

New Insights in Business Cycle Coherence; Empirical Evidence from Slovenia¹

Daniel Tomić

Juraj Dobrila University of Pula
Faculty of Economics and Tourism »Dr. Mijo Mirković«, Pula, Croatia
dtomic@unipu.hr

Marija Kenjereš

Juraj Dobrila University of Pula
Faculty of Economics and Tourism »Dr. Mijo Mirković«, Pula, Croatia
markenje@unipu.hr

Abstract

Many argue that business cycle analysis has served as an important impulse in stimulating and provoking interesting academic and professional debates, especially within the European Union. Measuring business cycles is critical in determining the stylised facts of the business cycle regarding aggregate macroeconomic behaviour over time. Although a cycle in economic activity is a stylized fact, in macroeconomics it is less clear as to when the economic growth dynamic coincides between countries/regions and when these dynamics synchronise and/or converge. The aim of this paper is to look into business cycle aspects of the Slovenian economy vis á vis European Union in terms of coherence measures. By applying methodology proposed by Mink, Jacobs and de Haan we calculated two measures of coherence, namely synchronicity and similarity in order to capture both co-movement and amplitude of the Slovenian growth perspective presented as the output gap variable. Output gap calculations are based on the growth cycle approach for deviation cycle variable is to be derived using the HP filter. In addition, some mediating macroeconomic variables are also being included in the analysis in order to provide us some new insights regarding business cycle coherence in the optimal currency area of which Slovenia has become an indispensable part.

Keywords: business cycle, synchronicity, similarity, HP-filter, Slovenia, European Union

¹ This work has been fully supported by the Croatian Science Foundation under the project number 9481 Modelling Economic Growth - Advanced Sequencing and Forecasting Algorithm. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of Croatian Science Foundation.

1 Introduction

The main goal of this paper is to evaluate business cycle movements and coherence concepts within the Slovenian economic perspective. Many argue that business cycle analysis has served as an important impulse in stimulating and provoking interesting academic and professional debates, especially within the European Union (EU). Measuring business cycles is critical in determining the stylised facts of the business cycle regarding aggregate macroeconomic behaviour over time. Complexities of macroeconomic relations in Slovenia reveal structural problems that dwell upon both fiscal and monetary policies. Therefore, by analyzing business cycle aspects of the Slovenian economy we are in fact addressing key macroeconomic issues that are or might be crucial for economic stability and sustainable progress. Considering different roles of fiscal and monetary policies within decision-making dilemma, each economic problem should be approached differently depending upon the specific cycle characteristics of the country. Our paper is supplement to the strand of literature that tries to evaluate controversies over economic policies in Slovenia i.e. their compatibility and/or coordination as well as it offers constructive analytical commentary.

If we ought to observe the business cycle coherence concept we should start from the macro aspects. Many growth motivated studies since the 1960s have shown that cyclical regularities and fluctuations can explain real economic movements, therefore studying business cycle has become an indispensable part of growth related research. The term synchronization, which is built on the coherence dynamics, is nothing but an attempt to clarify the interdependence between individual sectors, countries or regions. It is now well established truth and fully known fact that the world is governed by the globalization process. Therein the key in explaining the global financial crisis could be sought in globally synchronised behaviour. This could be the basis, for easiest way to clarify the very concept of synchronization, and so the synchronization of business cycles. Empirical evidence suggests that synchronization of business cycles across countries helps in determining the desirability for a common currency. The decisive period for Slovenia was the period of implementation of reforms from 1991 to 1994. Though Slovenia, before entering the EU and ERM2, tolerated high inflation rate, it succeeded in setting the goals that were pointed towards the European tradition which helped in turning the position from recession to growth. By analyzing disproportion in lags/leads behaviour of the Slovenian real macroeconomic variables together with the coherence approach we want to reconcile with vast empirical evidence supporting the hypothesis that European integration process leads to greater business cycle convergence and synchronisation which finally leads to greater economic welfare in each of the member country.

In order to provide some stylized facts on the macroeconomic behaviour of selected variables we opted for deviation cycle analysis. Output gap calculation are based on the growth cycle approach for deviation cycle variable is to be derived using the HP filter. By applying methodology proposed by Mink et al. (2012) we calculated two measures of coherence, namely synchronicity and similarity in order to capture both co-movement and relative amplitude of the Slovenian growth perspective presented as the output gap variable. Quarterly data were collected from International Financial Statistics and Eurostat ranging from 1992Q1 to 2014Q2 in regards to different aspects of the analysis.

2 Theoretical background and main empirical facts

Before we get any further into the topic let us clarify some basic terminology. Broadly used term business cycle synchronization, as an indicator of the degree of co-movements of the fluctuations across countries and time, is a mere coherence measure. Hence, most of the scholars use term synchronisation to explain coherence between the cyclical patterns of growth between the countries. We will follow their example in this theoretical part, though in the empirical section we will make a distinction, namely methodological, distinguishing two coherence measures (see *Section 3*). For now, synchronisation appellation will be sufficient.

