.454	12.629
Sweden	0.079	-0.151	0.915***	0.587***	31.963	25.707	62.279	45.573
UK	0.117	-0.239	0.915***	0.535***	16.767	7.263	22.462	17.984
Minimum	-0.308	-0.772	0.338	0.188	0.368	0.037	0.097	0.076
Maximum	0.864***	0.918***	0.991***	0.905***	45.262	154.828	536.725	479.879
Average	0.521	0.035	0.811	0.634	11.461	12.808	34.057	30.102
Average EU15	0.521	0.217	0.912	0.729	11.461	6.591	16.573	13.229

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

In the more recent period between 1999 and 2009, all countries depict a high level synchronization with the euro area. Below average synchronization is reported for several EU New Member States (notably Poland, with the lowest synchronization, Bulgaria and Romania), and Greece. Interestingly, Cyprus, Latvia and Slovenia already showed a correlation above the average. Indeed, several countries outside the euro area

in that sub-period had already a higher economic synchronization than some euro area countries (Greece and Portugal, for instance), in line with Korhonen (2003).

Table 1 also shows the volatility of the correlation coefficients that measure the respective business cycle synchronisation. We can then see that the average volatility increased throughout the three sub-periods. In the first sub-period, business cycle volatility ranged between Luxembourg and Ireland and Germany, which had the lowest volatility level. Between 1993 and 1998, countries like Austria, Cyprus, Greece, Latvia, Luxembourg, Malta, Slovenia and Slovakia also presented low volatility levels, while the opposite occurred in the case of Hungary. In the 1999-2009 sub-period the number of countries with low business cycle volatility diminished.

In Table 2 we report the results for the Business Cycle Synchronization Index for each of the EU Member States, taking into consideration three time periods: 1971-1992, 1993-2009 and 1971-2009 (the reason why 1971 is the first year is because all the values obtained come from a first-order differences process).

For the first sub-period, and given that the closer BSCI is to zero, the higher will be the synchronization between country i and the euro area, we observe that the countries that were more synchronized with the euro area are France and Germany, and the least synchronized ones were Portugal and Greece.

Between 1993 and 2009, the most synchronized countries were France (0.004), Germany (-0.005), Belgium (-0.005), and Austria (-0.006), and the least synchronized were Lithuania (-0.680) and Latvia (-0.062). These results are in line with conclusions that can be drawn for the full period, and also with the overall results from Table 1, where the HP filter was used.

Moreover, and as we have observed also in Table 1, and evaluating the evolution of values showed in the last line of Table 2 (average to the EU-15), we can see that overall countries have become more synchronized with the euro area over time. The same is true for the EU New Member States, a result in line with what had been argued notably by Rose and Engel (2002), once increased intra EU trade also increase the synchronization of their business cycle with the EU.

Table 2 – GDP Business cycle synchronization Index (vis-à-vis EA12)

	Business Cycle Synchronization Index		
	1971-1992	1993-2009	1971-2009
Austria	-0.013	-0.006	-0.010
Belgium	-0.008	-0.005	-0.006
Bulgaria		-0.040	-0.042
Cyprus		-0.013	-0.015
Czech Republic		-0.023	-0.027
Denmark	-0.018	-0.008	-0.013
Estonia		-0.058	-0.058
Finland	-0.019	-0.016	-0.018
France	-0.006	-0.004	-0.005
Germany	-0.007	-0.005	-0.006
Greece	-0.028	-0.016	-0.022
Hungary		-0.020	-0.020
Ireland	-0.021	-0.039	-0.029
Italy	-0.010	-0.007	-0.009
Latvia		-0.062	-0.082
Lithuania		-0.068	-0.077
Luxembourg	-0.024	-0.020	-0.022
Malta		-0.019	-0.020
Netherlands	-0.009	-0.008	-0.009
Poland		-0.033	-0.034
Portugal	-0.031	-0.008	-0.021
Romania		-0.047	-0.053
Slovakia		-0.040	-0.040
Slovenia		-0.027	-0.032
Spain	-0.014	-0.007	-0.011
Sweden	-0.015	-0.011	-0.013
UK	-0.015	-0.009	-0.012
Minimum	-0.031	-0.068	-0.082
Maximum	-0.006	-0.004	-0.005
Average	-0.016	-0.023	-0.026
Average EU15	-0.016	-0.011	-0.014

Given that we are using the 12 "old" countries of the EU to build the aggregate cyclical components of GDP, it is worthwhile comparing the peaks and troughs that we uncover with the ones reported by the CEPR Euro Area Cycle Dating Committee. Such comparison is reported in Figure 1.

Interestingly, it is possible to observe that the downturns identified by the Committee are very close to the peaks and troughs that we computed for the cyclical component of GDP (using the HP filter).

Figure 1 – Real GDP, trend GDP, cyclical component, EA12

1.1 – GDP, cyclical and trend components
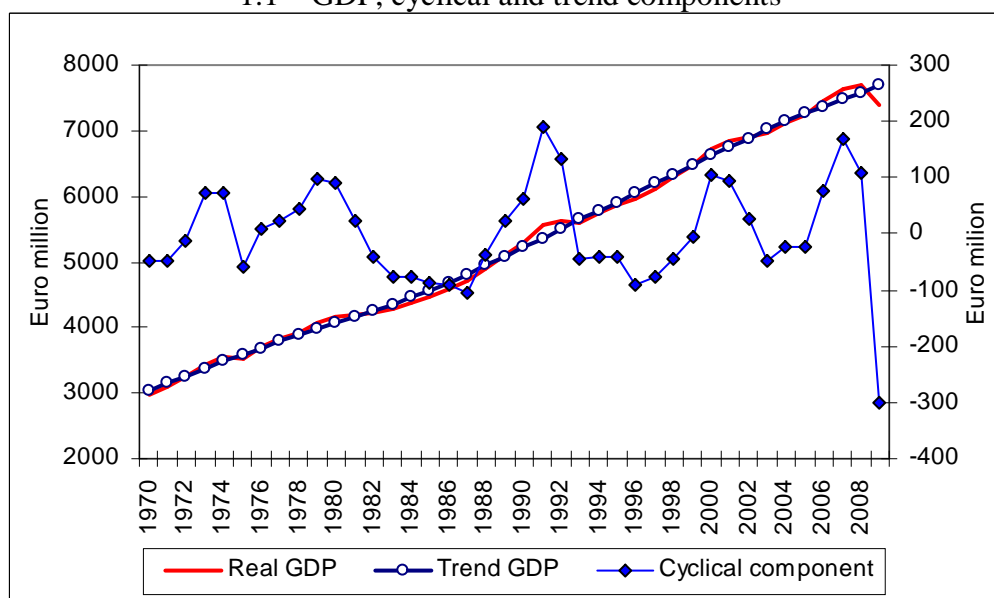
1.2 – Real and trend GDP growth rates, and CEPR peaks and troughs
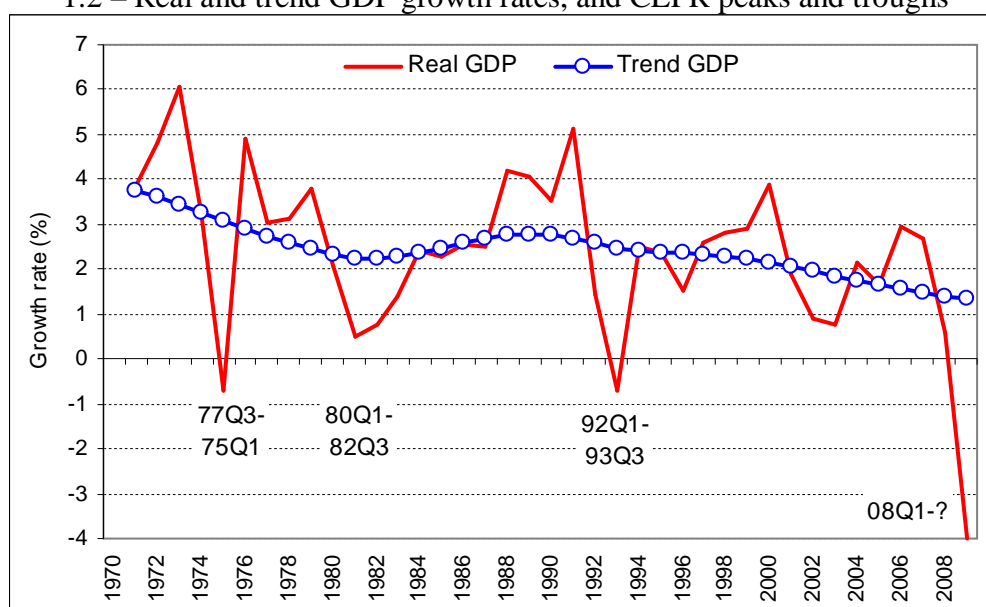
Source: own computations and CEPR Euro Area Cycle Dating Committee for the euro area peaks and troughs in chart 1.2 (http://www.cepr.org/data/dating/).

4.3. Business Cycle Synchronization by GDP components

Private Consumption synchronization

In Table 3 there are three different types of information available. The first four columns show the correlation between the cyclical component of private consumption in country *i* and the cyclical component of real GDP in the euro area. The next four columns report the share of private consumption in GDP. The last four columns in

Table 3 present the volatilities of those private consumption business cycle correlations. The sub-periods considered remain the same.

