Theoretical and Applied Economics
Volume XX (2013), No. 7(584), pp. 33-42

Business cycles synchronization in the European Union: truth or challenge?

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Abstract. *This paper provides an updated picture of the degree of business cycles synchronization in the European Union, analyzing its evolution during 1999-2011. We use the Hodrick-Prescott filter to capture the relevant trends in the business cycles and the Pearson correlation coefficient to measure the degree of synchronization. The results obtained show that the highest level of business cycle synchronization with the Euro Area is reached by Finland and France, while Poland is by far the country with the most divergent business cycle.*

Keywords: synchronization; business cycle; Euro area; European Union.

JEL Classification: E32, F15, F44.
REL Classification: 8H.

Introduction

The international crisis that started in 2007 has shown over the last four years the existence of a strong business cycles synchronization in the European Union (EU). The economic and financial crisis has affected the old EU Member States (MS) almost at the same time, and with only a slight delay the New Member States (NMS). Thus, European policymakers and the European Central Bank had to deal with and respond to the economic downturn that occurred relatively simultaneously in all EU MS, even if their amplitude varied from country to country.

The issue of business cycles synchronization especially in the European Monetary Union (EMU) is seen in the literature as an "one size dot not fit all" problem, considering that one single model cannot be a valid one for all the EMU MS.

Business cycles in the Euro Area (EA) have experienced both periods of convergence and divergence over time (De Haan, Inklaar, Jong-a-Pin, 2005). The question arising now is whether the business cycles will become more synchronized in the next years so that the "one size does not fit all" problem will be solved. In the same time, there are NMS that are willing to join the Euro area in short time, putting presure on the effectiveness and the optimality of the EMU, taking into consideration that the discrepancies between the EA member states will be even bigger. The answer to this question is seen by economists from two different perspectives: the optimistic perspective claims a higher degree of synchronization due to the widening of economic and monetary integration (Artis, Zhang, 1999), while the negative perspective, based on the assumption that deeper integration goes to industrial concentration and specialization, supports more divergence of business cycles in the next years (Krugman, 1991).

1. Literature review

In the last years a consistently literature focusing on business cycle synchronization within the EA and between MS that joined the EU in 2004 and 2007 was developed in order to analyze the opportunity of EA enlargement. In the same time, Sweden, Denmark and Great Britain and their relationship with the EA has been analyzed in numerous studies.

Main contributions in this field of research were made by Artis and Zhang (1999) who established the existence of corelations in the EA states that are becoming more evident over time.

In a recent study, Gayer (2007) notes that the degree of business cycles in the EA was high in the early 1990s and has undergone notable changes with the

introduction of the single currency in 1999, except for short interruptions recorded in 2003-2004. Moreover, the results of Gayer (2007) highlight evidence of a distinct business cycle in the EA. However, de Haan et al. (2007) argue that there is a consistent trend towards an European business cycle. Artis (2003), in an attempt to identify an European business cycle, notes that while some European countries tend to stay together, to move in the same direction, there are many others who do not. Overall, the results in the literature vary according to the period analyzed and the state or group of states used as reference.

Business cycles synchronization between the NMS and the EA is consistently considered in the literature, but was heavily restricted by the limited time series, relatively short, available for NMS. Due to the variety of dating methods and indicators used for estimating cycles and timing, there are major differences between the results and conclusions arising from studies dealing with this topic. In addition, the results differ because the high heterogeneity in the NMS group, so that a general conclusion for the whole group of countries is very difficult to shape.

A detailed analysis of business cycle synchronization between the NMS and the EA was made by Darvas and Szapary (2004) in their study involving several variables, several states and several ways of measuring the degree of synchronization than most studies, providing more relevant results. Thus, Hungary, Poland and Slovakia have the highest degree of synchronization between the NMS with the Euro zone peripheral states. The remaining NMS are less synchronized with the EA, raising questions about their accession to the Euro zone in the near future.

Fidrmuc and Korhonen (2006) provides a very comprehensive survey of the literature on business cycle synchronization between the NMS and the EA and on the asymmetric macroeconomic shocks between these two groups of countries, presenting the results of 35 studies. The highest correlation of business cycles with the EA is owned by Hungary, followed by Slovenia and Poland. In several studies, one or more NMS cycles strongly correlated with the EA than the peripheral economies of the Euro zone (Greece, Portugal and Ireland).