The business cycle synchronization process is observed over a period of time, but also refers to the totality of mechanisms; from time perspective, definition of co-movements to the ways of recovery. Generally, synchronization of business cycles can be seen as a positive result of external influences in some countries, but also as a problem that occurs in response to external shocks. Furthermore, the notion of synchronization is frequently related to the question of optimum currency areas, as it has come to be recognized as a prerequisite for any higher level of economic integration such as European Monetary Union (EMU) for example. As Camacho et al. (2006) point: ‘When countries join a monetary union they leave to supranational decision maker traditional instruments for the control of the business cycles. Obviously, the optimality of this delegation of the decisions to a higher authority will be a direct function of the similarities across these economies. If the economies move together, we might think that they need the same type of economic policy decisions at the same time. If, there is no synchronization of their business cycle co-movements, we might think that different solutions are optimal for different economies and probably, the costs associated to an economic union might be higher than the gains’. Important question for the EU as well as Slovenia is whether economies move according to some common driving forces.

In accordance to the arguments of Kenen from 1969 on the point of factor mobility, the literature on business cycle synchronization has also highlighted the importance of sectoral similarity (e.g. Imbs (2006), Clark and van Wincoop (2001), de Haan et al. (2008)). Countries with similar economic structures are more likely to be affected by similar demand shocks, while countries with dissimilar structures will experience a different timing of demand shocks. Sectoral dissimilarity between countries is supposed to result in different business cycles. As found in Siedschlag and Tondl (2011), specialization has also an indirect positive effect *via* trade.

Existing literature on the issue of cycle synchronicity is vast, especially one dealing with the EU and the EMU. Camacho et al. (2006) with three different measures of synchronisation found relatively high linkages across euro countries, but these are prior to the establishment of the monetary union. Monsour (2003) found that world component is generally more important than the European component; European component varies widely among EU members. Van Aarle et al. (2008) came to overall conclusion that on average business cycle convergence in the euro area has not changed substantially since the introduction of the euro. Walti (2009) by using probit regressions of synchronicity found that although the introduction of the euro has raised the likelihood of business cycle synchronicity, it has not affected the relative amplitude of business cycles. Antonakakis and Tondl (2011) reassessed that business cycles have become more synchronised in the EU. Mink et al. (2012) concluded that the synchronicity and similarity between output gaps of individual countries and the reference fluctuate over time, and often are not higher than would be expected under output gap independence.

Though we can find numerous studies on this topic, Slovenia was not so often included in them. Yet we found few interesting studies that included Slovenia and their conclusions are conceptually related to ours. Majority of studies suggested significant correlation between business cycles of EU and Slovenia. Traistaru (2004), Jagrič and Ovin (2004), Fidrmuc and Korhonen (2006), Savva et al. (2007), Levasseur (2008), Afonso and Sequeira (2010), Siedschlag (2010), Stanisić (2013) and etc. found that Slovenia, together with Poland and Hungary had one of the highest average correlations of business cycles with the euro area. This is probably due to their geographical proximity, economic smallness and historical factors that influenced their trade patterns, as stated by Stanisić (2013). Afonso and Sequeira (2010) also noticed very high degree of business cycle synchronization to that of some EU-15 countries. Jazbec (2013) inclined that synchronization of Slovenian business cycle with the euro area and the main trading partners was increasing and was at its peak around the entry in the EU and the Euro adoption, hence the increase was driven by implicit trade integration. He also concluded that recent de-synchronization termed as decoupling is not due to trade decrease but that the most likely reasons could be found in volatile domestic financial factors.

3 Methodology and data

Methodological framework of this study is based on two approaches or better to say analysis: (1) evaluation of cyclical characteristics of main macroeconomic variables and (2) measurement of business cycle synchronisation of the Slovenian economy within the EU. Both approaches are relevant in explaining the business cycle dynamics since we know that short-run disturbances can produce extremely negative effects on one economy, therefore it is of utmost importance to scrutinize how business cycle *de facto* evolves over time