Table 3 – Private consumption synchronization (vis-à-vis EA12)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.644***	0.083	0.674**	0.543***	57.8	57.7	54.2	56.8	1.324	0.884	0.733	1.108
Belgium	0.899***	0.319	0.897***	0.847***	54.5	55.0	52.3	54	1.520	0.432	1.135	1.320
Bulgaria		0.411	0.624**	0.539***		67.6	71.0	69.6		1.392	0.994	1.097
Cyprus		-0.308	0.479*	0.255*		62.7	66.4	65.3		0.277	0.193	0.215
Czech Republic		-0.841	0.185	-0.15		50.6	52.0	50.7		43.342	20.627	49.681
Denmark	-0.188	-0.319	0.697***	0.18	54.1	51.0	49.4	52.4	13.841	12.505	19.025	15.022
Estonia		-0.165	0.77***	0.669***		54.5	57.9	56.7		1.532	7.539	6.055
Finland	0.066	-0.466	0.825***	0.355**	53.2	52.5	50.7	52.4	1.733	1.673	1.326	1.786
France	0.697***	0.601	0.829***	0.688***	57.6	56.3	57.4	57.3	8.134	6.115	6.093	8.759
Germany	0.68***	0.481	0.268	0.422***	56.2	59.4	57.9	57.2	32.150	19.328	11.352	26.183
Greece	0.641***	0.691*	0.681**	0.657***	64.5	75.0	72.7	68.3	2.033	0.228	2.508	2.010
Hungary		0.402	0.41	0.39***		53.6	56.5	55.7		384.672	473.049	438.732
Ireland	0.449**	0.273	0.975***	0.786***	63.2	52.1	47.5	57.2	0.792	0.440	2.715	1.623
Italy	0.741***	0.365	0.833***	0.737***	58.4	58.9	59.6	58.8	10.164	7.053	8.706	10.431
Latvia		-0.51	0.818***	0.702***		64.1	65.7	65.3		0.119	0.573	0.492
Lithuania		-0.087	0.785***	0.669***		61.2	66.6	65.1		0.767	4.172	3.594
Luxembourg	0.788***	0.625*	0.29	0.543***	53.4	44.5	38.6	48.0	0.125	0.081	0.232	0.162
Malta		-0.921	0.327	0.362**		65.0	66.5	66.1		0.031	0.053	0.050
Netherlands	0.61***	-0.049	0.566**	0.605***	54.2	50.0	49.1	52.2	3.292	2.215	4.495	3.826
Poland		-0.419	0.075	0.163		64.1	63.9	63.6		8.746	9.439	8.669
Portugal	0.798***	0.568	0.688***	0.705***	58.5	63.6	65.2	61.1	1.751	1.157	1.130	1.539
Romania		-0.747	0.6**	0.392***		63.2	79.7	71.8		3.263	7.155	6.030
Slovakia		-0.509	0.445*	0.226*		45.3	55.5	52.4		0.328	0.522	0.490
Slovenia		-0.477	0.683**	0.094		59.0	55.7	56.2		0.170	0.207	0.338
Spain	0.797***	0.713*	0.891***	0.852***	62.0	59.9	59.7	61.1	8.319	4.089	12.449	9.631
Sweden	0.353**	0.085	0.883***	0.542***	54.1	50.2	48.6	52.0	25.197	5.969	17.764	24.391
UK	0.212	0.271	0.749***	0.501***	59.6	63.5	66.4	62.0	12.603	3.030	14.261	13.235
Minimum	-0.188	-0.921	0.075	-0.15	53.2	44.5	38.6	48	0.125	0.031	0.053	0.050
Maximum	0.899***	0.713***	0.975***	0.852***	64.5	75.0	79.7	71.8	32.150	384.672	473.049	438.732
Average	0.546	0.003	0.628	0.492	57.4	57.8	58.8	58.9	8.199	18.883	23.276	23.573
Average EU15	0.546	0.283	0.716	0.598	57.4	56.6	55.3	56.7	8.199	4.347	6.928	8.068

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

For the period from 1970 to 1992, only Denmark presented a small negative private consumption synchronization (although not statistically significant) with the euro area. Belgium was the best synchronized country, followed by Portugal. In the last sub-

period, most countries presented high synchronization values, although to less extent in the cases Poland, Czech Republic, Germany, Malta and Luxembourg.

Considering the contribution of private consumption to GDP, we can see that it has barely changed throughout time, representing on average a somewhat between 57% and 59% of GDP. At the country level, and apart from the EU New Member States, only Italy, Portugal and the UK had an increase if the contribution to GDP of private consumption. Is some cases such share decreased, notably in France, with a negative variation from the first to the second sub-period, and a positive one from the second to the third, while the opposite occurred in Belgium, Germany and Greece. In all the other countries the share of private consumption in GDP decreased.

Regarding the volatilities of private consumption business cycle correlations, in the first sub-period, those countries that were best synchronized with the euro area presented themselves with lower volatility values as well. Between 1993 and 1998, the volatilities of the correlations between the consumption of country i and the GDP in euro area decreased, except in the cases of the Czech Republic and Hungary. In the last sub-period period, volatilities have increased for most countries, as we have observed for the case of GDP as well.

Final Consumption Expenditure of General Governments synchronization

Table 4 shows the same kind of information for the final consumption expenditure of general government, as it was previously presented for private consumption.

In this case, government spending represents, on average, around 20% of the GDP. In every period under analysis, Sweden is the country with the highest share of government spending in GDP. Interestingly, the New EU Member States show similar characteristics and behaviour as in the case of the other EU countries.

For the overall period we can see that public expenditure synchronization with GDP in the euro area was positive (and statistically significant) for Bulgaria, Greece, Ireland, Italy, the Netherlands, Poland Portugal, Spain, and Sweden. To some extent, we see in these cases the existence of some pro-cyclicality of government spending, which one would not expect to help fiscal sustainability. Negative correlations are uncovered for countries like Austria, Belgium, Denmark and France.

Table 4 – Final consumption expenditure of general government synchronization (vis-à-vis EA12)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	-0.047	0.203*	-0.133	-0.147	18.1	20.0	18.9	18.6	0.437	0.711	0.752	0.592
Belgium	0.108	-0.674	-0.617	-0.093	21.3	21.4	22.5	21.7	0.844	0.460	0.621	0.737
Bulgaria		0.91*	0.076*	0.412***		15.2	17.4	16.9		0.709	0.242	0.528
Cyprus		-0.626	-0.55	-0.511		15.6	18.1	17.4		0.053	0.078	0.070
Czech Republic		-0.098*	0.042	0.047		21.3	21.5	21.6		12.656	14.405	24.148
Denmark	-0.271	0.122	-0.598	-0.308	24.8	25.5	26.4	25.4	5.084	2.443	3.668	4.368
Estonia		0.273	0.307	0.187		22.6	18.7	20.1		0.807	1.045	0.964
Finland	0.503***	-0.829	-0.518	0.158	19.1	22.9	21.8	20.4	0.663	0.344	0.544	0.617
France	-0.151	0.142***	0.044	-0.073	20.9	23.7	23.4	22.0	3.122	4.438	3.456	3.359
Germany	0.507***	0.172***	-0.548*	0.14	18.8	19.5	18.8	18.9	11.906	5.914	5.593	9.857
Greece	-0.256	0.3	0.341*	0.21*	13.6	14.8	17.1	14.7	0.523	0.524	0.999	0.772
Hungary		0.601***	0.212	-0.19		24.5	22.0	23.1		433.067	182.015	546.750
Ireland	0.172	0.382***	0.64	0.443***	17.2	15.9	15.4	16.5	0.369	0.379	0.662	0.461
Italy	0.591***	0.287**	0.136*	0.435***	17.8	18.6	19.7	18.5	5.469	5.759	4.476	5.581
Latvia		0.438	0.523	0.204		21.0	19.8	18.6		0.065	0.078	0.076
Lithuania		-0.3	0.362	-0.024		23.1	20.5	20.6		1.277	0.483	1.419
Luxembourg	0.577***	0.035*	-0.531**	0	15.1	16.0	16.0	15.5	0.063	0.058	0.123	0.083
Malta		-0.932	-0.474**	-0.561		19.0	20.2	19.4		0.016	0.032	0.027
Netherlands	0.528***	0.72**	0.155	0.337**	23.1	23.2	24.2	23.4	1.354	1.823	2.023	1.588
Poland		-0.248	0.156	0.45***		18.7	18.0	18.8		3.901	3.611	4.675
Portugal	0.751***	0.416**	-0.205	0.36**	13.8	18.0	20.4	16.3	0.561	0.501	0.614	0.570
Romania		0.223**	0.265	0.253*		13.4	16.7	15.8		1.261	1.104	1.106
Slovakia		-0.614	-0.04	-0.189		22.9	19.3	20.6		0.405	0.238	0.314
Slovenia		0.482***	-0.237**	0.062		18.7	18.8	18.6		0.062	0.073	0.074
Spain	0.709***	0.473***	-0.284	0.238*	13.8	18.0	18.1	15.6	2.089	2.831	2.230	2.197
Sweden	0.596***	0.301	0.249	0.488***	26.4	27.4	26.7	26.6	10.840	7.446	7.446	10.082
UK	0.236	0.352***	-0.204*	0.102	20.6	19.1	20.6	20.4	3.283	5.818	4.806	4.242
Minimum	-0.271	-0.932	-0.617	-0.561	13.6	13.4	15.4	14.7	0.063	0.016	0.032	0.027
Maximum	0.751***	0.91***	0.64***	0.488***	26.4	27.4	26.7	26.6	11.906	433.067	182.015	546.750
Average	0.304	0.093	-0.053	0.09	19.0	20.0	20.0	19.5	3.107	18.286	8.941	23.158
Average EU15	0.304	0.160	-0.138	0.153	19.0	20.3	20.7	19.6	3.107	2.630	2.534	3.007

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Regarding the evolution on private consumption synchronization over time, it varied negatively in the elder members of the EU (except for France, Greece and Ireland), and positively for the New Member States (excluding Bulgaria, Hungary and Slovenia).

When we look to the volatility levels, the Czech Republic and Hungary have the highest values, and, interestingly, high levels of volatility also occurred in the period 1993-1998.

Gross Fixed Capital Formation synchronization

Table 5 shows the investment component of GDP, more precisely gross fixed capital formation (GFCF).

During the period 1970-2009, GFCF synchronization with euro area GDP was rather high for many countries (notably France, Italy, and Spain), although there are also low synchronization levels, such as the case of Denmark and Finland. In the period 1993-1998, only France and Germany presented a positive variation from the first sub-period to the second one. Between 1999 and 2009, the lower levels of GFCF business cycle synchronisation were the New Member States like the Czech Republic, Bulgaria and Slovakia. Finland and Denmark also present low correlations. On the other hand, the best synchronized countries were France and Italy.

GFCF is responsible, on average, for around 21% of GDP. For the sub-period 1999- 2009, the U.K. is the country in which the investment's share in GDP is the lowest (17.5%), while Estonia had the highest level (31.1%).

Again, from the last four columns in 5, we observe an increase in business cycle volatility, with the Czech Republic, Hungary and Sweden, with the highest volatility levels.