2. The degree of business cycles synchronization – empirical analysis

In order to determine the degree of business cycles synchronization we first have to detach the business cycles trends. In order to do so, we use the macroeconomic indicator Gross Domestic Product (GDP), annual time series for the period 1999-2011, taken from Eurostat, one of the European Commission databases. The most direct technique to separate the cyclical component from the trend is to compute

the first differences in order to obtain stationary data series. Most studies use non-parametric filters like Hodrick-Prescott filter (HP, 1997) and band pass filters like Baxter King (BK, 1999) and Christiano-Fitzgerald (CF, 2003).

The most widely used filter is the HP filter. The trend component is estimated by minimizing deviations from trend. There are relatively few studies that check the sensitivity of results to different methods used for filtration. Artis and Zhang (1997) and Calderon et al. (2002) concluded that the option of using a filter is not crucial for their results.

As already mentioned, there are numerous empirical methods for measuring the cyclical component of the business cycles. Following the European Commission's methodology, in this paper we use the HP method of estimation of business cycles, applied in the logs of the variables. In order to determine the economic cycle we use HP filter with $\lambda = 100$, which is appropriate for annual macroeconomic data series.

The HP filter is a very frequent parametric method for decomposing time series (y_t) into two unobservable components, which are trend ($\overline{y}_t$) and cycle (c_t). The trend is extracted through the minimization of a loss function of this type:

$$\min_{\overline{y}_t} = [\sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T}((\overline{y}_{t+1} - \overline{y}_t) - (\overline{y}_t - \overline{y}_{t-1}))]^2, \quad (1)$$

unde

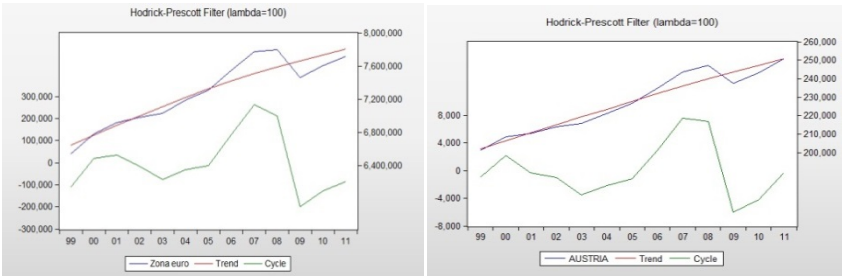
T is the total number of observations;

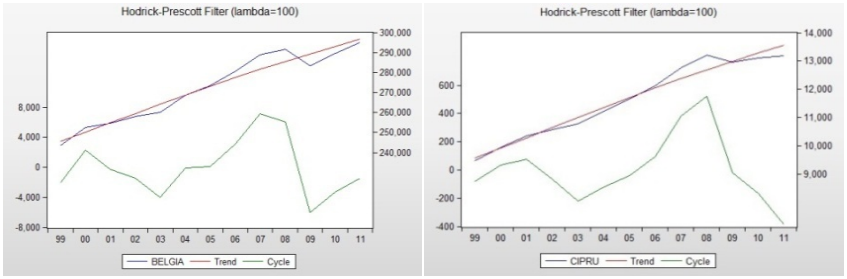
$\sum_{t=1}^{T} c_t^2$ represents the sum of squared deviations, being equal to $\sum_{t=1}^{T}(y_t - \overline{y}_t)^2$;

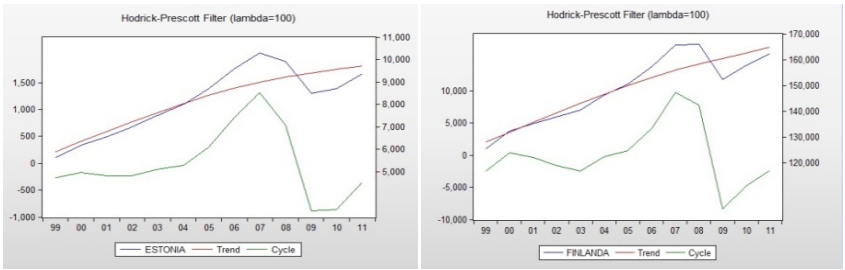
$\sum_{t=1}^{T}((\overline{y}_{t+1} - \overline{y}_t) - (\overline{y}_t - \overline{y}_{t-1}))$ represents the sum of the trend growth rate changes;

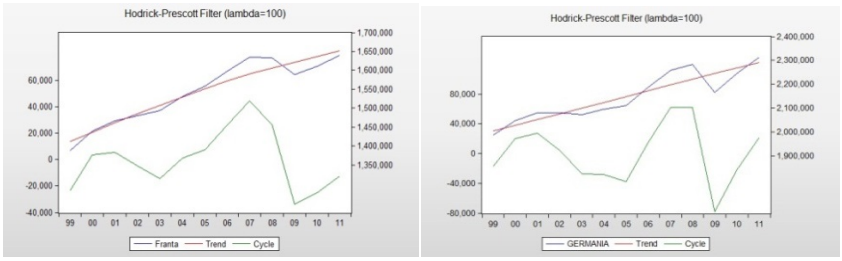
λ is the parameter meant to penalize the fluctuations in the growth rate of the trend series;