First, in order to evaluate cyclical components of selected macroeconomic variables we followed the works of Stock and Watson (1998), Agresti and Mojon (2001), and Napoletano, Roventini and Sapio (2005).). Though their work was based on Baxter-King filter, we used Hodrick-Prescott (HP) filter that has come to be recognised as standard method for removing long run movements from the time series in the business cycle literature. Furthermore, we tested integration properties of the data to evaluate their methodological possibilities (similarly to Benazić and Tomić, 2014). The popularity of the HP filter to detrend a time series is certainly due to the fact that it is easy to estimate and to comprehend. Hodrick and Prescott's (1997) analysis was based on the assumption that time series are consisted of cyclical and growth components, so if growth accounting can provide estimates of growth components with errors that are small relative to the cyclical component, computing the cyclical component is just a matter of calculating the difference between the observed value and the growth component. It resulted in creation of the filter that became standard method for removing long run movements from the time series in the business cycle literature. The HP filter focuses at removing a smooth trend τ_t from some given data y_t by solving next equation:

$$\min_t \sum_{t=1} ((y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2) \quad (1)$$

so the residual $y_t - \tau_t$ is then commonly referred to as the business cycle component. This is actually a linear filter that requires previous specification of a parameter known as lambda (λ). Giving the form of the observation (annually, quarterly or monthly) this parameter tunes the smoothness of the trend i.e. penalizes the acceleration in the trend component relative to the cycle component. Many point that the parameter λ does not have an intuitive interpretation for

the user and that its choice is consider the main weakness of the HP filter. Non-the-less, HP filter has been applied in a number of relevant studies; Blackburn and Ravn (1992), De Arcangelis and Di Giorgio (1999), Franke (2006), etc.

According to Stock and Watson (1998) and Napoletano, Roventini and Sapio (2005), co-movements between variables are revealed through the cross-correlation of the cyclical component of each series with the cyclical component of real gross domestic product as a benchmark variable, which is thought to represent the business cycle. This is the correlation between x_t and y_{t+k} , where x_t is the filtered series and y_{t+k} is the k -quarter lead of the filtered real gross domestic product. A large positive correlation at $k = 0$ (i.e. around lag zero) indicates pro-cyclical behaviour of the series; a large negative correlation at $k = 0$ indicates counter-cyclical behaviour; and no correlation indicates acyclical behaviour of the series. A maximum correlation at, for example, $k = -1$ indicates that the cyclical component of the variable tends to lag the aggregate business cycle by one quarter. In other words, if the absolute maximum (or minimum) is achieved at some real gross domestic product lead, then the variable is denoted as *leading*, whereas it is called *lagging* in the opposite case². Finally, *coincident* variables are those displaying the bulk of their cross-correlation with real gross domestic product at lag zero.

Second, in order to observe and evaluate conclusions from the previous analysis we introduced to concept of coherence i.e. synchronicity as a part of the *deviation cycle analysis*³. The usual interpretation given by scholars to the concept of synchronization between growth and business cycles relates to the pattern of growth between these countries rather than the magnitude of growth rates or the amplitude of the growth trend or business cycles as stated by Crowley and Schultz (2010). By synchronicity we always mean the similarity of movements in growth rates over time, so we have to be careful when we analyze convergence which presents the proximity of growth rates with growth rates of other observed country or unit. Many studies opt to calculate both indicators in order to serve better conclusions. An intensive work by Mink et al. (2007) led to a paper in 2012 which introduced new insight into business cycle coherence by measuring two separate indicators: a) *synchronicity* (φ_{ir}) and b) *similarity* (γ_{ir}). Within their study, coherence of the EU member country i and the benchmark r represented by the enlarging Euro area was measured:

$$\varphi_{ir}(t) = \frac{g_i(t)g_r(t)}{|g_i(t)g_r(t)|} \quad (2)$$

and

$$\gamma_{ir}(t) = -\frac{n |g_i(t) - g_r(t)|}{\sum_{i=1}^n |g_i(t)|} \quad (3)$$

where $g_i(t)$ is the cyclical component of the analyzed output of a country i in time t and $g_r(t)$ refers to the cyclical component of the reference country r in time t . When averaged over a time interval and transformed to a uniform scaling, the synchronicity measure shows the fraction of time that the output gap of country i has the same sign as the output gap of the

² For deeper insight see Napoletano, Roventini and Sapio (2005) or Benazić and Tomić (2014).

³ Deviation cycle analysis is concerned with phases of above and below trend rates of growth as it is known also as a growth cycle approach. Alternative measure is viewed as classical cycle approach.

reference cycle, whereas averaging similarity between individual countries and the reference over all n countries in the sample yields co-movement for the region as a whole (Mink et al., 2012). In general, synchronicity between the business cycle of an individual country and the reference cycle ranges between 1 and -1 , while for co-movement these values are 0 and $-n$. Important feature of this measurement is ‘right’ reference cycle. Following the dilemmas in Mink et al. (2007) we adopted the same statistical *ex post* approach by selecting the cycle that lies the closest to all individual countries’ cycles in the EU i.e. the median of all output gaps observed in that period. So we choose the median of all EU 28 member countries⁴.

