National Bank of the Republic of Macedonia

Working Paper
2016

FINANCIAL AND REAL CYCLE SYNCHRONIZATION IN CENTRAL, EASTERN AND SOUTHEASTERN EUROPEAN COUNTRIES

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Abstract

This paper analyzes the interactions between the real and financial cycles in the Central, Eastern and Southeastern European (CESEE) region and also between the financial and real cycles of these countries with the respective cycles of the euro area. The properties of the business and financial cycles are also extensively analyzed, both on a country and region-level basis. The analysis is done using the Bry-Boschan Quarterly algorithm (BBQ) covering 16 CESEE countries. Our findings indicate that observed on a country-level, real and financial cycles are significantly synchronized only in the minority of CESEE countries (Macedonia, Bulgaria, Croatia, Estonia, Lithuania and Turkey). Analyzed on a regional level, concordance between the real and financial cycle is found only in some of the SEE and Baltic countries, whereas the two cycles appear independent of each other in the CEE region. We have also found that there are a few CESEE countries which have a synchronous real business cycle with the euro area as opposed to the financial cycles which were found to be significantly concordant with the euro area in far larger number of the CESEE countries.

JEL Classification: C14, C26, E32

Keywords: real business cycles, financial cycles, turning points, synchronization, Concordance index, BBQ algorithm

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* This paper was presented at the Fifth Annual Research Conference of the National Bank of the Republic of Macedonia organized on 7-8 April 2016 in Skopje. We thank the discussant Meta Ahtik and Dubravko Mihaljek for their thoughtful comments and suggestions which are implemented in the final version of the paper. We are also grateful to many conference participants for their interest and comments on the subject. The opinions and views expressed in this paper are only those of the authors and do not necessarily reflect the position and views of the National Bank of the Republic of Macedonia. Any errors or omissions are the responsibility of the authors.

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1. Introduction

The role of the financial markets in driving real business cycles is a long debated topic in the literature. The interest in the subject is supported by anecdotal evidence that recognizes the interrelations between the financial and real cycles. The cases of Japan and its "Lost Decade" and the Asian crisis, form some prominent examples from the 1990s where economic downturns were preceded by financial busts that came after a prolonged booming phase at some particular segment of the financial market. More recent example is the global economic crisis from 2008-2009, that was to a large extent shaped by the overturn in the financial cycle. These developments have brought to the fore the debate about the linkages between the real economy and the financial sector and have renewed the interest of researchers in studying the finance-growth nexus.

We study this question by analyzing the interactions between the real and financial cycles in the Central, Eastern and Southeastern European (CESEE) region and also between the financial and real cycles of these countries with the respective cycles of the euro area. The motive is to examine the role of the credit market developments in shaping the real business cycles in CESEE. In addition to the financial and real cycle synchronization, our study provides an extensive analysis of the main characteristics of the real and financial cycles, which is done both, on a country-level and on a region-level basis. In order to measure the cycle characteristics and synchronization we use a variation of the Bry- Boschan procedure developed by Harding and Pagan (2002) which is applicable to quarterly data and henceforth is referred to as BBQ algorithm. The analysis is done for 16 CESEE countries: Czech Republic, Slovakia, Hungary, Poland, Slovenia, Macedonia, Serbia, Bulgaria, Albania, Bosnia and Herzegovina, Croatia, Romania, Estonia, Latvia, Lithuania and Turkey. For analysis purposes, the countries are then grouped in four sub-regions consisting of: Central and Eastern Europe – CEE (Czech Republic, Slovakia, Hungary, Poland and Slovenia); Southeastern Europe – SEE (Macedonia, Serbia, Bulgaria, Albania, Bosnia and Herzegovina, Croatia and Romania); the Baltic region (Estonia, Latvia, Lithuania) and Turkey. We use GDP to study the real cycle, while credit to the private sector is used as proxy to measure the financial cycle. The analysis covers the period from 1995-2015 conditional to data availability when it comes to separate countries. We use quarterly data.

Our findings indicate that observed on a country-level, real and financial cycles are significantly synchronized only in the minority of CESEE countries (Macedonia, Bulgaria, Croatia, Estonia,

Lithuania and Turkey). Analyzed on a regional level, concordance between the real and financial cycle is found only in some of the SEE and Baltic countries, whereas the two cycles appear independent of each other in the CEE region. We have also found that there are a few CESEE countries which have a synchronous real business cycle with the euro area as opposed to the financial cycles which were found to be significantly concordant with the euro area in far larger number of the CESEE countries.

The paper is organized as follows. Section 2 covers the literature review. Section 3 provides some stylized facts on credit and real GDP developments in CESEE countries. Section 4 discusses the data and methodology. Section 5 documents the empirical results. Section 6 concludes.

2. Literature review

The interactions between the financial sector and the real economy are broadly studied in the literature. The interest in the finance-growth nexus dates back to Fisher (1933) and Keynes (1936) in their studies of Great Depression where they acknowledged the financial and real sector interconnections. The more recent research in the field includes Bernanke and Gertler (1989), Bernanke et al. (1999) and Kiyotaki and Moore (1997) who study the role of the financial variables in shaping the macroeconomic developments. According to Cochrane (2006), macroeconomic and financial developments are closely linked to each other interacting through the wealth and substitution effects. Reinhart and Rogoff (2009) focus on financial crises examining the real and financial variables reactions to shocks. Helbing et al. (2010) find that credit shocks play important role in driving global business cycles, while Adrian et al. (2010) go one step further, including the monetary cycles in the analysis. Borio (2012) analyzes the characteristics of the financial cycle. He concludes that the best way to capture the financial cycle is by studying the movements in credit and property prices. His findings further suggest that financial cycles have larger amplitude and last longer as compared to the traditional business cycles. Similar findings can be found in Claessens et al. (2011) who report that financial cycles are severe and long in duration and highly synchronized across countries. Avouyi-Dovi and Matheron (2003) examine the interconnections of the business and stock market cycles. Their findings suggest that movements in the real sector activity and the stock prices are shaped by the same determinants in the long term. Still, strong dependence link between the two is not evidenced in their research, except for the United States.