Table 5 – Gross fixed capital formation synchronization (vis-à-vis EA12)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.82***	-0.19	0.785***	0.732***	23.4	24.3	22.5	23.3	1.510	0.523	1.434	1.361
Belgium	0.753***	0.09	0.593**	0.649***	20.8	20.5	21.4	20.9	2.791	0.794	2.180	2.401
Bulgaria		0.556	0.668**	0.533***		11.4	23.8	19.9		0.950	1.147	1.067
Cyprus		0.127	0.64**	0.49***		18.7	18.9	18.8		0.052	0.135	0.117
Czech Republic		-0.702	0.723***	0.077		27.8	28.3	27.3		48.750	31.820	44.508
Denmark	-0.193	-0.346	0.904***	0.347**	16.1	17.4	20.5	17.5	13.169	15.275	18.732	14.933
Estonia		0.601	0.736***	0.658***		22.3	31.1	28.0		1.397	7.956	6.362
Finland	-0.024	-0.352	0.957***	0.312**	24.8	17.3	19.4	22.2	2.149	2.499	1.400	2.244
France	0.78***	0.793**	0.955***	0.833***	20.1	17.8	19.9	19.7	10.458	3.721	10.394	10.684
Germany	0.772***	0.841**	0.614**	0.641***	20.3	21.0	20.0	20.3	18.738	9.359	21.910	18.301
Greece	0.528***	0.208	0.703***	0.65***	22.6	17.6	22.0	21.7	1.912	0.538	2.964	2.220
Hungary		0.644*	0.439*	0.565***		20.1	24.1	22.2		104.659	179.674	167.222
Ireland	0.263	-0.318	0.79***	0.611***	25.0	20.3	22.0	23.5	0.837	1.136	4.069	2.261
Italy	0.782***	-0.428	0.895***	0.812***	21.2	18.7	20.7	20.7	7.866	4.854	11.479	9.682
Latvia		0.731**	0.756***	0.691***		17.7	29.5	26.3		0.109	0.433	0.370
Lithuania		0.017	0.813***	0.709***		17.5	22.6	21.0		0.763	3.176	2.642
Luxembourg	0.547***	0.534	0.803***	0.697***	20.8	20.5	22.5	21.2	0.205	0.180	0.365	0.258
Malta		0.289	0.525**	0.506***		23.8	19.1	20.4		0.053	0.089	0.079
Netherlands	0.382**	-0.349	0.671**	0.531***	20.3	20.2	20.8	20.4	1.972	3.653	5.618	3.568
Poland		-0.324	0.276	0.185		18.7	21.6	19.7		16.339	20.029	17.103
Portugal	0.597***	0.063	0.705***	0.632***	22.1	23.4	24.2	22.9	1.425	1.719	1.949	1.683
Romania		-0.555	0.397	0.152		17.5	24.8	20.9		1.093	3.642	2.941
Slovakia		-0.442	0.529**	0.16		29.3	26.9	27.7		1.148	0.875	0.977
Slovenia		-0.362	0.862***	0.677***		20.9	26.4	23.3		0.184	0.549	0.452
Spain	0.647***	0.541	0.881***	0.792***	21.7	22.4	27.1	23.3	7.733	2.477	14.194	10.063
Sweden	0.234	-0.452	0.914***	0.585***	18.2	15.8	17.7	17.7	21.692	20.295	32.459	26.473
UK	0.101	0.077	0.937***	0.582***	15.1	15.6	17.5	15.8	6.542	6.523	11.813	8.461
Minimum	-0.193	-0.702	0.276	0.077**	15.1	11.4	17.5	15.8	0.205	0.052	0.089	0.079
Maximum	0.82***	0.841***	0.957***	0.833***	25.0	29.3	31.1	28.0	21.692	104.659	179.674	167.222
Average	0.466	0.048	0.721	0.548	20.8	19.9	22.8	21.7	6.600	9.224	14.462	13.275
Average EU15	0.466	0.048	0.807	0.627	20.8	19.5	21.2	20.7	6.600	4.903	9.397	7.640

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Exports and Imports of goods and services synchronization

In Table 6 we report the results related to business cycle synchronization, volatility and the share of exports in GDP. A relevant issue is the rapid growth of average share of exports in GDP between 1970 and 2009. This evolution may be explained by a higher level of market integration and the introduction of the single currency, which naturally facilitated intra EU trade.

Table 6 – Exports of goods and services synchronization (vis-à-vis AE12)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.626***	0.296	0.959***	0.8***	26.2	36.4	53.4	35.2	1.479	1.257	7.872	4.369
Belgium	0.668***	0.119	0.967***	0.81***	47.9	64.9	81.0	59.6	2.586	2.380	13.009	7.155
Bulgaria		-0.684	0.69***	0.52***		50.8	61.8	58.9		0.699	1.676	1.499
Cyprus		-0.339	0.966***	0.909***		50.9	52.2	51.8		0.147	0.348	0.298
Czech Republic		0.402	0.822***	0.692***		45.3	80.9	62.9		30.371	219.769	162.873
Denmark	-0.056	0.335	0.951***	0.655***	25.8	37.9	50.5	34.4	9.366	9.331	34.911	20.820
Estonia		0.747**	0.79***	0.735***		62.8	79.6	73.7		4.144	11.034	9.026
Finland	-0.515	0.448	0.964***	0.578***	20.3	32.5	45.4	29.0	1.392	0.674	6.695	3.608
France	0.53***	0.15	0.949***	0.753***	14.9	22.7	28.6	19.8	4.172	9.116	21.243	12.450
Germany	0.219	-0.172	0.942***	0.711***	22.5	25.1	41.1	28.0	14.926	12.795	66.284	37.425
Greece	0.127	0.288	0.796***	0.584***	11.8	17.6	22.9	15.7	0.946	0.822	2.580	1.641
Hungary		-0.079	0.871***	0.856***		41.3	91.1	68.6		260.367	1319.975	1060.533
Ireland	-0.671	0.517	0.826***	0.518***	33.6	70.4	98.9	57.1	1.043	2.074	6.185	4.074
Italy	-0.063	-0.259	0.991***	0.579***	15.6	23.8	26.6	19.9	6.177	7.982	23.130	13.024
Latvia		-0.595	0.783***	0.636***		41.7	41.8	41.7		0.086	0.273	0.239
Lithuania		-0.471	0.625**	0.453***		47.2	54.7	52.7		0.988	3.767	3.368
Luxembourg	0.613***	0.897***	0.939***	0.794***	104.2	125.6	164.3	123.9	0.558	0.773	2.556	1.453
Malta		0.891***	0.896***	0.879***		88.9	91.6	90.9		0.139	0.210	0.197
Netherlands	0.59***	0.206	0.971***	0.788***	39.0	56.3	75.3	51.6	2.748	2.941	17.610	9.551
Poland		-0.318	0.787***	0.676***		20.6	32.6	26.5		5.482	21.035	16.133
Portugal	0.309*	-0.295	0.966***	0.692***	13.9	26.1	32.2	20.8	0.606	0.972	2.331	1.317
Romania		-0.008	0.467*	0.395***		20.5	41.0	30.8		1.363	2.743	2.315
Slovakia		0.853**	0.814***	0.777***		53.0	82.3	71.0		1.178	3.264	2.631
Slovenia		-0.147	0.885***	0.683***		48.4	62.2	57.2		0.367	1.303	1.210
Spain	-0.658	-0.306	0.976***	0.474***	12.5	22.8	29.1	18.6	3.325	5.184	11.637	6.838
Sweden	-0.562	-0.051	0.929***	0.506***	23.5	36.6	49.8	32.7	20.613	27.163	83.733	46.778
UK	-0.171	-0.692	0.858***	0.52***	17.9	24.2	28.5	21.8	3.814	7.342	17.918	9.906
Minimum	-0.671	-0.692	0.467*	0.395***	11.8	17.6	22.9	15.7	0.558	0.086	0.210	0.197
Maximum	0.668***	0.897***	0.991***	0.909***	104.2	125.6	164.3	123.9	20.613	260.367	1319.975	1060.533
Average	0.066	0.064	0.866	0.666	28.6	44.2	59.2	46.5	4.917	14.672	70.485	53.360
Average EU15	0.066	0.098	0.932	0.651	28.6	41.5	55.2	37.9	4.917	6.054	21.180	12.027

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

For the overall period, we can see that most of the countries exhibit a quite high level of exports synchronization with GDP in the euro area, and synchronization increased considerably since 1970. In the first sub-period, from fifteen countries considered, seven presented negative correlations, especially Ireland and Spain. Nevertheless, there are still some countries showing strong business cycle

synchronization, namely Belgium and Austria. The values related to the last period are considerably higher. For instance, that is the case for Italy, which has a correlation coefficient equal to 0.991 (and statistically significant).

For what concerns the respective business cycle volatilities, the average volatility level has increased between periods, and Hungary and the Czech Republic remained the countries with the highest synchronisation levels.

The average share of exports in GDP grew significantly between 1970 and 2009, from 28.6% in the first period (1970-1992) to 59.2% in the last period (1999-2009). This evolution may be explained by a higher level of market integration and the introduction of the single currency, which naturally facilitated intra EU trade.

Moreover, it is also possible to observe that in the New Member States of the EU the GDP export share has become rather important, surpassing in some cases the contribution of external demand to GDP in the "old" EU members. An example is Hungary where the contribution of exports to GDP more than doubled between 1993-1998 and 1999-2009. For Luxembourg it is interestingly to notice that the share of exports in GDP is above 100%, which has to be seen in the light of the significant financial services industry existent in that country,

In Table 7 report the results related to business cycle synchronization, volatility and the share of imports in GDP.

Observing the fourth column in Table 7, we can see that Belgium, France and Italy are the countries where imports are best synchronized with GDP in the euro area. Actually, in the first sub-period we find some countries with negative correlations (like Denmark and Ireland), and between 1999 and 2009 the least synchronized country is Romania, with a correlation coefficient of 0.671.

In the sub-period of 1999 to 2009, and although the New Members States are less synchronized, the respective values are already comparable to the values of the first fifteen members of the EU, which is a sign of increased integration with the EU.

The average imports volatilities of business cycle correlations have increased, throughout time. Once again, Hungary and Czech Republic are cases to highlight regarding relevant increases in GDP imports share. In addition, as in the case of the export shares, the imports shares also increased overall. Just as we saw in the analysis for exports, Luxembourg is the country with highest GDP imports shares.

Table 7 – Imports of goods and services synchronization (vis-à-vis AE12)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.836***	-0.185	0.906***	0.834***	28.8	38.1	49.7	35.9	1.811	1.267	5.915	3.418
Belgium	0.812***	0.099	0.959***	0.864***	47.2	63.4	77.1	57.8	3.769	2.315	11.824	6.799
Bulgaria		0.342	0.818***	0.709***		43.8	77.3	68.3		1.417	2.931	2.580
Cyprus		-0.63	0.816***	0.704***		51.2	55.2	54.0		0.176	0.431	0.364
Czech Republic		-0.426	0.851***	0.613***		46.3	83.2	63.6		31.807	201.651	156.557
Denmark	-0.241	0.039	0.893***	0.59***	23.8	32.8	47.1	31.6	8.441	11.354	44.826	24.318
Estonia		0.631*	0.827***	0.757***		66.7	91.6	82.8		3.780	21.151	16.877
Finland	-0.093	-0.265	0.933***	0.607***	21.8	27.5	36.6	26.7	1.427	1.125	4.802	2.757
France	0.76***	0.68*	0.973***	0.86***	15.7	21.3	29.3	20.3	7.038	6.395	22.052	13.905
Germany	0.874***	0.557	0.884***	0.832***	19.7	25.5	37.2	25.4	12.091	8.405	43.347	24.688
Greece	0.616***	0.232	0.971***	0.798***	16.2	27.0	35.0	23.0	0.850	0.961	4.455	2.618
Hungary		0.797**	0.919***	0.891***		44.3	92.3	70.2		322.810	1252.585	1002.709
Ireland	-0.239	0.425	0.903***	0.619***	39.4	60.7	82.4	54.5	1.165	2.667	6.896	4.291
Italy	0.797***	0.303	0.964***	0.863***	15.5	21.0	26.8	19.4	7.324	7.976	20.490	13.088
Latvia		-0.272	0.805***	0.713***		48.0	55.2	53.3		0.099	0.733	0.625
Lithuania		-0.364	0.758***	0.622***		51.5	65.2	61.6		1.367	7.144	6.208
Luxembourg	0.584***	0.813**	0.938***	0.787***	96.8	107.0	142.2	110.8	0.453	0.507	2.261	1.286
Malta		0.435	0.844***	0.801***		99.9	96.9	97.7		0.197	0.266	0.248
Netherlands	0.579***	0.022	0.961***	0.783***	37.2	50.6	68.7	47.9	3.161	4.785	15.749	9.059
Poland		-0.34	0.766***	0.616***		23.0	36.7	29.1		16.742	28.735	22.954
Portugal	0.694***	0.317	0.9***	0.787***	16.5	33.2	42.2	26.1	1.090	1.345	3.037	1.851
Romania		-0.327	0.671**	0.56***		23.2	60.4	43.0		1.047	10.269	7.740
Slovakia		0.093	0.834***	0.781***		57.3	84.1	73.8		0.945	2.805	2.294
Slovenia		-0.056	0.871***	0.638***		49.0	64.7	57.2		0.329	1.442	1.247
Spain	0.763***	0.444	0.918***	0.79***	11.1	23.0	35.1	19.5	4.119	3.051	24.409	13.322
Sweden	-0.045	0.034	0.924***	0.614***	24.8	32.4	40.9	30.4	19.125	32.137	73.121	42.458
UK	0.063	-0.152	0.868***	0.628***	16.8	23.8	31.7	21.9	5.853	4.650	22.410	12.924
Minimum	-0.241	-0.63	0.671***	0.56***	11.1	21.0	26.8	19.4	0.453	0.099	0.266	0.248
Maximum	0.874***	0.813***	0.973***	0.891***	96.8	107	142.2	110.8	19.125	322.810	1252.585	1002.709
Average	0.451	0.120	0.877	0.728	28.8	44.1	60.9	48.4	5.181	17.395	67.990	51.748
Average EU15	0.451	0.224	0.926	0.750	28.8	39.2	52.1	36.7	5.181	5.929	20.373	11.785