Quarterly data presenting macroeconomic variables for Slovenia were collected from International Financial Statistics and Eurostat for the period of 1992Q1 – 2013Q4. Data were seasonally adjusted using the Census X12 seasonal adjustment procedure. In order to extract the business cycle component that presents the stationary cycle of the variable we used smoothing parameter λ of 1,600 which is the standard value for quarterly frequencies. To test the integration properties we analyzed graphical displays of the variables and applied three unit root tests Augmented Dickey Fuller test - ADF (1979), Phillips-Perron test - PP (1988) and Kwiatkowski-Phillips-Schmidt-Shin test (1992). Generally, graphs and tests confirmed the absence of unit root in the observed variables⁵ which is important property of detrended variables (see Benazić and Tomić, 2014). Variables included in the evaluation of cyclical properties of the Slovenian economy are: producer price index (**PPI**), consumer price index (**CPI**), harmonised index of consumer prices (**HCPI**), industrial production (**IND**), employment (**EMP**), real gross domestic product index (**GDP**), imports of goods (**IMP_G**) and exports of goods (**EXP_G**) for the period 1992Q1-2013Q4(Q4); final consumption expenditure (**CONS**), final consumption expenditure of general government (**GOV**), imports (**IMP**) and exports (**EXP**) of goods and services for the period 2000Q1-2012Q4. Coherence based measures are calculated with nominal values of output in millions of euros for the period 1995Q1-2014Q2 due to data availability.

4 Interpretation of the results

Here are some stylized facts on the business cycle positions. By interpreting cross-correlations with lags/leads between the real output (GDP) and selected variables (*Table 1*. in the *Appendix*) we can notice that most of the variables exhibit pro-cyclical leading behaviour. Interestingly, monetary variables suggest statistically insignificant and weak correlation to the output movements, only producer price index exhibiting relatively mediocre (significant) leading and pro-cyclical pattern. Slovenia is a part of the euro area, therefore its external and internal vulnerability depends on the EU’s monetary policy. Since this monetary policy is mostly directed towards neutralization of shocks and the stability of financial system, we can say that Slovenia does not have important instrument of economic policy in their hand, yet the period of this global crisis certainly proved the audacity of European Central Bank who helped the European and therefore Slovenian economy not to lose its growth potential. There has been a small decrease in correlation of cyclical behaviour of the Slovenian GDP during post-crisis period, as Jazbec (2013) states, implicating that there has been a withdrawal of

⁴ First we observed the possibility of reference ‘output’ cycle as the total EU28, total EU15, only Germany as economically strongest European country, EU28 median and the median of three countries important for Slovenian economy (Germany, Austria and Italy) for their trade relevance. Graphical display of the variables suggested almost similar movements (see *Appendix*) so we opted for the EU28 median analogously to Mink et al. (2012).

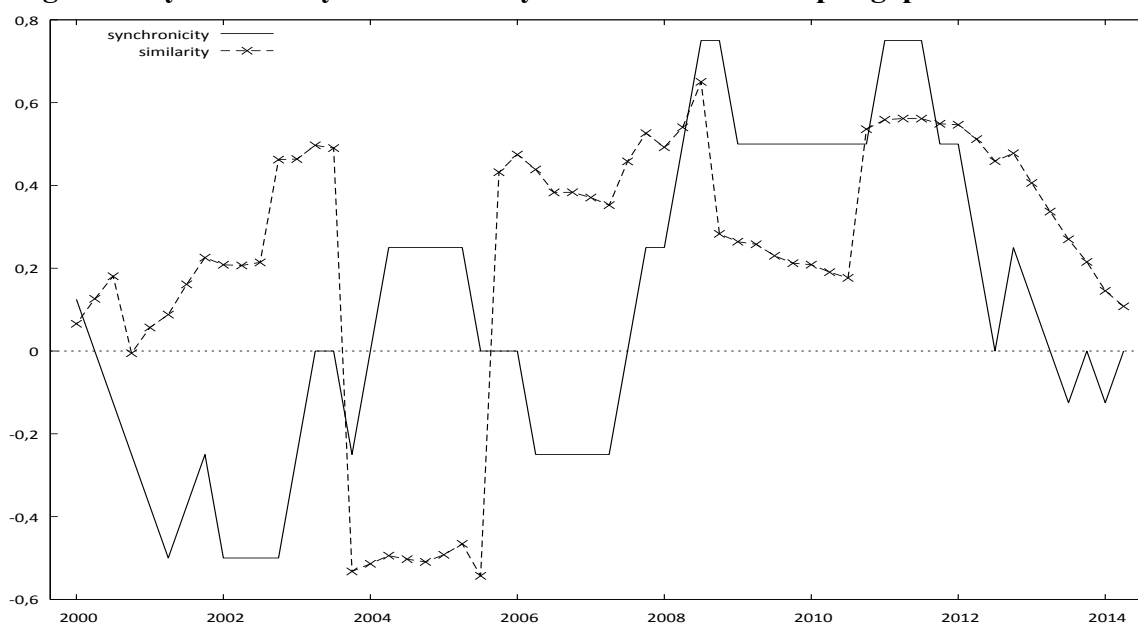
⁵ Available upon request.

foreign funding for banks which could cause large fluctuations in credit and output in Slovenia. Such developments could have detrimental effect on the economy even though there exists very limited foreign ownership of the Slovenian banking sector. This argument could be used in explaining relative reduction in business cycle synchronization of the Slovenian economy.