The literature provides many methods for studying cycles. Most of them rely on detecting the turning points in the series to isolate the boom and bust phases in the cycle. One of the frequently used methods was set by Bry and Boschan (1971) who developed a procedure that was able to successfully replicate the business cycle reference dates determined by a committee of renowned economists from the USA-based National Bureau of Economic Research (NBER). Harding and Pagan (2002) introduced a quarterly version of this method that became broadly recognized as BBQ algorithm and widely used in the literature. IMF extensively uses the BBQ algorithm and its variants when studying the financial and real sector interactions. One prominent study is from Claessens et al. (2011) employing extensive database of over 200 business and 700 financial cycles in 44 countries for the period 1960-2007. Their findings point to strong linkages between business and financial cycles suggesting that financial disruptions tend to amplify the severity of the recessions, while rapid growth in credit and house prices tends to support stronger recoveries from recessions. Kannan et al. (2009) examine recessions and recoveries in advanced economies and the role of countercyclical macroeconomic policies. Their findings support the role of financial developments in determining real sector dynamics. What they find is that when associated with financial crisis, recessions tend to last longer and are more severe as compared to episodes with properly functioning financial sector. Egert and Sutherland (2012) study the nature of financial and real cycles in OECD countries. They provide evidence on the main characteristics of the cycle, including the length, amplitude and asymmetry of the cycle, as well as the degree of economic and financial cycle synchronization between OECD countries by using BBQ algorithm. They report changing nature of the cycles between 1950 and 2009 with growing asymmetries in the length of the phases in favor of extended expansionary phases. Though not fully conclusive, their findings suggest strengthening synchronization of business cycles among countries over time and unprecedented synchronization of the real and financial cycles during the global economic crisis, that holds for both, across countries and within countries.

Our paper also relates to the literature that employs the BBQ algorithm in analyzing financial and real cycles. It adds to the literature by analyzing the CESEE countries, given that the literature in the field is mainly focused on advanced and OECD countries while relevant research dedicated to this region is rather scarce.

3. Real and financial sector relations in CESEE: Some stylized facts

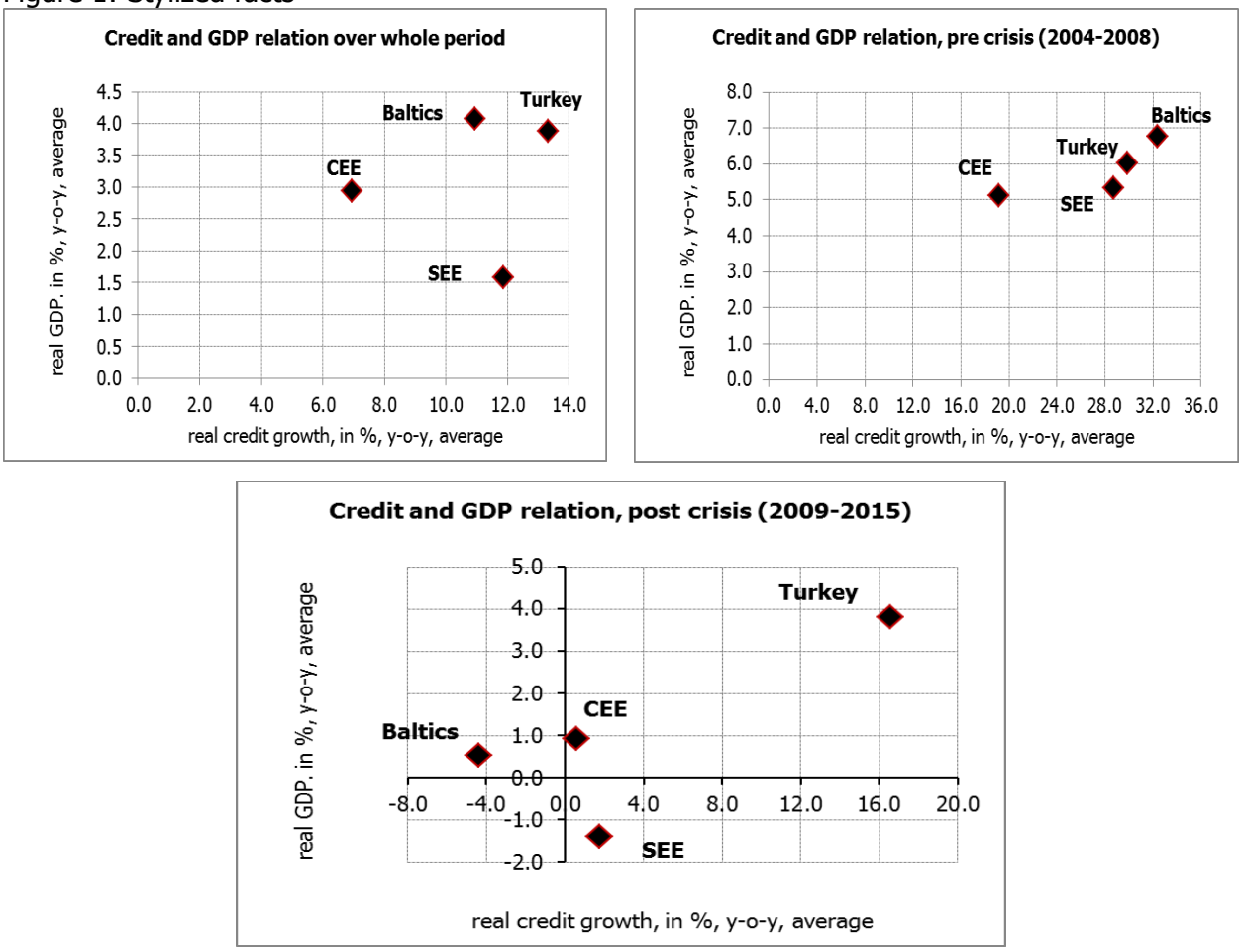
As noted in the previous section, there is a vast literature dealing with financial and real sector relations, but it is mainly focused on advanced economies. Research covering emerging markets is rather poor that, despite the data availability, to a large extent can be related to the specifics of these countries. Given the massive transformations of their economies and multiple shocks and crises of different nature they have faced, the claims from theory may not fully apply in emerging economies leading to disruptions in the main macroeconomic links. So, the state of the financial and real sector linkages in emerging economies may be quite different and heterogonous as compared to advanced economies.