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

If we cross-check the information from tables 6 and 7, we see that there is not a full match between countries that are better synchronized exports wise and the countries best synchronized regarding imports. Nevertheless, the countries least synchronized with the euro area, Romania and Lithuania, report the last positions as much in exports as in imports synchronisation, between 1999 and 2009.

In addition, analyzing the weight of each component of the GDP, on average, and for each period considered, we can see that the values for exports and imports are quite similar.

Finally, we report in Table 8 the correlations of the cyclical component of the different aggregate demand's components with the GDP one, for the period 1970-2009. It is possible to see that the private investment is the component revealing the highest GDP correlation, followed by private consumption. On the other hand, government spending is aggregate's demand least correlated component with GDP, while also showing negative correlations with imports and exports.

Table 8 – Correlation of cyclical components for the EA12

1970-2009	GDP	C	GFCF	FCGG	EXP	IMP
GDP	1					
C	0.884***	1				
GFCF	0.951***	0.836***	1			
FCGG	0.315**	0.509***	0.179	1		
EXP	0.752***	0.423***	0.727***	-0.198	1	
IMP	0.874***	0.638***	0.881***	-0.058	0.949***	1
1970-1992	GDP	C	GFCF	FCGG	EXP	IMP
GDP	1					
C	0.937***	1				
GFCF	0.938***	0.872***	1			
FCGG	0.648***	0.785***	0.498***	1		
EXP	0.283*	-0.018	0.287*	-0.297	1	
IMP	0.922***	0.823***	0.943***	-0.378	0.455**	1
1993-1998	GDP	C	GFCF	FCGG	EXP	IMP
GDP	1					
C	0.732**	1				
GFCF	0.640*	0.357	1			
FCGG	0.315	0.767*	-0.321	1		
EXP	-0.029	-0.643	0.374	-0.908	1	
IMP	0.409	-0.189	0.793*	-0.732	0.849*	1
1999-2009	GDP	C	GFCF	FCGG	EXP	IMP
GDP	1					
C	0.929***	1				
GFCF	0.966***	0.880***	1			
FCGG	-0.410	-0.396	-0.593	1		
EXP	0.991***	0.901***	0.961***	-0.423	1	
IMP	0.976***	0.901***	0.981***	-0.520	0.989***	1

***,**,* denote significance respectively at 1%, 5%, and 10%.

In the 1970-1992 sub-period, private consumption and private investment are clearly the most correlated component with the GDP. In the sub-period 1993-1998 exports are negatively correlated with the GDP, private consumption, imports and government spending correlate positively.

Between 1999 and 2009, we see that all the aggregated demand components are positively and strongly correlated with GDP, with exception for government spending. We must emphasize the fact that this component presents negative correlations with all the other variables examined.

4.4. Some regression analysis

In this section we assess some potential linkages between business cycle synchronization and other related relevant economic variables. For this purpose, we have considered the pooled sample of 69 country observations: 15 for the sub-period 1970-1992; 27 for the sub-period 1993-1998; and finally, the remaining 27 that cover the sub-period 1999-2009. We report in Table 9 the main results of this analysis.

Table 9 – Regression analysis

Independent Variable	Dependent Variable							
	bcexp	bcimp	bcexp	bcimp	bcc	bcgfcf	bcgdp	bbalance
constant	-1.03*** (-3.88)	-0.38 (-1.50)	-0.08 (-0.63)	0.31** (2.46)	-0.28 (-1.04)	-0.10 (-0.39)	0.44*** (7.11)	2.77*** (-7.84)
lgdppc	0.54*** (5.42)	0.33*** (3.54)			0.25** (2.47)	0.19* (1.97)		
xmy			0.005*** (3.82)	0.002* (1.63)				
dgdppc							0.28* (1.96)	
vg								-0.01* (-1.65)
R^2	0.29	0.14	0.17	0.02	0.07	0.04	0.04	0.02
N	69	69	69	69	69	69	69	69

***,**,* denote significance respectively at 1%, 5%, and 10%. t-statistics are in brackets.

Note: *bcexp*: Exports Business Cycle Synchronisation; *bcimp*: Imports Business Cycle Synchronisation; *bcc*: Private Consumption Business Cycle Synchronisation; *bcgfcf*: Gross Fixed Capital Formation Business Cycle Synchronisation; *bcgdp*: GDP Business Cycle Synchronisation; *bbalance*: Budget Balance (in percentage of GDP); *lgdppc*: Logarithm of GDP *per capita*; *xmy*: Trade-to-GDP ratio or trade openness ratio; *dgdppc*: GDP *per capita* deviation (relative to average); *vg*: Volatility of cyclical components of government spending;

According to the results we can conclude that the higher a country's national wealth, proxied by per capita GPD, the higher will be its exports, imports, private consumption and private investment business cycle synchronization level with the euro area. Another relevant factor for exports and imports synchronization is the country's

degree of openness or integration in the world economy. Indeed, higher trade openness ratios imply better business cycle synchronization in the above mentioned components.[3]

This analysis allows us to also to highlight an interesting outcome based on the relation between the budget balance and the volatility of the cyclical component of government spending. Thus, an increase in the volatility of this component of aggregated demand reduces the budget balance (increases the budget deficit).

5. Conclusion

As argued in the literature, the stabilization costs of joining a monetary union is a decreasing function of the correlation between the cyclical output of the member country and the cyclical output of the union as a whole. In this context, and in the case of the euro area, we were able to corroborate the existence of strong business cycle correlations between individual countries and the euro area aggregates, which facilitates the implementation of the single monetary policy by the European Central Bank.

More specifically, in this paper we have analyzed business cycle synchronization in the EU, using annual data for the period 1970-2009. In particular we looked at business cycle synchronization of both GDP and of the aggregate demand components.

The results that we obtained show that the level of business cycle synchronization for the 27 EU countries has increased between 1970 and 2009, in line with Furceri and Karras (2008). Notably, it has been higher after the introduction of the single currency. In the most recent sub-period, we see that some of the new Member States (Cyprus, Latvia and Slovenia) already present business cycle synchronization similar to that of some EU-15, namely comparing to Greece and Portugal.

We also compare the peaks and troughs that we uncover with the ones reported by the CEPR Euro Area Cycle Dating Committee, concluding that the downturns identified by the committee are very close to the peaks and troughs that we computed for the cyclical component of GDP (using the HP filter).

In addition, we have considered each aggregated demand sub-component, computing for each of them the respective level of business cycle synchronization, the volatility of its cyclical component and the corresponding respective total valued added shares. Although private consumption is, on average, the biggest component of GDP, in

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[3] Since trade would also be influenced by the degree of synchronization, we have instrumented openness with the distance between each country and the other Euro area countries. However, results were not significant, so the overall conclusion needs to be read with care.

general and on average, external demand tends to be a more important determinant for GDP business cycle synchronization.

Another interesting issue is the rapid growth of average share of exports in GDP between 1970 and 2009. This evolution may be explained by a higher level of market integration and the introduction of the single currency, which naturally facilitated intra EU trade. Indeed, higher trade openness ratios imply better business cycle synchronization in the imports and exports components.

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Annex – Data

Original series (from AMECO) 1/	AMECO code	
GDP, current market prices	1.0.0.0.UVGD	Y
GDP, 2000 market prices	1.1.0.0.OVGD	
GDP Price deflator, 2000 = 100.	3.1.0.0.PVGD	
Private final consumption expenditure at current prices	1.0.0.0.UCPH	C
Private final consumption expenditure at 2000 prices	1.1.0.0.OCPH	
Price deflator private final consumption expenditure	3.1.0.0.PCPH	
Gross fixed capital formation at current prices; total economy	1.0.0.0.UIGT	I
Gross fixed capital formation at 2000 prices; total economy	1.1.0.0.OIGT	
Price deflator gross fixed capital formation; total economy	3.1.0.0.PIGT	
Gross capital formation; general government at current prices	1.0.0.0.UIGG0	
Gross fixed capital formation at current prices; private sector	1.0.0.0.UIGP	
Final consumption expenditure of general government at current prices	1.0.0.0.UCTG	G
Exports of goods and services at current prices (National accounts)	1.0.0.0.UXGS	X
Exports of goods and services at 2000 prices	1.1.0.0.OXGS	
Price deflator exports of goods and services	3.1.0.0.PXGS	
Imports of goods and services at current prices (National accounts)	1.0.0.0.UMGS	M
Imports of goods and services at 2000 prices	1.1.0.0.OMGS	
Price deflator imports of goods and services	3.1.0.0.PMGS	
Net exports of goods and services at current prices (National accounts)	1.0.0.0.UBGS	X-M
Domestic demand excluding stocks at current prices	1.0.0.0.UUNF	
Domestic demand including stocks at current prices	1.0.0.0.UUNT	
	1.0.0.0.UUNT -	
Change in inventories	1.0.0.0.UUNF	CHI

1/ European Commission *Annual Macro-economic Database* (AMECO).
Y=C+I+G+(X-M)+CHI.

Net lending (+) or net borrowing (-); general government ESA 1995 (Percentage of GDP at market prices) Source: AMECO Database.