Turning the attention to the real variables, we can notice similar pro-cyclical and leading behaviour but with much stronger statistically significant effect. As an exception we have industrial production that show relatively strong and statistically significant lagging behaviour suggesting that an increase in industrial production comes as a result of positive expectations of output growth and purchasing power. Variable employment suggests strong leading behaviour especially in the $t+2$ period, meaning that the accountability of employed work force certainly can explain fluctuations in the output. Though cross-correlations show statistically insignificant and counter-cyclical behaviour of final consumption expenditure, graphical display indicate that we have certain pro-cyclical co-movements with the output. It suggests that business cycles in Slovenia are not manifested through real consumption. However, variable final consumption expenditure of general government indicate relatively strong, statistically significant and leading behaviour suggesting that Slovenia can still use its fiscal policy in an expansive manner. There is also strong, statistically significant and stable cross-correlation of output with export and import. Therefore, by influencing its export and import, Slovenia could determine or at least affect certain phase of business cycle as its EU synchronization process was well influenced by trade developments.

There are many reasons why coherence in movements in economic growth between (some) countries is economically relevant, as stated by Crowley and Schultz (2010), but currently for Slovenia, as a country that is a part of EU, the most important question is how similar movements in economic growth could indicate similar patterns in growth within the EMU. Following the methodology presented in *Section 3* we calculated two measures of coherence, namely the synchronicity and similarity between the Slovenian output gap and the output gap of EU28, and presented their eight-year moving averages in graphical form (*Figure 1.*).

Figure 1: Synchronicity and similarity of the Slovenian output gap vs. EU28median



Source: Authors' calculation.

Results and graph suggest that synchronicity and similarity levels fluctuated substantially over time, however synchronicity seems to be much less volatile than the similarity. Correlation between these two measures over time of 0,17% illustrates that synchronicity and similarity are in fact two different concepts that tend to change and fluctuate within time domain. This also means that deviations in business cycles and impact of different shocks have different effects on the pattern and amplitudes of growth in Slovenia which is indicative for economic policy reasoning. Overall conclusion is that both coherence measures increased within analyzed period, however their positive trend was somewhat different⁶.

Synchronicity was rather weak in the beginning, which is opposite conclusion to most of the studies that suggested that cyclical synchronization between Slovenia and the EU was already similar in some aspects due to a better preparation in joining the EU well before 2004. As the point of accession in the EMU was getting closer, Slovenia was achieving higher degree of synchronization with the EMU countries for GDP, industrial production and export (Stanisic, 2013). It indicates that Slovenia has relatively strong economic links with specific eurozone countries such as Germany and Italy which helped in this synchronization process. Following the EMU accession Slovenia was showing one of the highest average estimates of business cycle synchronization with the EU, especially with the countries in euro area. Explanation for the rise in business cycle synchronicity can be found in the stronger trade and financial linkages with the EU and the increase in the symmetry of macroeconomic shocks across countries. Recent crises resulted in drastic decline in cycle synchronicity probably due to austerity measures and a decline in general consumption. Weak demand side could be presenting great obstacle for higher degree of synchronization with the EU for Slovenia. On the other hand, similarity seems to be relatively stable over time with only serious decrease around the EU accession point probably due to last preparations which included trade transaction costs and financial information costs, tendencies towards institutional quality, financial deepening, more flexible labour and product markets etc. After the 2005, similarity measure tends to follow synchronicity measure in trend perspective, which is especially seen following the start of the crisis.

As we previously pointed, likely reasons for recent, though slight, decoupling of the business cycle in Slovenia should not be sought in trade developments, but in strong cyclical reduction in financing of both households and firms with the withdrawal of foreign funding (see Jazbec, 2013). Again, though Slovenian banking sector is only partially in foreign ownership, such developments can have feasible negative effects. This could present additional shock to the already weak demand side and real activity of the Slovenian economy. The renewed uncertainty, coupled with slow export growth and low investment means that there is no room for ambivalence, hence policy responses must be both immediate and resolute. Unclear responses could add to market uncertainty and magnify economic and social tensions. *Ditto*, it indicates that the fast convergence with other EU member states is not an easy process. Global crisis certainly had great negative effect upon the Slovenian and euro area (and the EU28) business cycle coherence, as synchronicity and similarity measures decreased similar to many other Central and East European countries meaning that the impact of Euro introduction upon the business cycle coherence was not as high as expected which supports the general findings of other related studies (see Najman and Rozmahel (2013) for example). Furthermore, phases of decoupling and recoupling of business cycle co-movements alter

⁶ Many studies came to conclusion that Slovenia, among other countries such as Hungary and Poland, showed strong improvement in cyclical correlations to old EU countries as moving from 1993-1999 to 2000 and on.

frequently, but a clear upward or downward trend is also barely observable in the average degree of business cycle synchronisation in the Euro area in last twenty years (Van Aarle et al., 2008).