The countries from CESEE region went through a massive restructuring of their economies as they moved from centrally-planed to market economies in the beginning of the 1990s. Turkey is an exemption, but on the other hand, it has faced many shocks and crises that urged for similar quantity of reforms and restructuring of the economy. So, what links these economies together is that starting the 1990s they have all been on a convergence path, still, achieving progress at different pace and reaching at different stages of development. Czech Republic, Slovakia, Hungary, Poland, Slovenia, Bulgaria, Romania, Estonia, Latvia and Lithuania are EU member states with Croatia joining recently. On the other hand, Serbia, Bosnia & Herzegovina, Macedonia, Albania and Turkey are candidate and potential candidate countries. They further differ with respect to the monetary and exchange rate policies. Slovenia, and more recently Slovakia, Estonia, Latvia and Lithuania are part of the Eurozone. Bulgaria and Bosnia & Herzegovina maintain a currency board. Macedonia and Croatia apply the strategy of exchange rate peg, while Poland, Czech Republic, Hungary, Romania, Serbia, Albania and Turkey exhibit a free or managed float regime. The CESEE region has differed widely and with respect to their vulnerability to external shocks, capital flow reversals and internal economic and political environment.

However, when it comes to financial sector structure and development, CESEE countries share many similarities. Their financial systems are predominantly bank-based with credit to the private sector representing a main channel of financing (with variations among the countries). Similar patterns are noticed and when analyzing credit dynamics. The pre-crisis period 2004-2008 was marked with dynamic growth of credit, with nominal credit growth averaging around 33%, y-o-y, on average. Looking at sub-regions, the Baltics and Turkey had the fastest credit growth (at around 45-46% on average, annually), followed by SEE (37% on average) and CEE

(23% on average). The conclusions are also similar when credit is analyzed in real terms. Such dynamics in credit to some extent relates to the catching-up process in some of the sub-regions given the low level of financial intermediation also boosted by foreign banks entrance, benign external environment and abundant capital inflows from abroad. High capital inflows were particularly typical for the Baltics which experienced the fastest credit growth.

Figure 1: Stylized facts



Buoyant credit has surely boosted economic activity with all of the sub-groups growing on average at around 5% or more. In line with the dynamics in credit, Baltics and Turkey were countries with fastest expanding GDP (at 6 to 7% on average) followed by SEE and CEE at around 5%. This suggests to positive relationship between credit and real economy growth in CESEE in the period prior to the crisis.

The global economic crisis from late 2008-early 2009 brought the credit boom in CESEE to a halt, even moving to a negative territory in some countries. Analyzed at sub-regional level,

largest correction was observed in the Baltics, which witnessed considerable credit deleveraging following the crisis. The adjustment was quite significant in SEE and CEE region as well, where credit growth was downsized to low single-digit numbers and remained negative for some time in most of the countries. Turkey was an outlier as it experienced a sort of a "mini credit boom" following the acute phase of the crisis on the back of the recovering economic activity and abundant capital inflows from abroad. The real credit growth in Turkey averaged around 16% in the post-crisis period, accompanied by robust GDP growth at nearly 4% on average. Despite the significantly subdued credit activity, most of the CESEE countries have recovered quite strongly from the crisis. The credit market revival lagged far behind the rebound in the economic activity, which holds for most of the countries. In the Baltics for instance, the economic recovery has started around 2010, while the recovery in credit markets came much later at around 2013/2014. Analyzed on a country-level, Poland performed quite well managing to deliver solid economic growth with private credit continuing to increase. Croatia on the other hand, went through a prolonged economic downturn coupled with significant credit rationing.

Macedonia, Slovakia, and Czech Republic were among the few that exhibited continuous positive growth in credit following the crisis, though at a much lower level as compared to the pre-crisis booming phase. Here also, some divergent trends were visible, with economic recovery leading the rebound in the credit markets immediately after the crisis, which is contrary to the period before the crisis when credit was expanding at higher rates than GDP. Such developments suggest to certain decoupling between the real and financial cycle in the period following the crisis. In the reminder of the paper we tend to evaluate the financial and real sector interrelations in CESEE, thus providing some useful stylized facts of the cycle behavior in the region which should prove valuable to policy makers in these countries.