Appendix 1 - Business cycle synchronization (vis-à-vis EU15, HP filter, λ=100)

Table A1.1 – GDP Business cycle synchronisation (vis-à-vis EU15)

	Business Cycle Synchronization				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.793***	0.619*	0.899***	0.861***	2.039	0.709	4.043	2.625
Belgium	0.883***	0.516	0.958***	0.916***	2.900	1.324	4.152	3.222
Bulgaria		0.349	0.583**	0.534***		1.554	1.351	1.405
Cyprus		0.275	0.799***	0.565***		0.160	0.152	0.150
Czech Republic		-0.395	0.706***	0.454***		60.991	88.901	89.064
Denmark	-0.129	0.183	0.952***	0.515***	17.427	19.101	30.317	21.594
Estonia		-0.134	0.822***	0.712***		3.328	10.455	8.493
Finland	0.167	0.244	0.994***	0.632***	3.178	3.291	4.386	3.887
France	0.9***	0.898***	0.975***	0.918***	16.308	6.812	20.859	18.482
Germany	0.61***	0.213	0.914***	0.619***	45.262	19.157	39.624	40.192
Greece	0.67***	0.451	0.72***	0.692***	2.785	0.304	2.808	2.677
Hungary		0.491	0.793***	0.837***		154.828	536.725	479.879
Ireland	0.125	0.139	0.919***	0.751***	0.806	1.261	6.184	3.570
Italy	0.837***	0.235	0.969***	0.911***	14.258	5.756	22.989	16.696
Latvia		0.14	0.874***	0.763***		0.286	0.649	0.724
Lithuania		0.018	0.826***	0.778***		3.339	5.141	5.783
Luxembourg	0.922***	0.277	0.958***	0.894***	0.368	0.516	0.739	0.528
Malta		0.159	0.622**	0.494***		0.037	0.097	0.076
Netherlands	0.836***	0.287	0.862***	0.849***	4.076	3.082	9.947	6.301
Poland		0.06	0.279	0.237*		16.935	19.705	21.047
Portugal	0.717***	0.21	0.769***	0.708***	2.604	1.412	2.357	2.472
Romania		-0.386	0.53**	0.3**		4.734	5.277	5.509
Slovakia		-0.127	0.535**	0.319**		0.503	1.752	1.454
Slovenia		0.179	0.904***	0.715***		0.251	0.724	0.746
Spain	0.823***	0.556	0.967***	0.897***	11.179	3.169	15.454	12.629
Sweden	0.326*	0.453	0.944***	0.736***	31.963	25.707	62.279	45.573
UK	0.416**	0.397	0.951***	0.717***	16.767	7.263	22.462	17.984
Minimum	-0.129	-0.395	0.279	0.237*	0.368	0.037	0.097	0.076
Maximum	0.922***	0.898***	0.994***	0.918***	45.262	154.828	536.725	479.879
Average	0.593	0.234	0.816	0.679	11.461	12.808	34.057	30.102
Average EU15	0.593	0.378	0.917	0.774	11.461	6.591	16.573	13.229

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A1.2 – Private consumption synchronisation (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.517***	-0.319	0.697***	0.44***	57.8	57.7	54.2	56.8	1.324	0.884	0.733	1.108
Belgium	0.854***	0.627*	0.862***	0.784***	54.5	55.0	52.3	54.0	1.520	0.432	1.135	1.320
Bulgaria		-0.054	0.652**	0.515***		67.6	71.0	69.6		1.392	0.994	1.097
Cyprus		-0.165	0.413	0.219*		62.7	66.4	65.3		0.277	0.193	0.215
Czech Republic		-0.351	0.178	-0.042		50.6	52.0	50.7		43.342	20.627	49.681
Denmark	-0.051	0.307	0.723***	0.289**	54.1	51.0	49.4	52.4	13.841	12.505	19.025	15.022
Estonia		-0.628	0.81***	0.691***		54.5	57.9	56.7		1.532	7.539	6.055
Finland	0.307*	0.095	0.863***	0.516***	53.2	52.5	50.7	52.4	1.733	1.673	1.326	1.786
France	0.799***	0.243	0.857***	0.732***	57.6	56.3	57.4	57.3	8.134	6.115	6.093	8.759
Germany	0.486***	-0.085	0.214	0.243*	56.2	59.4	57.9	57.2	32.150	19.328	11.352	26.183
Greece	0.567***	0.332	0.718***	0.63***	64.5	75.0	72.7	68.3	2.033	0.228	2.508	2.010
Hungary		0.239	0.49*	0.452***		53.6	56.5	55.7		384.672	473.049	438.732
Ireland	0.557***	0.116	0.972***	0.852***	63.2	52.1	47.5	57.2	0.792	0.440	2.715	1.623
Italy	0.739***	0.596	0.839***	0.738***	58.4	58.9	59.6	58.8	10.164	7.053	8.706	10.431
Latvia		-0.653	0.836***	0.719***		64.1	65.7	65.3		0.119	0.573	0.492
Lithuania		-0.259	0.809***	0.69***		61.2	66.6	65.1		0.767	4.172	3.594
Luxembourg	0.785***	0.676*	0.22	0.494***	53.4	44.5	38.6	48.0	0.125	0.081	0.232	0.162
Malta		-0.93	0.286	0.33**		65.0	66.5	66.1		0.031	0.053	0.050
Netherlands	0.638***	0.174	0.543**	0.614***	54.2	50.0	49.1	52.2	3.292	2.215	4.495	3.826
Poland	0.621***	-0.186	0.001	0.133		64.1	63.9	63.6		8.746	9.439	8.669
Portugal	0.693***	0.106	0.654**	0.603***	58.5	63.6	65.2	61.1	1.751	1.157	1.130	1.539
Romania		-0.352	0.612**	0.456***		63.2	79.7	71.8		3.263	7.155	6.030
Slovakia		-0.284	0.409	0.203		45.3	55.5	52.4		0.328	0.522	0.490
Slovenia		-0.106	0.663**	0.212*		59.0	55.7	56.2		0.170	0.207	0.338
Spain	0.853***	0.188	0.929***	0.89***	62.0	59.9	59.7	61.1	8.319	4.089	12.449	9.631
Sweden	0.54***	0.557	0.908***	0.654***	54.1	50.2	48.6	52.0	25.197	5.969	17.764	24.391
UK	0.477**	0.151	0.799***	0.66***	59.6	63.5	66.4	62.0	12.603	3.030	14.261	13.235
Minimum	-0.051	-0.93	0.001	-0.042	53.2	44.5	38.6	48.0	0.125	0.031	0.053	0.050
Maximum	0.854***	0.676***	0.972***	0.89***	64.5	75.0	79.7	71.8	32.150	384.672	473.049	438.732
Average	0.586	0.001	0.628	0.508	57.4	57.8	58.8	58.9	8.199	18.883	23.276	23.573
Average EU15	0.584	0.251	0.720	0.609	57.4	56.6	55.3	58.9	8.199	4.347	6.928	8.068

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A1.3 – Final consumption expenditure of general government synchronization
(vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	-0.172	-0.037	-0.192	-0.24	18.1	20.0	18.9	18.6	0.437	0.711	0.752	0.592
Belgium	-0.095	-0.667	-0.619	-0.206	21.3	21.4	22.5	21.7	0.844	0.460	0.621	0.737
Bulgaria		0.49	0.135	0.364**		15.2	17.4	16.9		0.709	0.242	0.528
Cyprus		-0.508	-0.554	-0.508		15.6	18.1	17.4		0.053	0.078	0.070
Czech Republic		-0.42	0.116	0.152		21.3	21.5	21.6		12.656	14.405	24.148
Denmark	-0.337	0.209	-0.635	-0.342	24.8	25.5	26.4	25.4	5.084	2.443	3.668	4.368
Estonia		0.462	0.29	0.17		22.6	18.7	20.1		0.807	1.045	0.964
Finland	0.458**	-0.743	-0.472	0.123	19.1	22.9	21.8	20.4	0.663	0.344	0.544	0.617
France	-0.397	-0.44	0.133	-0.153	20.9	23.7	23.4	22.0	3.122	4.438	3.456	3.359
Germany	0.286*	-0.332	-0.614	-0.054	18.8	19.5	18.8	18.9	11.906	5.914	5.593	9.857
Greece	-0.256	0.273	0.318	0.243*	13.6	14.8	17.1	14.7	0.523	0.524	0.999	0.772
Hungary		0.005	0.296	-0.179		24.5	22.0	23.1		433.067	182.015	546.750
Ireland	-0.086	-0.125	0.641**	0.365**	17.2	15.9	15.4	16.5	0.369	0.379	0.662	0.461
Italy	0.565***	-0.281	0.19	0.41***	17.8	18.6	19.7	18.5	5.469	5.759	4.476	5.581
Latvia		0.605	0.515*	0.261*		21.0	19.8	18.6		0.065	0.078	0.076
Lithuania		0.299	0.348	0.089		23.1	20.5	20.6		1.277	0.483	1.419
Luxembourg	0.539***	-0.487	-0.504	-0.042	15.1	16.0	16.0	15.5	0.063	0.058	0.123	0.083
Malta		-0.614	-0.531	-0.59		19.0	20.2	19.4		0.016	0.032	0.027
Netherlands	0.487***	0.271	0.113	0.266**	23.1	23.2	24.2	23.4	1.354	1.823	2.023	1.588
Poland		-0.445	0.091	0.354**		18.7	18.0	18.8		3.901	3.611	4.675
Portugal	0.536***	-0.184	-0.202	0.215*	13.8	18.0	20.4	16.3	0.561	0.501	0.614	0.570
Romania		0.085	0.323	0.292**		13.4	16.7	15.8		1.261	1.104	1.106
Slovakia		-0.536	-0.052	-0.191		22.9	19.3	20.6		0.405	0.238	0.314
Slovenia		-0.143	-0.27	0.041		18.7	18.8	18.6		0.062	0.073	0.074
Spain	0.533***	-0.141	-0.325	0.077	13.8	18.0	18.1	15.6	2.089	2.831	2.230	2.197
Sweden	0.417**	-0.106	0.316	0.398***	26.4	27.4	26.7	26.6	10.840	7.446	7.446	10.082
UK	0.193	-0.111	-0.128	0.099	20.6	19.1	20.6	20.4	3.283	5.818	4.806	4.242
Minimum	-0.397	-0.743	-0.635	-0.59	13.6	13.4	15.4	14.7	0.063	0.016	0.032	0.027
Maximum	0.565***	0.605***	0.641***	0.41***	26.4	27.4	26.7	26.6	11.906	433.067	182.015	546.750
Average	0.178	-0.134	-0.047	0.052	19.0	20.0	20.0	19.5	3.107	18.286	8.941	23.158
Average EU15	0.178	-0.193	-0.132	0.077	19.0	20.3	20.7	19.6	3.107	2.630	2.534	3.007