5 Beyond conclusion

The academic literature, especially in Europe as well as the media press is full of references and studies that imply the importance of the synchronisation of links between economies. The goal of this paper was to look into business cycle aspects of the Slovenian economy *vis á vis* European Union in terms of coherence measures in order to evaluate development perspectives. The main scientific contribution reflects in generalizability of conclusions and their argumentative character for such could bear important implications for the Slovenian macroeconomic management, especially for sustainable development perspective. The external environment has significantly worsened recently and will likely remain uncertain for a prolong period of time. Recent events suggest that access to a large EU market and the political stability factor, while crucial, are not sufficient to achieve country development by itself. Namely, EU membership generates both opportunities and challenges that need to be timely recognized. Aligned economies i.e. synchronization tendencies is certainly a factor that could assure better development framework. In order to evaluate business cycle movements and coherence concepts within the Slovenian economic perspective we applied two distinctive methods.

First, we used output gap cross-correlation in order to present some stylized facts on the business cycle positions. General conclusion on this part suggests that most of the selected variables exhibit pro-cyclical leading tendencies. Next, we evaluated two coherence measures that take into account, both differences between cycle amplitudes as well as synchronicity of cycles. This is important because cycle amplitude component of business cycle similarity is generally overlooked. Overall conclusion is that both coherence measures increased within analyzed period, yet their trend developments were rather intriguing. Recent crisis showed negative effects upon synchronicity and similarity behaviour of the Slovenian economy, thus a clear – positive or negative – “euro effect” on synchronisation does not appear in the latest available data. However, we cannot talk about clear decoupling phase for Slovenia since the trade developments and financial flows *de facto* caused greater synchronization in economic growth between Slovenia and the EU, especially after the introduction of the euro, only recent crisis obstructing this pattern in some manners.

Although the results of some studies suggested post 1990s as the time in which business cycles in the euro area have become more similar, the business cycles of many euro countries are still substantially out of sync. Since we expect in the future that the implementation of monetary policy in the enlarged EMU is to be more successful if the member countries have synchronized business cycle, the development of co-movements in cycle synchronicity and amplitude of the Slovenian economy is of utmost importance for its macroeconomic management. Though we lately witness some de-synchronization processes, stable monetary policy conducted by the European Central Bank did not amplify negative trends in business cycle developments in Slovenia, therefore it presented close substitute for national monetary policy. Further positive developments on the demand side in Slovenia with optimistic trends on the whole European market should boost more cooperative international system that will be weighed against the expansion of production capabilities, interaction between consumption and investment, fiscal consolidation, improved quality of life and sustainable development. In

this manner the concept of synchronization will be building on its importance and relevance.