4. Empirical Analysis

4.1 Cycle description methodology

4.1.1 Determining turning points

In the literature, a cycle is defined as "a process that moves sequentially between a series of clearly identifiable phases in a recurrent or periodic fashion" (Hamilton 2005, p.435). In order to identify the phases of the cycle determining the cyclical turning points is a necessary condition. Then, on the basis of these points, the time period between a high point (peak) and a low point

(trough) can be associated with the contractionary phase, whereas a trough-to-peak will represent the expansionary phase of the cycle. In their seminal work, Bry and Boschan (1971) developed a procedure that was able to successfully replicate the business cycle reference dates determined by a committee of renowned economists from the National Bureau of Economic Research (NBER). Since then, their procedure became widely used in academic research and is described by Harding and Pagan (2002) as "the best known algorithm for performing these tasks" (p.10). Consequently, for the purpose of identifying the turning points in our paper, we use a variation of the BB procedure developed by Harding and Pagan (2002) which is applicable to quarterly data[3] and henceforth is referred to as BBQ. Similar to the Bry and Boschan procedure for monthly observations, the BBQ algorithm is able to detect peaks and troughs for a single time series subject to certain censoring rules. We conduct our research with the following default rules of the algorithm:

- Local maxima and minima are identified in a symmetric window of t+/-2 quarters. A peak/trough is reached at t if the value of the series at date t is higher/lower than the value of the surrounding observations within the window. Technically, a peak is an observation for which $(y_{t-2},\ldots, y_{t-1}) < y_t > (y_{t+1},\ldots,y_{t+2})$ and a trough is an observation for which $(y_{t-2},\ldots, y_{t-1}) > y_t < (y_{t+1},\ldots,y_{t+2})$.

- The procedure ensures that peaks and troughs alternate, so that no two consecutive local maxima/minima occur. In case of multiple consecutive maxima/minima, the highest/lowest maximum/minimum is chosen.

- Censoring rules stating that every peak-to-trough and trough-to-peak phases should be at least *p* quarters long and every peak-to-peak and trough-to-trough cycles should be at least *c* quarters long. Harding and Pagan (2002) impose that the minimum length of the phases equal two quarters and the length of completed cycles equal at least five quarters as default in the algorithm for quarterly data.

4.1.2 Measuring cycle characteristics

Once the dates of the turning points have been identified, they can be used in conjunction with the original series to analyze various features of classical cycles. Commonly, the characteristics that are of main interest are the duration and amplitude of the cycle and phases, cumulative movements within phases and asymmetries between the phases (Harding and Pagan, 2002).

[3] The original Bry and Boschan procedure was applied only to monthly data.

Duration measures the length, whereas amplitude refers to the depth of expansions and contractions (average rise or decline of activity). Cumulation refers to cumulated gains or losses and represents the sum of the amplitudes for each period of the phase. As a way to analyze asymmetries, the excess movements metrics capture the divergences from a triangle which is used as an approximation of a typical phase with the height being the amplitude and the base being the duration. Given that the triangle approximation measures the cumulative change in the level of the variable, if it changed at a constant rate over a phase, the excess metrics is able to capture the shape of the cycle compared to this triangle approximation. In order to calculate the measures of these characteristics, one should first transform the original series containing the turning points into binary variables. We follow Harding and Pagan (2002) in defining binary variables S_t that take values of 1 when the series is in expansionary phase and 0 when the series is in contractionary phase. Then, for example the average duration (1) and amplitude (2) of expansions can be calculated as:

$$(1)\ D = \frac{\sum_{t=1}^{T} S_t}{\sum_{t=1}^{T-1}(1-S_{t+1})S_t} \qquad (2)\ A = \frac{\sum_{t=1}^{T} S_t \Delta y_t}{\sum_{t=1}^{T-1}(1-S_{t+1})S_t}$$

where the denominator in (1) and (2) represents number of peaks, the numerator in (1) represents the total time spent in expansions and the numerator in (2) represents sum of the changes in the level of the variable in the expansionary phases.

Cumulative movements and excess movements[4], respectively, are given by:

$$(3)\ C = \sum_{t=1}^{T} r_t - \frac{1}{2}A \qquad (4)\ E = \frac{1}{D}\left(\frac{1}{2}DA - \sum_{t=1}^{T} r_t + \frac{1}{2}A\right)$$

where $\sum_{t=1}^{T} r_t$ is the sum of the areas of t rectangles, with each rectangle referring to the log difference between the level of the variable in each quarter during the phase and the level of the variable at the beginning of the phase. Other metrics of the cycle are also available, such as the coefficients of variation of durations and amplitudes[5].

4.1.3 Measuring cycle synchronization

In order to analyze the degree of synchronization between classical business and financial cycles we use the concordance index established by Harding and Pagan (2002). The concordance index is a descriptive statistic which specifies the average amount of time in which

[4] Excess movements are usually calculated for both phases, although these metrics might not be very reliable for contractions, given that they are short-lived (Engel, Haugh and Pagan, 2005).
[5] More details can be found in Engel, Haugh and Pagan, 2005.

two variables, in our case GDP and credit, are found to be in the same phase of their cycles. It can take any number between 0 and 1, with 1 representing perfect overlap of the two cycles and 0 indicating that the series are always in opposite phases of the cycle. The index has the advantage in that it does not require the two variables to be stationary. In order to compute the index, Harding and Pagan (2002) apply the following formula:

$$\hat{I} = \frac{1}{T}\left\{\sum_{t=1}^{T} S_{xt}\, S_{yt} + \sum_{t=1}^{T}(1 - S_{xt})(1 - S_{yt})\right\}$$

Given the two series x_t and y_t, S_{xt} and S_{yt} are the binary variables obtained from the non-parametric BBQ algorithm which, as mentioned previously, are defined as:

S_{xt} = {1 if x is in expansionary phase at time t, 0 otherwise}

S_{yt} = {1 if y is in expansionary phase at time t, 0 otherwise}

T is the number of time periods in the sample.