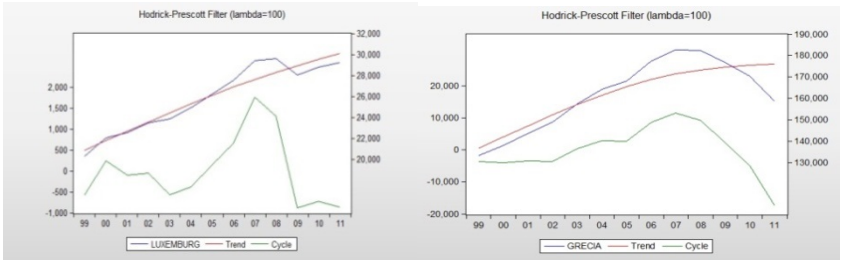
The results of applying the HP filter to the GDP data series are shown in the images below:

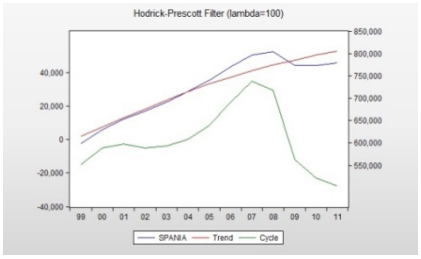

Hodrick-Prescott Filter (lambda=100)
Zona euro Trend Cycle
Hodrick-Prescott Filter (lambda=100)
AUSTRIA Trend Cycle

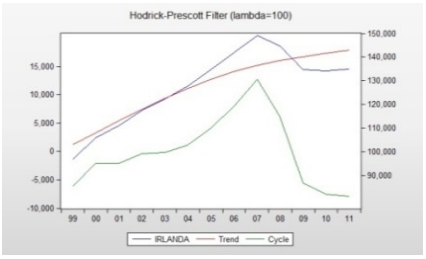

Hodrick-Prescott Filter (lambda=100)
BELGIA Trend Cycle
Hodrick-Prescott Filter (lambda=100)
CIPRU Trend Cycle

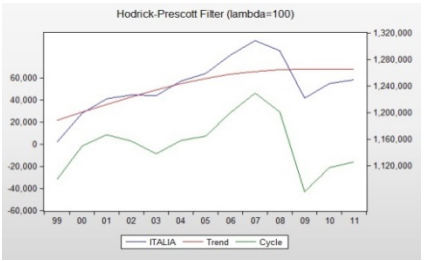

Hodrick-Prescott Filter (lambda=100)
ESTONIA Trend Cycle
Hodrick-Prescott Filter (lambda=100)
FINLANDIA Trend Cycle

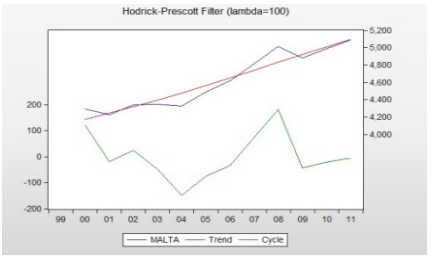

Hodrick-Prescott Filter (lambda=100)
Franta Trend Cycle
Hodrick-Prescott Filter (lambda=100)
GERMANIA Trend Cycle

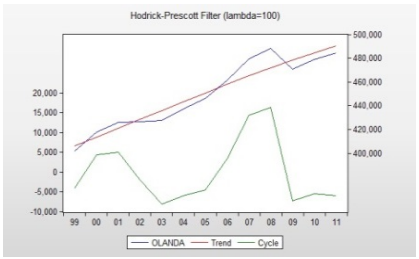

Hodrick-Prescott Filter (lambda=100)
LUXEMBURG Trend Cycle
Hodrick-Prescott Filter (lambda=100)
GRECIA Trend Cycle