Literature

- Afonso, A. & Sequeira, A. (2010). Revisiting Business Cycle Synchronization in the European Union. *ISEG Working Paper 22*, School of Economics and Management, Technical University of Lisbon.
- Agresti, A. M. & Mojon, B. (2001). Some Stylised Facts on the Euro Area Business Cycle. *ECB Working Paper 95*, European Central Bank.
- Antonakakis, N. & Tondl, G. (2011). Has Integration Promoted Business Cycle Synchronization in the Enlarged EU? *FIW Working Paper 75*, Research Centre International Economics.
- Benazić, M. & Tomić, D. (2014). The evaluation of fiscal and monetary policy in Croatia over a business cycle. *Zbornik radova Ekonomskog fakulteta Rijeka*, Vol. 32, No. 1, pp. 75-99.
- Blackburn, K. & Ravn, M. O. (1992). Growth, Human Capital Spillovers and International Policy Coordination. *Scandinavian Journal of Economics*, Vol. 95, No 4, pp. 495-515.
- Camacho, M., Perez-Quiros, G. & Saiz, L. (2006). Are European Business Cycles Close Enough to be just One? Retrieved from www.sciencedirect.com/science/article/pii/S2212567114003815. (22th December 2014).
- Clark, T. E. & Van Wincoop E. (2001). Borders and Business Cycles. *Journal of International Economics*, Vol. 55, pp. 59–85.
- Crowley, P. & Schultz, A. (2010). A new approach to analyzing convergence and synchronicity in growth and business cycles: cross recurrence plots and quantification analysis. *Research Discussion Papers, Vol. 16*, Bank of Finland.
- De Arcangelis, G. & Di Giorgio, G. (1999). Monetary policy shocks and transmission in Italy: A VAR analysis. *Economics Working Papers*, No. 446, pp. 1-47.
- De Haan, J., Inklaar, R. & Jong-A-Pin, R. (2008). Will business cycles in the euro area converge? A critical survey of empirical research. *Journal of Economic Surveys*, Vol. 22, No. 2, pp. 234-273.
- Eurostat (2014): Retrieved from: <http://epp.eurostat.ec.europa.eu>. (22th December 2014).
- Fidrmuc, J. & Korhonen, I. (2010). The impact of the global financial crisis on business cycles in Asian emerging economies. *Journal of Asian Economics*, Vol. 21, No. 3, pp. 293-303.
- Franke, R. (2006). Themes on Okun's Law and Beyond. *Technical Report*, SCEPA.
- Hodrick, R. J. & Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*, Vol. 29, No. 1, pp. 1-16.
- Imbs, J. (2006). The real effects of financial integration. *Journal of International Economics*, Vol. 68, No. 1, pp. 296-324.
- International Financial Statistics. Retrieved from: <http://www.imf.org/external/data.htm>. (22th December 2014).
- Jagrič, T. & Ovin, R. (2004). Method of analyzing business cycles in a transition economy: The case of Slovenia. *The Developing Economies*, Vol. 42, No. 1, pp. 42–62.
- Jazbec, B. (2013). Decoupling of Cycles in Slovenia. Retrieved from: www.oenb.at/.../2013/06_ceedi_2013_presentation_jazbec.pdf. (24th December 2014).
- Levasseur, S. (2008). Updating empirical evidence on business cycles synchronization between CEECs and the euro area: How important is the recent period. *Document de travail No. 2008-11*, Observatoire Francais des Conjonctures Economiques.

- Mansour Malek, J. (2003). Do National Business Cycles Have an International Origin? *Empirical Economics*, Vol. 28, pp. 223–247.
- Mink, M., Jacobs, J. & de Haan, J. (2007). Measuring Synchronicity and Co-Movement of Business Cycles With an Application to the Euro Area, *CESifo Working Paper 2112*. Ifo Institute for Economic Research, Munich.
- Mink, M., Jacobs, J. & de Haan, J. (2012). Measuring coherence of output gaps with an application to the euro area. *Oxford Economic Papers*, Vol. 64, pp. 217-236.
- Najman, N. & Rozmahel, P. (2013). Business cycle coherence and OCA endogeneity testing during the integration period in the European Union. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 61, No. 4, pp. 1033-1040.
- Napoletano, M., Roventini, A. & Sapio, S. (2006.). Are Business Cycles All Alike? A Bandpass Filter Analysis of the Italian and US Cycles. *LEM Working Paper Series* 2004/25.
- Savva, C., Neanidis, K. C. & Osborn, D. R. (2007). Business cycle synchronization of the euro area with the new and negotiating member countries. Retrieved from: www.csavva.com/Savva_Neanidis_Osborn_Nov07.pdf. (21th December 2014).
- Siedschlag, I. (2010). Patterns and determinants of business cycle synchronization in the enlarged European Economic and Monetary Union. *Eastern Journal of European Studies*, Vol. 1, No. 1, pp. 21-44.
- Siedschlag, I. & Tondl, G. (2011). Regional output growth synchronization with the Euro Area. *Empirica Springer*, Vol. 38, No. 2, pp. 203-221.
- Šimurina, J. & Nadoveza O. (2012). Utjecaj gospodarskih ciklusa na razvoj malog otvorenog gospodarstva – primjer Hrvatske, Slovenije, Slovačke i Mađarske. In G. Družić and I. Družić (Ed.), *Zbornik radova: Razvojna strategija malog nacionalnog gospodarstva u globaliziranom svijetu* (pp. 353-385). Hrvatska akademija znanosti i umjetnosti i Ekonomski fakultet u Zagrebu: Zagreb.
- Stanisic, N. (2013). Convergence between the business cycles of Central and Eastern European Countries and the Euro area. *Baltic Journal of Economics*, Vol. 13, No. 1, pp. 63-74.
- Stock, J. H. & Watson, M. W. (1999). Business cycle fluctuations in us macroeconomic time series, *NBER Working Paper Series 6528*, National Bureau of Economic Research.
- Traistaru, I. (2004). Sectoral Specialization, trade intensity and business cycles synchronization in an enlarged EMU. *Centre for European Integration Studies*, University of Bonn.
- Van Arle, B., Kappler, M., Seymen, A. & Weyerstrass, K. (2008). Business cycle synchronization with(in) the euro area: stylized facts. *5th Eurostat Colloquium on Modern Tools for Business Cycle Analysis*, Eurostat and European University Institute.
- Walti, S. (2009). The myth of decoupling. *MPRA Paper 20870*, University Library of Munich, Germany.