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A1.4 – Gross fixed capital formation synchronisation (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.788***	0.049	0.767***	0.677***	23.4	24.3	22.5	23.3	1.510	0.523	1.434	1.361
Belgium	0.835***	0.248	0.557**	0.646***	20.8	20.5	21.4	20.9	2.791	0.794	2.180	2.401
Bulgaria		0.35	0.654**	0.506***		11.4	23.8	19.9		0.950	1.147	1.067
Cyprus		-0.042	0.632**	0.475***		18.7	18.9	18.8		0.052	0.135	0.117
Czech Republic		-0.304	0.723***	0.177		27.8	28.3	27.3		48.750	31.820	44.508
Denmark	0.052	0.225	0.905***	0.505***	16.1	17.4	20.5	17.5	13.169	15.275	18.732	14.933
Estonia		0.329	0.786***	0.691***		22.3	31.1	28.0		1.397	7.956	6.362
Finland	0.173	0.153	0.946***	0.446***	24.8	17.3	19.4	22.2	2.149	2.499	1.400	2.244
France	0.865***	0.574	0.936***	0.859***	20.1	17.8	19.9	19.7	10.458	3.721	10.394	10.684
Germany	0.591***	0.458	0.558**	0.496***	20.3	21.0	20.0	20.3	18.738	9.359	21.910	18.301
Greece	0.597***	-0.04	0.755***	0.713***	22.6	17.6	22.0	21.7	1.912	0.538	2.964	2.220
Hungary		0.484	0.51*	0.608***		20.1	24.1	22.2		104.659	179.674	167.222
Ireland	0.219	0.176	0.84***	0.686***	25.0	20.3	22.0	23.5	0.837	1.136	4.069	2.261
Italy	0.825***	0.063	0.922***	0.858***	21.2	18.7	20.7	20.7	7.866	4.854	11.479	9.682
Latvia		0.806**	0.804***	0.737***		17.7	29.5	26.3		0.109	0.433	0.370
Lithuania		0.252	0.84***	0.735***		17.5	22.6	21.0		0.763	3.176	2.642
Luxembourg	0.651***	-0.028	0.822***	0.746***	20.8	20.5	22.5	21.2	0.205	0.180	0.365	0.258
Malta		0.119	0.559**	0.532***		23.8	19.1	20.4		0.053	0.089	0.079
Netherlands	0.568***	0.057	0.62**	0.582***	20.3	20.2	20.8	20.4	1.972	3.653	5.618	3.568
Poland		0.121	0.211	0.183		18.7	21.6	19.7		16.339	20.029	17.103
Portugal	0.596***	0.314	0.664**	0.627***	22.1	23.4	24.2	22.9	1.425	1.719	1.949	1.683
Romania		-0.205	0.356	0.16		17.5	24.8	20.9		1.093	3.642	2.941
Slovakia		-0.124	0.515*	0.178		29.3	26.9	27.7		1.148	0.875	0.977
Slovenia		0.219	0.861***	0.755***		20.9	26.4	23.3		0.184	0.549	0.452
Spain	0.761***	0.647*	0.921***	0.872***	21.7	22.4	27.1	23.3	7.733	2.477	14.194	10.063
Sweden	0.448**	0.149	0.907***	0.707***	18.2	15.8	17.7	17.7	21.692	20.295	32.459	26.473
UK	0.38**	0.46	0.956***	0.735***	15.1	15.6	17.5	15.8	6.542	6.523	11.813	8.461
Minimum	0.052	-0.304	0.211	0.16**	15.1	11.4	17.5	15.8	0.205	0.052	0.089	0.079
Maximum	0.865***	0.806***	0.956***	0.872***	25.0	29.3	31.1	28.0	21.692	104.659	179.674	167.222
Average	0.557	0.204	0.723	0.589	20.8	19.9	22.8	21.7	6.600	9.224	14.462	13.275
Average EU15	0.557	0.234	0.805	0.677	20.8	19.5	21.2	20.7	6.600	4.903	9.397	7.640

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A1.5 – Exports of goods and services synchronisation (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.611***	0.533	0.969***	0.851***	26.2	36.4	53.4	35.2	1.479	1.257	7.872	4.369
Belgium	0.76***	0.499	0.98***	0.878***	47.9	64.9	81.0	59.6	2.586	2.380	13.009	7.155
Bulgaria		-0.746	0.735***	0.561***		50.8	61.8	58.9		0.699	1.676	1.499
Cyprus		-0.35	0.947***	0.894***		50.9	52.2	51.8		0.147	0.348	0.298
Czech Republic		-0.076	0.824***	0.725***		45.3	80.9	62.9		30.371	219.769	162.873
Denmark	-0.132	0.013	0.945***	0.691***	25.8	37.9	50.5	34.4	9.366	9.331	34.911	20.820
Estonia		0.313	0.818***	0.739***		62.8	79.6	73.7		4.144	11.034	9.026
Finland	-0.435	0.758**	0.954***	0.65***	20.3	32.5	45.4	29.0	1.392	0.674	6.695	3.608
France	0.453**	0.549	0.945***	0.793***	14.9	22.7	28.6	19.8	4.172	9.116	21.243	12.450
Germany	0.317*	0.347	0.949***	0.789***	22.5	25.1	41.1	28.0	14.926	12.795	66.284	37.425
Greece	0.171	0.331	0.786***	0.634***	11.8	17.6	22.9	15.7	0.946	0.822	2.580	1.641
Hungary		0.219	0.853***	0.849***		41.3	91.1	68.6		260.367	1319.975	1060.533
Ireland	-0.527	0.695*	0.814***	0.597***	33.6	70.4	98.9	57.1	1.043	2.074	6.185	4.074
Italy	0.006	0.211	0.992***	0.644***	15.6	23.8	26.6	19.9	6.177	7.982	23.130	13.024
Latvia		-0.459	0.812***	0.666***		41.7	41.8	41.7		0.086	0.273	0.239
Lithuania		-0.351	0.657**	0.484***		47.2	54.7	52.7		0.988	3.767	3.368
Luxembourg	0.733***	0.482	0.944***	0.851***	104.2	125.6	164.3	123.9	0.558	0.773	2.556	1.453
Malta		0.8**	0.905***	0.882***		88.9	91.6	90.9		0.139	0.210	0.197
Netherlands	0.698***	0.604	0.962***	0.845***	39.0	56.3	75.3	51.6	2.748	2.941	17.610	9.551
Poland		0.203	0.802***	0.728***		20.6	32.6	26.5		5.482	21.035	16.133
Portugal	0.414**	0.299	0.969***	0.767***	13.9	26.1	32.2	20.8	0.606	0.972	2.331	1.317
Romania		-0.161	0.471*	0.432***		20.5	41.0	30.8		1.363	2.743	2.315
Slovakia		0.496	0.821***	0.766***		53.0	82.3	71.0		1.178	3.264	2.631
Slovenia		0.442	0.893***	0.764***		48.4	62.2	57.2		0.367	1.303	1.210
Spain	-0.647	0.239	0.984***	0.563***	12.5	22.8	29.1	18.6	3.325	5.184	11.637	6.838
Sweden	-0.376	0.519	0.944***	0.624***	23.5	36.6	49.8	32.7	20.613	27.163	83.733	46.778
UK	0.022	-0.15	0.88***	0.626***	17.9	24.2	28.5	21.8	3.814	7.342	17.918	9.906
Minimum	-0.647	-0.746	0.471*	0.432***	11.8	17.6	22.9	15.7	0.558	0.086	0.210	0.197
Maximum	0.76***	0.8**	0.992***	0.894***	104.2	125.6	164.3	123.9	20.613	260.367	1319.975	1060.533
Average	0.138	0.232	0.872	0.715	28.6	44.2	59.2	46.5	4.917	14.672	70.485	53.360
Average EU15	0.138	0.395	0.934	0.720	28.6	41.5	55.2	37.9	4.917	6.054	21.180	12.027

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A1.6 – Imports of goods and services synchronisation (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.79***	-0.185	0.906***	0.869***	28.8	38.1	49.7	35.9	1.811	1.267	5.915	3.418
Belgium	0.904***	0.099	0.959***	0.916***	47.2	63.4	77.1	57.8	3.769	2.315	11.824	6.799
Bulgaria		0.342	0.818***	0.732***		43.8	77.3	68.3		1.417	2.931	2.580
Cyprus		-0.63	0.816***	0.674***		51.2	55.2	54.0		0.176	0.431	0.364
Czech Republic		-0.426	0.851***	0.685***		46.3	83.2	63.6		31.807	201.651	156.557
Denmark	-0.058	0.039	0.893***	0.682***	23.8	32.8	47.1	31.6	8.441	11.354	44.826	24.318
Estonia		0.631*	0.827***	0.774***		66.7	91.6	82.8		3.780	21.151	16.877
Finland	0.14	-0.265	0.933***	0.726***	21.8	27.5	36.6	26.7	1.427	1.125	4.802	2.757
France	0.868***	0.68*	0.973***	0.923***	15.7	21.3	29.3	20.3	7.038	6.395	22.052	13.905
Germany	0.757***	0.557	0.884***	0.828***	19.7	25.5	37.2	25.4	12.091	8.405	43.347	24.688
Greece	0.641***	0.232	0.971***	0.848***	16.2	27.0	35.0	23.0	0.850	0.961	4.455	2.618
Hungary		0.797**	0.919***	0.905***		44.3	92.3	70.2		322.810	1252.585	1002.709
Ireland	-0.085	0.425	0.903***	0.701***	39.4	60.7	82.4	54.5	1.165	2.667	6.896	4.291
Italy	0.834***	0.303	0.964***	0.919***	15.5	21.0	26.8	19.4	7.324	7.976	20.490	13.088
Latvia		-0.272	0.805***	0.749***		48.0	55.2	53.3		0.099	0.733	0.625
Lithuania		-0.364	0.758***	0.651***		51.5	65.2	61.6		1.367	7.144	6.208
Luxembourg	0.727***	0.813**	0.938***	0.853***	96.8	107.0	142.2	110.8	0.453	0.507	2.261	1.286
Malta		0.435	0.844***	0.815***		99.9	96.9	97.7		0.197	0.266	0.248
Netherlands	0.741***	0.022	0.961***	0.849***	37.2	50.6	68.7	47.9	3.161	4.785	15.749	9.059
Poland		-0.34	0.766***	0.644***		23.0	36.7	29.1		16.742	28.735	22.954
Portugal	0.663***	0.317	0.9***	0.798***	16.5	33.2	42.2	26.1	1.090	1.345	3.037	1.851
Romania		-0.327	0.671**	0.576***		23.2	60.4	43.0		1.047	10.269	7.740
Slovakia		0.093	0.834***	0.768***		57.3	84.1	73.8		0.945	2.805	2.294
Slovenia		-0.056	0.871***	0.726***		49.0	64.7	57.2		0.329	1.442	1.247
Spain	0.828***	0.444	0.918***	0.862***	11.1	23.0	35.1	19.5	4.119	3.051	24.409	13.322
Sweden	0.21	0.034	0.924***	0.72***	24.8	32.4	40.9	30.4	19.125	32.137	73.121	42.458
UK	0.343*	-0.152	0.868***	0.762***	16.8	23.8	31.7	21.9	5.853	4.650	22.410	12.924
Minimum	-0.085	-0.63	0.671***	0.576***	11.1	21.0	26.8	19.4	0.453	0.099	0.266	0.248
Maximum	0.904***	0.813***	0.973***	0.923***	96.8	107.0	142.2	110.8	19.125	322.810	1252.585	1002.709
Average	0.554	0.120	0.877	0.776	28.8	44.1	60.9	48.4	5.181	17.395	67.990	51.748
Average EU15	0.554	0.224	0.926	0.817	28.8	39.2	52.1	36.7	5.181	5.929	20.373	11.785

Note: Hodrick-Prescott Filter with smoothness parameter equal to 100.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Appendix 2 - Business cycle synchronization (vis-à-vis EU15, HP filter, λ=6.25)