Once the concordance index is calculated, the next step is to test whether the degree of synchronization of the two cycles is statistically significant or not. To this end, and by previously showing that the concordance index is monotonic in the correlation between the two series S_{xt} and S_{yt}, Harding and Pagan (2006) suggest estimating the following linear relationship:

$$\frac{S_{yt}}{\hat{\sigma}_{Sx}\hat{\sigma}_{Sy}} = \alpha_1 + \rho\frac{S_{xt}}{\hat{\sigma}_{Sx}\hat{\sigma}_{Sy}} + u_t$$

where $\hat{\sigma}_{Sx}$ and $\hat{\sigma}_{Sy}$ are the estimated standard deviations of S_{xt} and S_{yt}, respectively, α_1 is a constant, ρ is the correlation coefficient and u_t is an i.i.d. error term. Then, the t-statistic on ρ can be used for testing the null hypothesis of no synchronization. However, since the S_{yt} *series* exhibits extensive serial correlation, one must take this fact into account and use autocorrelation (and heteroscedasticity) consistent method to obtain the correct t-ratios and draw inference about the statistical significance of the concordance indicator. To this end, following Harding and Pagan (2006) we use the Generalized Method of Moments (GMM) estimator with a HAC estimation weighing matrix, Bartlett kernel and Newey-West fixed bandwidth method to test whether there exists significant cycle synchronization between the real economic and credit activity in the countries of interest. The same method is used to pin down the European countries that exhibit a common real and financial cycle with the euro area.

4.2 Data Description

Our sample consists of sixteen countries of the CESEE region classified in four sub-regions as explained before. In addition, the Economic and Monetary Union, i.e. the euro area, is included to serve as benchmark for comparison of the results.

Following Harding and Pagan (2002) we focus on cycles in the levels of the variables, which are generally referred to as classical cycles. Hence, in order to study the business cycle we use real GDP volumes[6], since this is the best available measure of the aggregate economic activity typically used in the literature. As a measure of the financial cycle, credit to the private sector[7] deflated by the consumer price index is used, as it represents the most important link between savings and investments. Same as Harding and Pagan, we work with the natural logarithm rather than the nominal value of the variables, because this is a commonly adopted transformation used in the applied work. Moreover, this transformation has no effect on the determination of the dates of turning points. Given the availability of data, and taking into account the requirements of the technique for identifying the turning points, data are with a quarterly frequency and are also adjusted for the seasonal effects. The sample period is different for each country depending on the time span of officially published data by national authorities, however for nearly all of countries there are data of more than ten years, which should ensure coverage for at least one complete cycle. Data are acquired from Eurostat, ECB, national statistical offices and national central banks of the analyzed countries. The BBQ analysis[8] was performed in MATLAB[9], whereas the GMM estimation was done in eViews.

5. Main results

First we start our analysis with a description of the main features of business and financial cycles, since we consider this as a necessary step before going into investigation about the relations between them. Thus, Sections 5.1 and 5.2 discuss about the estimates of the average duration of the cyclical phases, amplitude, average cumulative movements and excess for the business and financial cycles. All of these measures are in terms of percentages, with the

[6] Gross domestic product at market prices, chain linked volumes in national currency, seasonally adjusted.

[7] Outstanding amounts at the end of the period (stocks) of loans of MFIs excluding central bank (total maturity, all currencies combined) to non-MFIs excluding general government sector, denominated in national currency, seasonally adjusted.

[8] Although we decided to use the default censoring rules, the algorithm was not able to detect any turning points in the case of Poland, Croatia and Albania. That is why for these countries only, we impose that the phase and turnphase last for at least one instead of two quarters. This is found to be very suitable and realistic in describing their cycles when the results are presented graphically.

[9] We use the code of the BBQ program in MATLAB written by James Engel that we have accordingly adjusted to our needs.

exception of duration which is in quarters. The results of the concordance analysis are presented in Section 5.3.

5.1 Business cycle characteristics

In Table 1 we present the main features and descriptive statistics of the different phases of the business cycle. The results indicate that in the CESEE region contractions last for about five quarters on average, whereas expansions last significantly longer (17 quarters or more than four years), which is to be expected of classical cycles in growing economies. Interestingly, these results are relatively close to those observed in the euro area, where the length of contractions and expansions is estimated to be 6.5 and 23 quarters, respectively. Analyzed by sub-regions, it was found that the CEE countries have experienced the shortest contractions (around 4 quarters), whereas the SEE and Baltic countries, as well as Turkey have spent somewhat larger number of quarters in recession (close to 5 quarters). However, there are clear differences among different countries. Namely, the shortest recessions are recorded in Poland and Albania[10] (between 1 and 2 quarters), and Macedonia and Slovakia (3 quarters), whereas Romania (9.5 quarters), Croatia (7 quarters) and Slovenia (6.5 quarters) have had the longest contractionary phases. A general finding is that in all countries in the sample, the average expansion length is greater than the average contraction length, but also there is a greater variation in the length of expansions compared to contractions between countries. The expansion length varies between around 8 quarters (Albania) and around 24 quarters (Lithuania). Three of the sub-regions have recorded above average duration of the expansionary phase, with the Baltic region being an outperformer, spending almost two years in expansion. On the other hand, the duration of expansions in the SEE region is the lowest of all and is also the only one below the CESEE average.