Appendix

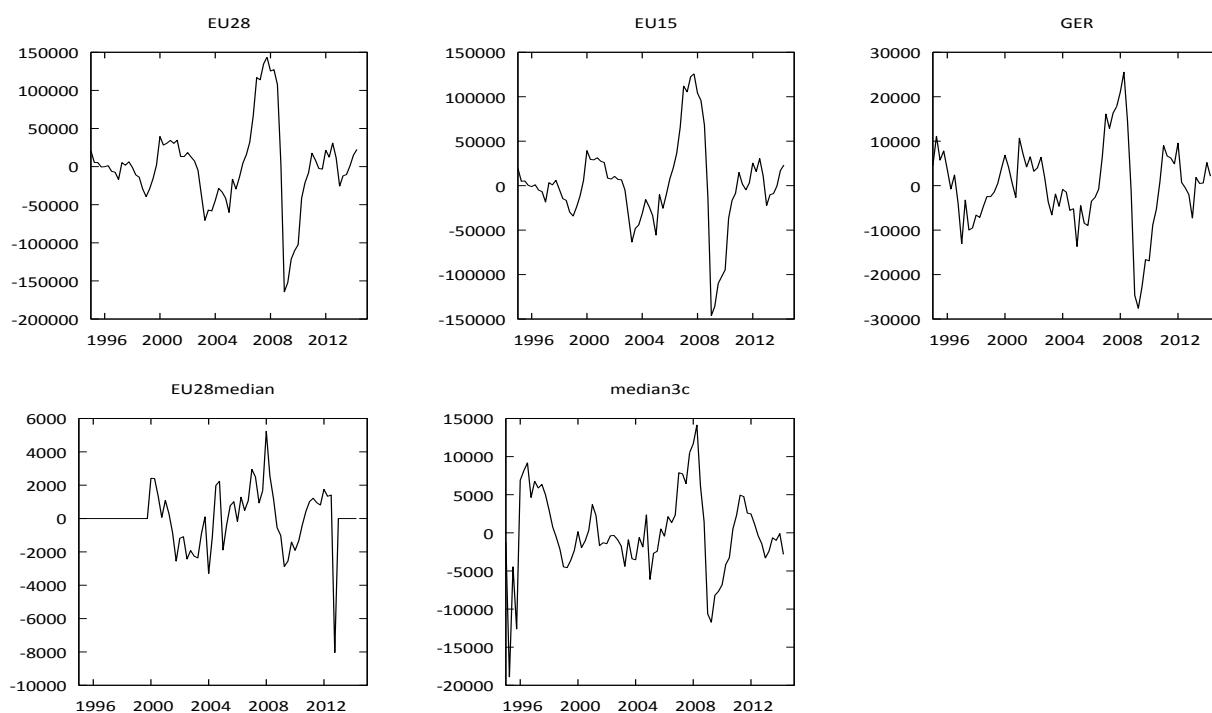
Table 1: Cross-correlation to GDP with lags and leads up to 4 periods (real variables)

Variable	t-4	t-3	t-2	t-1	t-0	t+1	t+2	t+3	t+4
PPI	-0,08	-0,07	-0,07	-0,07	0,29	0,41	0,55	-0,08	-0,07
CPI	-0,16	-0,14	-0,10	-0,05	0,02	0,03	0,05	0,02	0,02
HCPI	-0,02	-0,02	-0,01	0,00	0,02	0,01	0,01	0,00	0,01
IND	0,68	0,49	0,32	0,17	0,05	-0,06	-0,11	-0,13	-0,14
EMP	-0,09	-0,09	-0,10	-0,10	0,35	0,51	0,70	-0,09	-0,08
IMP_G	-0,12	-0,11	0,34	0,79	0,60	0,23	-0,07	-0,06	-0,05
EXP_G	-0,12	-0,11	0,35	0,82	0,61	0,23	-0,09	-0,07	-0,06
IMP	-0,16	-0,16	-0,01	0,20	0,43	0,59	0,81	0,44	0,10
EXP	-0,16	-0,17	0,00	0,20	0,44	0,62	0,84	0,43	0,08
CONS	0,03	0,03	-0,01	-0,01	-0,03	-0,03	-0,02	-0,03	-0,05
GOV	-0,17	-0,19	-0,03	0,15	0,39	0,54	0,80	0,44	0,14

**bold number denotes 1%, 5% or 10% significance levels respectively*

Source: Authors' calculation.

Figure 2: Alternative variables for reference business cycle



Source: Authors' calculation.