Table A2.1 – GDP Business cycle synchronization (vis-à-vis EU15)

	Business Cycle Synchronization				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.732***	0.501	0.97***	0.905***	1.359	0.543	3.4	2.045
Belgium	0.774***	0.811**	0.969***	0.897***	1.785	1.477	3.372	2.295
Bulgaria		0.597	0.905***	0.686***		1.048	0.851	0.873
Cyprus		0.689*	0.945***	0.667***		0.153	0.13	0.134
Czech Republic		0.437	0.956***	0.57***		50.078	62.563	63.286
Denmark	0.346*	0.86**	0.946***	0.744***	11.522	11.125	21.852	14.628
Estonia		-0.477	0.891***	0.801***		2.065	6.781	5.5
Finland	0.201	0.712*	0.994***	0.724***	1.936	1.765	3.408	2.372
France	0.802***	0.893***	0.972***	0.892***	9.648	6.205	15.363	11.38
Germany	0.633***	0.433	0.976***	0.776***	28.404	5.384	33.931	27.754
Greece	0.585***	0.661*	0.808***	0.623***	2.013	0.602	1.827	1.799
Hungary		0.707*	0.87***	0.862***		84.614	285.619	226.008
Ireland	0.387**	0.26	0.924***	0.818***	0.59	0.596	3.868	2.049
Italy	0.804***	0.833**	0.97***	0.893***	9.601	7.746	16.341	11.473
Latvia		0.728*	0.927***	0.762***			0.447	0.408
Lithuania		0.373	0.886***	0.794***			3.705	3.273
Luxembourg	0.871***	-0.249	0.947***	0.869***	0.186	0.287	0.604	0.359
Malta		0.717*	0.82***	0.796***		0.016	0.073	0.056
Netherlands	0.745***	0.371	0.963***	0.908***	2.308	0.797	7.85	4.453
Poland		0.483	0.814***	0.499***		7.791	11.893	12.228
Portugal	0.657***	-0.239	0.904***	0.684***	1.559	0.725	1.427	1.462
Romania		0.466	0.796***	0.418***		3.901	3.408	3.867
Slovakia		0.152	0.877***	0.775***		0.385	1.272	1.009
Slovenia		0.869**	0.953***	0.733***		0.195	0.606	0.522
Spain	0.704***	0.897***	0.987***	0.919***	4.186	2.103	10.898	6.638
Sweden	0.294*	0.951***	0.942***	0.785***	16.776	25.573	44.224	27.902
UK	0.4**	0.94***	0.966***	0.737***	9.938	5.386	14.947	10.831
Minimum	0.201	-0.477	0.796***	0.418***	0.186	0.016	0.073	0.056
Maximum	0.871***	0.951***	0.994***	0.919***	28.404	84.614	285.619	226.008
Average	0.596	0.533	0.921	0.761	6.787	8.822	20.765	16.467

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A2.2 – Private consumption synchronization (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.253	-0.232	0.587**	0.316**	57.8	57.7	54.2	56.8	0.842	0.607	0.562	0.734
Belgium	0.816***	0.726*	0.944***	0.802***	54.5	55.0	52.3	54.0	0.881	0.400	0.868	0.833
Bulgaria		-0.069	0.923***	0.627***		67.6	71.0	69.6		0.756	0.641	0.632
Cyprus		0.49	0.815***	0.59***		62.7	66.4	65.3		0.229	0.147	0.169
Czech Republic		0.37	0.545**	-0.004		50.6	52.0	50.7		28.457	13.204	37.935
Denmark	0.089	0.756**	0.836***	0.493***	54.1	51.0	49.4	52.4	9.487	8.480	12.953	10.195
Estonia		-0.51	0.88***	0.787***		54.5	57.9	56.7		1.497	5.011	4.066
Finland	0.302*	0.645*	0.868***	0.56***	53.2	52.5	50.7	52.4	0.892	1.235	0.982	0.965
France	0.554***	0.339	0.873***	0.629***	57.6	56.3	57.4	57.3	4.154	4.406	3.996	4.356
Germany	0.393**	-0.482	0.229	0.239*	56.2	59.4	57.9	57.2	20.145	8.279	7.345	15.990
Greece	0.524***	0.577	0.822***	0.679***	64.5	75.0	72.7	68.3	1.163	0.568	1.676	1.240
Hungary		0.875**	0.409	0.391***		53.6	56.5	55.7		190.232	193.645	185.851
Ireland	0.564***	-0.659	0.964***	0.861***	63.2	52.1	47.5	57.2	0.510	0.230	2.173	1.178
Italy	0.688***	0.599	0.842***	0.676***	58.4	58.9	59.6	58.8	6.348	5.055	5.608	6.256
Latvia		-0.944	0.926***	0.895***		64.1	65.7	65.3		0.063	0.423	0.359
Lithuania		-0.788	0.925***	0.902***		61.2	66.6	65.1		0.156	3.068	2.598
Luxembourg	0.49***	0.387	0.353	0.414***	53.4	44.5	38.6	48.0	0.070	0.053	0.179	0.109
Malta		-0.471	0.393	0.357**		65.0	66.5	66.1		0.038	0.045	0.042
Netherlands	0.623***	-0.405	0.728***	0.648***	54.2	50.0	49.1	52.2	1.645	0.713	2.173	1.795
Poland		-0.463	0.488*	0.402***		64.1	63.9	63.6		5.266	5.306	4.945
Portugal	0.565***	-0.714	0.732***	0.529***	58.5	63.6	65.2	61.1	1.011	0.592	0.794	0.926
Romania		0.456	0.878***	0.657***		63.2	79.7	71.8		2.811	4.957	4.182
Slovakia		-0.482	0.773***	0.63***		45.3	55.5	52.4		0.275	0.379	0.347
Slovenia		0.559	0.034	-0.014		59.0	55.7	56.2		0.741	1.137	2.063
Spain	0.686***	0.061	0.959***	0.888***	62.0	59.9	59.7	61.1	2.879	0.912	8.242	4.879
Sweden	0.206**	0.877**	0.856***	0.575***	54.1	50.2	48.6	52.0	11.110	7.568	12.910	11.599
UK	0.375**	-0.04	0.898***	0.591***	59.6	63.5	66.4	62.0	7.106	1.545	7.008	6.522
Minimum	0.089	-0.944	0.034	-0.014	53.2	44.5	38.6	48.0	0.070	0.038	0.045	0.042
Maximum	0.816***	0.877***	0.964***	0.902***	64.5	75.0	79.7	71.8	20.145	190.232	193.645	185.851
Average	0.475	0.054	0.721	0.56	57.4	57.8	58.8	58.9	4.550	10.043	10.942	11.510

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A2.3 – Final consumption expenditure of general government synchronization
(vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	-0.423	-0.079	0.194	-0.012	18.1	20.0	18.9	18.6	0.229	0.641	0.397	0.353
Belgium	-0.069	-0.025	-0.596	-0.28	21.3	21.4	22.5	21.7	0.449	0.428	0.481	0.445
Bulgaria		0.098	-0.012	0.053		15.2	17.4	16.9		0.434	0.143	0.268
Cyprus		-0.832	-0.496	-0.495		15.6	18.1	17.4		0.038	0.069	0.061
Czech Republic		-0.145	-0.077	-0.14		21.3	21.5	21.6		11.364	8.744	16.985
Denmark	-0.219	-0.484	-0.682	-0.373	24.8	25.5	26.4	25.4	3.429	2.354	2.710	3.042
Estonia		0.823**	0.633**	0.59***		22.6	18.7	20.1		0.679	0.801	0.738
Finland	0.16	0.091	-0.608	-0.075	19.1	22.9	21.8	20.4	0.425	0.498	0.295	0.406
France	-0.468	-0.737	-0.368	-0.369	20.9	23.7	23.4	22.0	1.365	3.185	1.555	1.740
Germany	0.229	-0.471	-0.602	-0.027	18.8	19.5	18.8	18.9	7.884	3.061	3.384	6.280
Greece	-0.139	0.3	0.313	0.191	13.6	14.8	17.1	14.7	0.409	0.552	0.758	0.535
Hungary		-0.736	0.089	-0.167		24.5	22.0	23.1		333.324	95.699	411.602
Ireland	-0.033	-0.152	0.776***	0.514***	17.2	15.9	15.4	16.5	0.250	0.158	0.524	0.330
Italy	0.457**	-0.765	-0.07	0.162	17.8	18.6	19.7	18.5	2.871	2.978	2.042	2.695
Latvia		0.418	0.601**	0.391***		21.0	19.8	18.6		0.063	0.072	0.070
Lithuania		0.757**	0.578**	0.05		23.1	20.5	20.6		0.752	0.370	0.989
Luxembourg	-0.126	-0.513	-0.744	-0.555	15.1	16.0	16.0	15.5	0.034	0.045	0.094	0.057
Malta		-0.295	-0.338	-0.338		19.0	20.2	19.4		0.011	0.023	0.018
Netherlands	-0.021	0.069	0.332	0.231*	23.1	23.2	24.2	23.4	0.704	1.082	1.760	1.108
Poland		-0.382	0.637**	0.467***		18.7	18.0	18.8		3.366	2.299	2.635
Portugal	0.458**	-0.94	-0.492	-0.11	13.8	18.0	20.4	16.3	0.297	0.277	0.430	0.336
Romania		0.44	0.202	0.214*		13.4	16.7	15.8		0.877	0.977	0.930
Slovakia		-0.462	0.099	-0.055		22.9	19.3	20.6		0.383	0.196	0.271
Slovenia		-0.713	-0.193	-0.223		18.7	18.8	18.6		0.039	0.065	0.053
Spain	0.17	-0.775	0.191	0.113	13.8	18.0	18.1	15.6	0.978	1.166	0.793	0.945
Sweden	0.391**	-0.494	0.103	0.22*	26.4	27.4	26.7	26.6	5.604	5.054	5.428	5.534
UK	-0.231	0.029	-0.606	-0.301	20.6	19.1	20.6	20.4	2.143	2.768	2.146	2.202
Minimum	-0.468	-0.94	-0.744	-0.555	13.6	13.4	15.4	14.7	0.034	0.011	0.023	0.018
Maximum	0.458***	0.823***	0.776***	0.59***	26.4	27.4	26.7	26.6	7.884	333.324	95.699	411.602
Average	0.009	-0.221	-0.042	-0.012	19.0	20.0	20.0	19.5	1.805	13.910	4.898	17.060