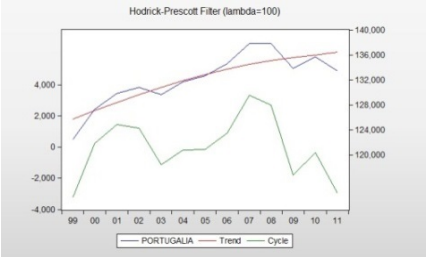

Hodrick-Prescott Filter (lambda=100)
SPANIA Trend Cycle

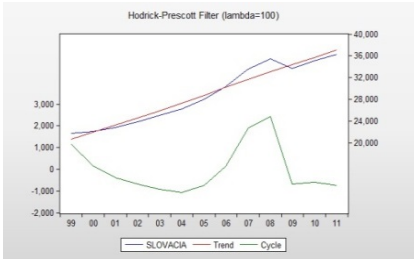

Hodrick-Prescott Filter (lambda=100)
IRLANDA Trend Cycle

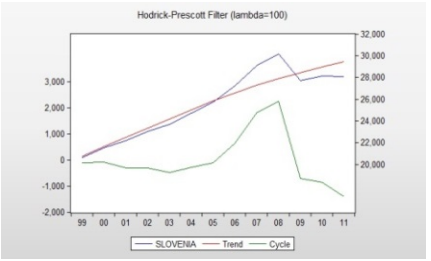

Hodrick-Prescott Filter (lambda=100)
ITALIA Trend Cycle

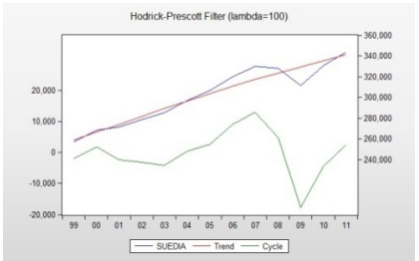

Hodrick-Prescott Filter (lambda=100)
MALTA Trend Cycle

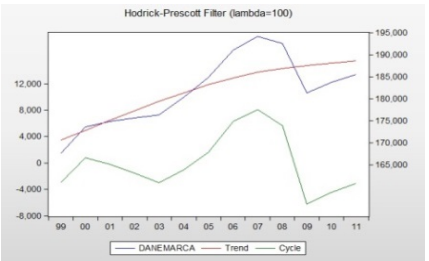

Hodrick-Prescott Filter (lambda=100)
OLANDA Trend Cycle

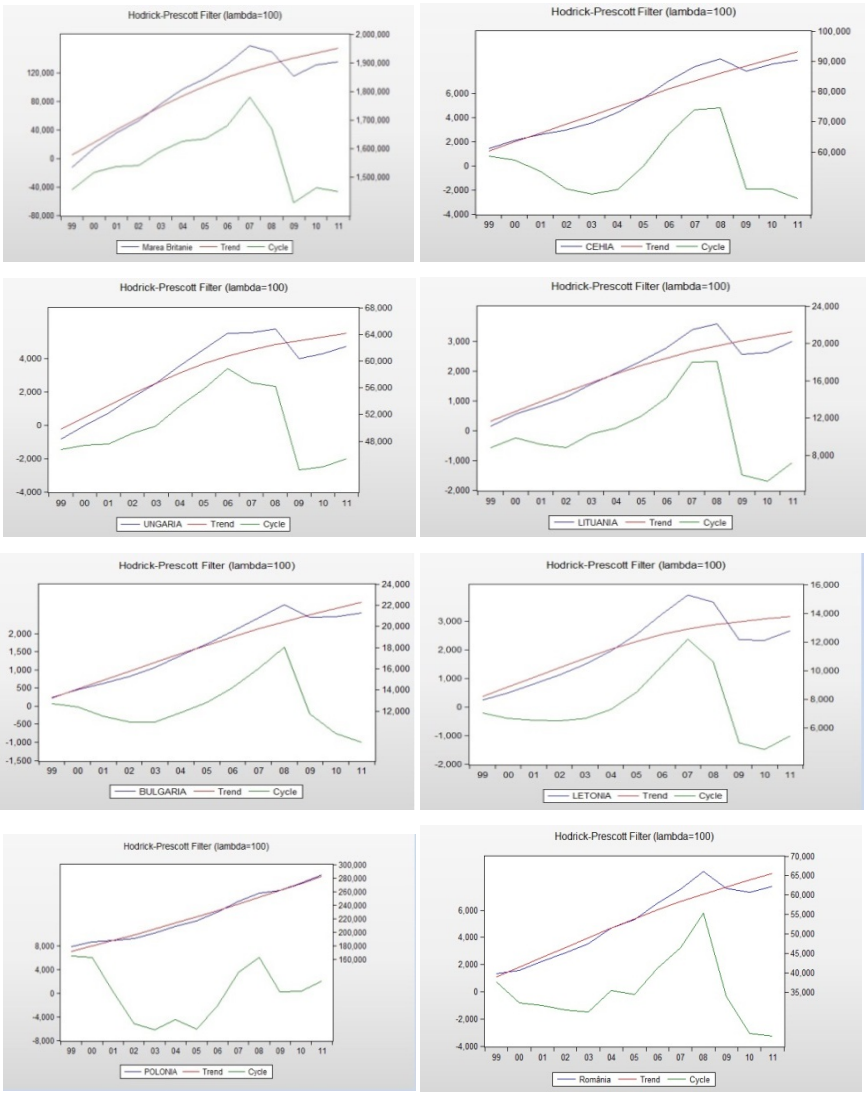

Hodrick-Prescott Filter (lambda=100)
PORTUGALIA Trend Cycle


Hodrick-Prescott Filter (lambda=100)
SLOVACIA Trend Cycle


Hodrick-Prescott Filter (lambda=100)
SLOVENIA Trend Cycle


Hodrick-Prescott Filter (lambda=100)
SUEDIA Trend Cycle


Hodrick-Prescott Filter (lambda=100)
DANEMARCA Trend Cycle



Equally varied are the ways of measuring the degree of business cycles synchronization. Most studies used simple correlation coefficients (Pearson), but there are other tools suggested in the literature as dynamic correlation, phase correlation and index adjusted according to Harding and Pagan's (2006).

As a mean of measuring the degree of business cycles synchronization, we use the Pearson correlation coefficient computed for the period 1999-2011. The Pearson coefficient can range between -1 and 1 and a negative/positive correlation indicates a negative/positive between the variables considered.

The table below shows the results obtained by decreasing ordering MS according to the Pearson coefficient:

Table 1. *Ranking MS according to the degree of business cycles synchronization with the EA*

Rank	Member State	Pearson coefficient	Observations
1	Finland	0.986064	EA member state
2	France	0.976970	EA member state
3	Luxembourg	0.968133	EA member state
4	Italy	0.967928	EA member state
5	Denmark	0.967498	non-EA member state (opt-out)
6	Belgium	0.966232	EA member state
7	Austria	0.961720	EA member state
8	Lithuania	0.932818	non-EA member state
9	Latvia	0.931807	non-EA member state
10	Estonia	0.927856	EA member state
11	Czech Republic	0.921441	non-EA member state
12	Netherlands	0.918042	EA member state
13	Slovenia	0.910291	EA member state
14	Spain	0.895024	EA member state
15	Ireland	0.870857	EA member state
16	Portugal	0.868624	EA member state
17	United Kingdom	0.863905	non-EA member state (opt-out)
18	Slovakia	0.852461	EA member state
19	Bulgaria	0.847989	non-EA member state
20	Sweden	0.847781	non-EA member state (derogation)
21	Germany	0.847380	EA member state
22	Cyprus	0.825215	EA member state