Turning to the measure of change in output in the cyclical phases, it is estimated that the amplitude of contractions for the full sample is -6%, whereas the average cumulative output loss is 22%. By sub-regions, the deepness of recessions is particularly large in the Baltic region and Turkey (-9.3% and -9.8%), whereas it is the smallest in the CEE region (-4%). The highest amplitude is recorded in Lithuania (-10.7%), whereas the lowest amplitude is observed in Poland (-0.6%). On the other hand, the average amplitude of expansions in the CESEE region is 20.9% and the average cumulative gain is 298.6%. Specifically, the Baltic countries and Turkey

[10] It should be noted however that the data time span for Albania is relatively short and thus might not be entirely representative for the longer history as well as comparative with the other countries. However, since there is coverage for at least one complete cycle, we do not exclude this country from the analysis.

experience the highest growth in output during expansions (of more than 30%), unlike the SEE region which registers twice as lower amplitude. By countries, Latvia has seen the largest expansion amplitude (36.7%), whereas the lowest is registered in Albania (6.5%).

In addition, the "excess" metrics show that there are significant asymmetries in the shapes of the contractionary and expansionary phase. In half of the countries, the excess index is negative in recessions implying concave shape of the phase, whereas in the other half the excess index is positive, implying convex shape of the phase. Regarding the expansions phases, in the majority of the countries the excess index is positive, implying that the cumulative gain is smaller than that of the triangle approximation, i.e. that the shape of the phase is convex. In the CESEE region as whole, cumulative losses during contractions are higher by 3.4% than the triangle approximation, while cumulative gains during expansions are lower by 4.5%, on average. It is also worth noting that in all countries the decreases in output recorded during contractions are more than compensated by the increases during expansions. The results show that expansions are more variable in terms of duration and amplitude than contractions. In addition, the amplitude of the contraction and especially the expansion phase in all of the CESEE sub-regions is noticeably greater compared to the euro area.

Overall, it seems that the SEE region is having the worst combination of characteristics of the cyclical phases, given that it spends more time in recessions and less time in expansions compared to other regions and experiences larger declines in output from peak to trough and smaller output gains from trough to peak. This might be an explanation of their poor economic performance over the sample period. On the other hand, the CEE region appears to be performing better than others, with the shortest duration and lowest amplitude of contractions and longest duration and reasonably large amplitude of expansions. The Baltic countries and Turkey experience both lengthy durations and large amplitudes of recessions and expansions which can explain the unsmooth growth pattern that they have been following in the analyzed period.

Table 1: Characteristics of business cycles, by country

Region	Country	Period	Mean duration (quarters)		Amplitude		Avg. cum. movement		Excess movements		CV of duration		CV of amplitude	
			Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions
	Euro area	1995q1:2015q3	6.5	23.0	-3.5	13.2	-10.1	290.7	-18.2	-13.9	0.33	1.09	-0.73	1.23
SEE	Macedonia	1997q1:2015q3	3.0	12.4	-6.2	16.5	-10.8	121.1	-1.7	5.2	0.27	0.66	-1.16	0.32
	Bulgaria	2000q1:2015q3	3.8	18.3	-4.7	20.6	-16.4	313.2	19.3	66.1	0.61	0.79	-1.34	1.27
	Croatia	2000q1:2015q3	7.0	13.7	-5.2	13.2	-31.6	191.1	18.9	7.2	0.76	1.10	-1.09	1.51
	Serbia	1995q1:2015q3	5.2	11.2	-7.8	17.9	-19.0	267.9	-7.0	1.6	0.32	1.21	-1.34	1.44
	Albania	2009q1:2015q3	1.5	7.7	-1.9	6.5	-2.4	60.9	-12.1	22.9	0.47	1.39	-1.15	0.98
	BIH	2006q2:2015q3	4.5	9.3	-1.7	7.0	-4.7	40.7	-15.4	-48.3	0.79	0.27	-0.17	0.64
	Romania	1995q1:2015q3	9.5	21.0	-9.6	24.5	-71.3	336.6	46.9	-15.0	0.22	0.74	-0.05	1.07
CEE	Slovenia	1995q1:2015q3	6.5	23.0	-7.4	21.6	-31.0	475.4	12.4	12.6	0.11	1.13	-0.50	1.37
	Czech Republic	1996q1:2015q3	4.3	16.3	-3.5	13.6	8.2	203.6	-6.7	-1.2	0.27	1.12	-0.63	1.35
	Slovakia	1997q1:2015q3	3.0	21.7	-5.5	27.2	-6.4	386.8	-34.4	4.1	0.33	0.74	-0.51	0.86
	Hungary	1995q1:2015q3	4.0	16.5	-3.1	13.7	-13.1	234.9	37.9	-2.5	0.61	1.06	-1.09	1.34
	Poland	2002q1:2015q3	1.3	12.5	-0.6	13.3	-0.7	177.2	5.2	12.6	0.43	1.07	-0.44	1.02
Baltics	Estonia	1995q1:2015q3	4.0	23.3	-8.7	35.4	-29.9	521.9	6.8	7.8	0.66	0.46	-1.40	0.67
	Latvia	1995q1:2015q3	5.7	21.7	-9.9	36.7	-62.1	481.1	-11.2	-9.8	0.97	0.58	-1.37	0.81
	Lithuania	1995q1:2015q4	5.0	24.3	-10.7	35.8	-38.9	526.3	-5.3	-2.8	0.28	0.43	-1.03	0.65
	Turkey	1998q1:2015q3	4.7	18.7	-9.3	30.7	-22.0	438.7	1.3	10.9	0.25	0.63	-0.56	0.61
CESEE	mean		4.6	17.0	-6.0	20.9	-22.0	298.6	3.4	4.5				
	min		1.3	7.7	-10.7	6.5	-71.3	40.7	-34.4	-48.3				
	max		9.5	24.3	-0.6	36.7	8.2	526.3	46.9	66.1				
	st.dev.		2.0	5.3	3.2	9.9	21.7	161.3	20.4	22.9				