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A2.4 – Gross fixed capital formation synchronization (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.541***	0.35	0.831***	0.678***	23.4	24.3	22.5	23.3	0.906	0.571	1.228	0.950
Belgium	0.537***	0.352	0.783***	0.65***	20.8	20.5	21.4	20.9	1.327	0.736	1.706	1.364
Bulgaria		0.77**	0.866***	0.839***		11.4	23.8	19.9		0.463	0.947	0.810
Cyprus		0.04	0.632**	0.505***		18.7	18.9	18.8		0.085	0.162	0.148
Czech Republic		0.447	0.753***	0.287**		27.8	28.3	27.3		37.243	27.116	36.259
Denmark	0.258	0.678*	0.906***	0.678***	16.1	17.4	20.5	17.5	7.562	7.917	14.274	9.630
Estonia		0	0.815***	0.731***		22.3	31.1	28.0		1.671	5.064	4.141
Finland	0.026	0.555	0.954***	0.444***	24.8	17.3	19.4	22.2	1.281	1.511	1.124	1.269
France	0.735***	0.726*	0.94***	0.856***	20.1	17.8	19.9	19.7	5.164	3.399	8.926	6.422
Germany	0.629***	0.194	0.891***	0.758***	20.3	21.0	20.0	20.3	11.398	5.463	16.279	12.261
Greece	0.511***	-0.319	0.718***	0.581***	22.6	17.6	22.0	21.7	1.560	0.276	1.784	1.494
Hungary		0.144	0.323	0.322**		20.1	24.1	22.2		81.563	82.915	78.103
Ireland	0.561***	0.455	0.805***	0.743***	25.0	20.3	22.0	23.5	0.545	0.550	2.471	1.338
Italy	0.803***	0.67*	0.962***	0.841***	21.2	18.7	20.7	20.7	4.953	6.018	7.234	5.921
Latvia		0.318	0.825***	0.78***		17.7	29.5	26.3		0.124	0.273	0.239
Lithuania		-0.093	0.887***	0.835***		17.5	22.6	21.0		0.770	2.380	1.992
Luxembourg	0.369**	-0.735	0.76***	0.602***	20.8	20.5	22.5	21.2	0.141	0.126	0.310	0.196
Malta		0.656*	0.42*	0.428***		23.8	19.1	20.4		0.035	0.072	0.063
Netherlands	0.548***	-0.01	0.869***	0.78***	20.3	20.2	20.8	20.4	1.311	1.382	4.057	2.387
Poland		0.112	0.748***	0.645***		18.7	21.6	19.7		7.610	10.845	8.995
Portugal	0.455**	0.041	0.866***	0.626***	22.1	23.4	24.2	22.9	1.032	0.917	1.204	1.079
Romania		0.679*	0.826***	0.612***		17.5	24.8	20.9		0.751	2.547	2.048
Slovakia		-0.273	0.713***	0.402***		29.3	26.9	27.7		0.892	0.657	0.716
Slovenia		0.878**	0.893***	0.801***		20.9	26.4	23.3		0.090	0.468	0.356
Spain	0.56***	0.783**	0.933***	0.848***	21.7	22.4	27.1	23.3	3.389	2.956	9.368	5.652
Sweden	0.333*	0.793**	0.966***	0.783***	18.2	15.8	17.7	17.7	11.369	17.714	26.519	17.565
UK	0.274	0.375	0.941***	0.74***	15.1	15.6	17.5	15.8	3.750	4.234	8.951	5.567
Minimum	0.026	-0.735	0.323	0.287**	15.1	11.4	17.5	15.8	0.141	0.035	0.072	0.063
Maximum	0.803***	0.878***	0.966***	0.856***	25.0	29.3	31.1	28.0	11.398	81.563	82.915	78.103
Average	0.476	0.318	0.808	0.659	20.8	19.9	22.8	21.7	3.713	6.854	8.847	7.665

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A2.5 – Exports of goods and services synchronization (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.616***	0.603	0.984***	0.894***	26.2	36.4	53.4	35.2	1.187	1.091	6.120	3.269
Belgium	0.745***	0.662*	0.97***	0.901***	47.9	64.9	81.0	59.6	2.016	2.188	9.905	5.323
Bulgaria		-0.715	0.83***	0.711***		50.8	61.8	58.9		0.686	1.074	0.980
Cyprus		0.348	0.953***	0.91***		50.9	52.2	51.8		0.150	0.288	0.249
Czech Republic		-0.054	0.972***	0.855***		45.3	80.9	62.9		20.215	170.347	124.869
Denmark	0.13	0.192	0.921***	0.761***	25.8	37.9	50.5	34.4	6.271	9.573	27.826	15.497
Estonia		-0.214	0.817***	0.753***		62.8	79.6	73.7		2.757	7.866	6.407
Finland	0.098	0.057	0.968***	0.803***	20.3	32.5	45.4	29.0	0.742	0.838	5.602	2.909
France	0.707***	0.553	0.967***	0.892***	14.9	22.7	28.6	19.8	3.362	5.310	14.804	8.245
Germany	0.343*	0.726*	0.985***	0.855***	22.5	25.1	41.1	28.0	11.787	11.687	52.062	28.255
Greece	0.248	-0.119	0.784***	0.648***	11.8	17.6	22.9	15.7	0.736	0.699	2.133	1.263
Hungary		0.606	0.993***	0.957***		41.3	91.1	68.6		298.989	1081.471	831.758
Ireland	0.283*	0.175	0.866***	0.75***	33.6	70.4	98.9	57.1	0.366	1.296	3.932	2.144
Italy	0.08	0.761**	0.972***	0.772***	15.6	23.8	26.6	19.9	4.167	5.758	18.053	9.897
Latvia		-0.214	0.817***	0.753***		41.7	41.8	41.7		2.757	7.866	6.407
Lithuania		-0.55	0.68	0.578***		47.2	54.7	52.7		1.591	2.836	2.576
Luxembourg	0.76***	0.037	0.973***	0.891***	104.2	125.6	164.3	123.9	0.406	0.511	2.062	1.113
Malta		0.983***	0.852***	0.815***		88.9	91.6	90.9		0.130	0.163	0.152
Netherlands	0.81***	0.634*	0.98***	0.904***	39.0	56.3	75.3	51.6	1.983	2.515	14.292	7.501
Poland		0.564	0.92***	0.822***		20.6	32.6	26.5		5.722	16.145	12.179
Portugal	0.558***	0.832**	0.975***	0.872***	13.9	26.1	32.2	20.8	0.476	0.711	1.877	1.049
Romania		0.505	0.63	0.499***		20.5	41.0	30.8		1.034	2.289	1.822
Slovakia		0.464	0.937***	0.903***		53.0	82.3	71.0		0.714	2.572	2.014
Slovenia		0.848**	0.973***	0.79***		48.4	62.2	57.2		0.345	1.023	0.843
Spain	0.081	0.49	0.988***	0.823***	12.5	22.8	29.1	18.6	1.209	2.213	8.478	4.464
Sweden	0.218	0.817**	0.96***	0.815***	23.5	36.6	49.8	32.7	11.080	15.489	63.927	33.891
UK	0.251	0.452	0.829***	0.698***	17.9	24.2	28.5	21.8	2.263	4.026	13.098	6.997
Minimum	0.08	-0.715	0.63	0.499***	11.8	17.6	22.9	15.7	0.366	0.130	0.163	0.152
Maximum	0.81***	0.983***	0.993***	0.957***	104.2	125.6	164.3	123.9	11.787	298.989	1081.471	831.758
Average	0.395	0.35	0.907	0.801	28.6	44.2	59.2	46.5	3.203	14.778	56.967	41.558

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.

Table A2.6 – Imports of goods and services synchronization (vis-à-vis EU15)

	Business Cycle Synchronization				Share in GDP (%)				Volatility of the cyclical component			
	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009	1970-1992	1993-1998	1999-2009	1970-2009
Austria	0.727***	0.791**	0.906***	0.89***	28.8	38.1	49.7	35.9	1.335	1.572	4.362	2.511
Belgium	0.828***	0.672*	0.959***	0.906***	47.2	63.4	77.1	57.8	2.399	1.881	9.506	5.205
Bulgaria		-0.408	0.818***	0.924***		43.8	77.3	68.3		0.517	2.105	1.795
Cyprus		0.286	0.816***	0.857***		51.2	55.2	54.0		0.152	0.386	0.325
Czech Republic		-0.08	0.851***	0.747***		46.3	83.2	63.6		25.560	159.515	123.775
Denmark	0.291*	0.414	0.893***	0.795***	23.8	32.8	47.1	31.6	6.103	9.557	35.348	18.809
Estonia		-0.248	0.827***	0.839***		66.7	91.6	82.8		3.394	14.391	11.554
Finland	0.113	0.197	0.933***	0.772***	21.8	27.5	36.6	26.7	0.988	0.771	3.893	2.126
France	0.811***	0.765**	0.973***	0.923***	15.7	21.3	29.3	20.3	4.557	5.719	16.961	9.675
Germany	0.708***	0.799**	0.884***	0.891***	19.7	25.5	37.2	25.4	8.295	7.569	35.245	19.430
Greece	0.655***	0.706*	0.971***	0.886***	16.2	27.0	35.0	23.0	0.694	0.472	3.454	1.875
Hungary		0.847**	0.919***	0.914***		44.3	92.3	70.2		196.519	1033.777	782.525
Ireland	0.676***	0.515	0.903***	0.814***	39.4	60.7	82.4	54.5	0.645	1.587	4.680	2.538
Italy	0.773***	0.814**	0.964***	0.925***	15.5	21.0	26.8	19.4	5.294	7.383	14.283	8.910
Latvia		-0.713	0.805***	0.838***		48.0	55.2	53.3		0.146	0.503	0.433
Lithuania		-0.831	0.758***	0.778***		51.5	65.2	61.6		2.095	5.383	4.702
Luxembourg	0.764***	0.721*	0.938***	0.887***	96.8	107.0	142.2	110.8	0.316	0.315	1.844	0.980
Malta		0.467	0.844***	0.785***		99.9	96.9	97.7		0.151	0.207	0.191
Netherlands	0.873***	0.599	0.961***	0.928***	37.2	50.6	68.7	47.9	2.315	2.504	12.704	6.828
Poland		0.231	0.766***	0.83***		23.0	36.7	29.1		10.802	23.164	17.815
Portugal	0.464**	0.575	0.9***	0.834***	16.5	33.2	42.2	26.1	0.698	0.870	2.380	1.376
Romania		0.1	0.671**	0.788***		23.2	60.4	43.0		1.210	8.225	6.078
Slovakia		0.303	0.834***	0.855***		57.3	84.1	73.8		0.910	2.147	1.734
Slovenia		0.138	0.871***	0.761***		49.0	64.7	57.2		0.258	1.164	0.943
Spain	0.607***	0.787**	0.918***	0.867***	11.1	23.0	35.1	19.5	2.227	2.278	17.152	8.970
Sweden	0.245	0.303	0.924***	0.833***	24.8	32.4	40.9	30.4	12.170	19.805	59.786	32.550
UK	0.388**	0.297	0.868***	0.775***	16.8	23.8	31.7	21.9	3.809	2.111	14.404	7.901
Minimum	0.113	-0.831	0.671**	0.747***	11.1	21.0	26.8	19.4	0.316	0.146	0.207	0.191
Maximum	0.873***	0.847***	0.973***	0.928***	96.8	107.0	142.2	110.8	12.170	196.519	1033.777	782.525
Average	0.595	0.335	0.877	0.846	28.8	44.1	60.9	48.4	3.456	11.337	55.073	40.058

Note: Hodrick-Prescott Filter with smoothness parameter equal to 6.25.
***,**,* denote significance respectively at 1%, 5%, and 10%.