23	Romania	0.815232	non-EA member state
24	Hungary	0.786525	non-EA member state
25	Greece	0.634186	EA member state
26	Malta	0.566897	EA member state
27	Poland	0.399708	non-EA member state

Source: Authors' calculations.

The highest level of business cycles synchronization with the EA is reached by Finland and France, with Pearson coefficient values above 0.97, while Poland is by far the country with the less synchronized business cycle, with a coefficient below 0.4.

Regarding the EA countries, Greece and Malta are the only countries which have relatively low coefficient values (below 0.65), the rest of the states registering high values, over 0.8, thus having the business cycles closely correlated with the EA business cycle.

Among the EU NMS that are currently on the road to Euro, Lithuania, Latvia and the Czech Republic have strongly correlated business cycles with the EA, given the very high values of the Pearson coefficients (over 0.9). The coefficients are also high in Bulgaria, Romania and Hungary. Poland is the only country in this group that is significantly detached from the EA, occupying the last place in the ranking.

Of the three countries covered by the opt-out clause or derogation from adopting the Euro currency, Denmark has the highest degree of business cycle synchronization with the EA, being in the 5th place in the ranking, while the United Kingdom and Sweden are found in the second half of the league.

Conclusions

The results obtained in this paper reiterates the gap between the EU MS in terms of business cycle synchronization. In the EA, Greece and Malta have the weakest correlations with the business cycle of the area, putting pressure on the currency area optimality. Interestingly, the degree of divergence of these two countries is much higher than that of the European countries which are not yet part of the EA, except Poland. In contrast, Finland and France are identified with the EA business cycle. In the group states that are on the track to join the EA, Poland, Hungary and Romania have the weakest correlations with the EA business cycle, being the least prepared to adopt the single currency. Significant differences observed in the EU MS jeopardize the future of the single currency area, being so weakened by the economic and financial turmoil of the past four years.

Acknowledgements

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013; project number POSDRU/107/1.5/S/77213 „Ph.D. for a career in interdisciplinary economic research at the European standards”.

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