Source: Authors' calculation. Cumulative movements combine information about duration, amplitude and the shape of cyclical phases and are represented as a percent of GDP in first quarter of phase. Excess movements show the percentage gain or loss of output per quarter during an expansion or contraction in comparison with the constant growth scenario. CV is the coefficient of variation calculated as a ratio of the standard deviation of durations and amplitudes to their means.

Table 2: Characteristics of business cycles, by regions

Region	Mean duration (quarters)		Amplitude		Avg. cum. movement		Excess movements	
	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions
Euro area	6.5	23.0	-3.5	13.2	-10.1	290.7	-18.2	-13.9
SEE	4.9	13.4	-5.3	15.2	-22.3	190.2	7.0	5.7
CEE	3.8	18.0	-4.0	17.9	-8.6	295.6	2.9	5.1
Baltics	4.9	23.1	-9.8	36.0	-43.6	509.8	-3.2	-1.6
Turkey	4.7	18.7	-9.3	30.7	-22.0	438.7	1.3	10.9
CESEE	4.6	17.0	-6.0	20.9	-22.0	298.6	3.4	4.5

Source: Authors' calculation.

5.2 Financial cycle characteristics

Turning to the financial cycle features, Table 3 shows that downturns of the credit cycle last longer than economic recessions on average, unlike credit upturns which tend to be shorter than economic expansions. Moreover, financial upturns persist for about 14 quarters on average, which is twice longer than the duration of downturns (about 7 quarters). In only three of the countries (Romania, Latvia and Lithuania) the contractionary phase is longer-lived than the expansionary phase. The findings are similar compared to the euro area, where the length of financial upturns and downturns is found to be 18 and 6 quarters, respectively. By sub-regions, downturns are with the shortest duration in the SEE countries and Turkey (around 5 quarters), whereas the Baltic countries have experienced the longest lasting credit downturns (around 13 quarters). By countries, the shortest duration of financial downturns is observed in Macedonia (2 quarters), whereas the longest duration is registered in Latvia and Lithuania (13 quarters). On the other hand, the length of the financial upturn phase in the CESEE countries varies between 6 quarters in Romania, and 27 quarters in the Czech Republic. An interesting

finding is that in the SEE countries and Turkey, the length of credit cycles is very comparable to the length of business cycles. Furthermore, it was found that the amplitude of financial downturns and upturns in the CESEE region is significantly higher than the amplitude of business cycle phases. On average, these countries experience 13.6% fall in credit activity during downturn phases and 57.2% increase in credit activity during upturn phase. These amplitudes are also significantly higher than the ones observed in the euro area. The SEE countries have the lowest amplitude of credit downturns and second lowest amplitude of upturns, which combined with the low duration of the two phases might only point towards shallow integration of their financial markets. The largest amplitudes of financial downturns and upturns are registered in Turkey and the Baltic region. Average cumulation for the region as a whole is rather higher compared to the business cycle measure, amounting -109.2% on average in contractions and 836.1% in expansions. The indicator of excess movements shows that as in the case of business cycles, there are asymmetries in the shapes of the downturn and upturn phase. Similarly to the business cycle, half of the countries have negative excess metrics in contractions, implying concavity of the phase, whereas the other half experience convex recessions, given their positive excess metrics. Contrary, in expansions the majority of the countries have negative excesses, indicating larger cumulative gains than the triangle approximation and hence concave shape of the expansion phases. In the CESEE region as a whole, cumulative losses during contractions are higher by 2.6%, whereas cumulative gains during expansions are higher by 5.9% on average than the triangle approximation. The reported coefficients of variation of duration and amplitude indicate that, in general, expansions are more variable than contractions, which was also the case with real business cycles.

Table 3: Characteristics of financial cycles, by country

Region	Country	Period	Mean duration (quarters)		Amplitude		Avg. cum. movement		Excess movements		CV of duration		CV of amplitude	
			Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions
	Euro area	1997q3:2015q4	6.0	18.3	-4.1	21.8	-23.5	508.8	3.08	26.54	0.73	1.31	-1.35	1.63
SEE	Macedonia	1997q1:2015q4	2.0	13.4	-3.3	46.8	-6.0	482.5	29.40	-10.94	0.00	0.55	-0.92	1.10
	Bulgaria	2004q1:2015q3	5.3	10.0	-4.4	43.7	-17.7	470.5	82.43	2.28	0.43	0.87	-1.05	1.61
	Croatia	1998q1:2015q3	4.6	9.4	-6.7	28.5	-33.2	478.3	1.60	13.82	0.82	1.52	-0.93	1.83
	Serbia	2004q1:2015q4	5.5	18.0	-7.7	67.6	-35.4	1332.6	-6.80	8.96	0.64	1.10	-1.66	1.32
	Albania	2002q4:2015q3	5.5	20.0	-5.0	119.9	-13.6	2780.8	-29.38	-5.16	0.64	1.20	-0.09	1.39
	BIH	2005q1:2015q3	4.0	11.3	-3.1	27.6	-6.4	219.0	-36.32	-26.36	0.35	0.72	-1.05	1.31
	Romania	2004q4:2015q4	7.0	5.8	-12.0	36.3	-58.5	294.8	26.28	-12.84	0.62	1.08	-0.42	1.79
CEE	Slovenia	2004q1:2015q4	11.5	12.0	-28.3	45.7	-262.0	439.9	-48.85	19.13	1.17	0.83	-1.35	1.34
	Czech Republic	1996q1:2015q3	12.0	27.0	-35.4	57.6	-319.1	1763.6	-18.18	44.77	1.06	1.31	-1.39	1.12
	Slovakia	2005q1:2015q4	3.0	12.3	-1.1	39.7	-1.8	323.3	-20.14	-20.29	0.00	0.38	-0.78	1.14
	Hungary	1996q1:2015q3	6.0	13.5	-16.3	42.0	-105.8	613.7	10.46	-31.00	1.11	1.42	-0.89	1.35
	Poland	1996q1:2015q3	2.5	13.6	-1.8	41.1	-3.6	390.1	21.65	-2.07	0.23	0.46	-0.47	0.93
Baltics	Estonia	1997q1:2015q4	11.5	17.3	-16.7	92.3	-158.1	1313.5	-2.94	-2.22	1.05	0.94	-1.14	1.01
	Latvia	2004q1:2015q3	13.0	10.0	-27.7	69.6	-319.7	742.3	-4.54	-44.37	1.09	1.13	-1.42	1.13
	Lithuania	2004q1:2015q4	13.0	10.5	-18.8	70.1	-306.8	737.1	26.86	-26.25	1.31	1.01	-1.41	1.32
	Turkey	1994q1:2015q4	4.8	16.5	-29.5	86.8	-99.9	996.0	9.88	-1.40	0.43	0.62	-0.73	0.60
CESEE	mean		6.9	13.8	-13.6	57.2	-109.2	836.1	2.6	-5.9				
	min		2.0	5.8	-35.4	27.6	-319.7	219.0	-48.9	-44.4				
	max		13.0	27.0	-1.1	119.9	-1.8	2780.8	82.4	44.8				
	st.dev.		3.9	5.1	11.4	25.6	123.4	677.7	31.6	21.8				

Source: Authors' calculation. Cumulative movements combine information about duration, amplitude and the shape of cyclical phases and are represented as a percent of GDP in first quarter of phase. Excess movements show the extra gain or loss during an expansion or contraction of the credit activity in comparison with the constant growth scenario. CV is the coefficient of variation calculated as a ratio of the standard deviation of durations and amplitudes to their means.

Table 4: Characteristics of financial cycles, by regions

Region	Mean duration (quarters)		Amplitude		Avg. cum. movement		Excess movements	
	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions
Euro area	6.0	18.3	-4.1	21.8	-23.5	508.8	3.08	26.54
SEE	4.8	12.6	-6.0	52.9	-24.4	865.5	9.6	-4.3
CEE	7.0	15.7	-16.6	45.2	-138.4	706.1	-11.0	2.1
Baltics	12.5	12.6	-21.1	77.3	-261.5	931.0	6.5	-24.3
Turkey	4.8	16.5	-29.5	86.8	-99.9	996.0	9.88	-1.40
CESEE	6.9	13.8	-13.6	57.2	-109.2	836.1	2.6	-5.9

Source: Authors' calculation.

5.3 Synchronization of classical cycles

5.3.1 Business cycle dating

Before we move to the main analysis of the co-movements of business and financial cycles, it is useful first to examine the timing of their peaks and troughs in order to get a visual impression about the relationship between them. In summary, by using the BBQ dating algorithm we have identified 44 contractions and 41 expansions of the economic activity in the CESEE region as a whole. Of these, 14 contractions and 14 expansions are in the CEE region, 20 contractions and 18 expansions are in the SEE region, 7 contractions and 7 expansions are in the Baltic region and 3 contractions and 2 expansions are in Turkey. On the other hand, we have found 37 downturns and 44 upturns regarding the financial cycle. More precisely, 12 downturns and 13 upturns are in the CEE region, 17 downturns and 21 upturns are in the SEE region, 4 downturns and 6 upturns are in the Baltic region and 4 downturns and 4 upturns are in Turkey. When we systemize the identified cyclical phases by date (Tables 5 and 6), one might come to a conclusion that there is a certain clustering in turning points of the two cycles, which is

especially evident in some of the SEE and Baltic countries as well as Turkey. A clear example is Macedonia, where it appears that the business and financial cycles are almost all the time in the same state. Moreover, the long phase of expansion of the economic and credit activity in the 2000's is clearly noticeable in almost all of the CESEE countries.

Table 5: Business cycle dates

	Euro area	Macedonia	Bulgaria	Croatia	Serbia	Albania	BIH	Romania	Slovenia	Czech Rep.	Slovakia	Hungary	Poland	Estonia	Latvia	Lithuania	Turkey
P		2001Q1															
T		2001Q3															
P		2002Q2															
T		2003Q1			1995Q4						1997Q4				1995Q4		1999Q3
P		2006Q1			1997Q4			1996Q3		1996Q3	1998Q4	1996Q2	2002Q4	1998Q3	1998Q2	1998Q3	2000Q4
T		2006Q4		2000Q2	1999Q2			1999Q2		1997Q4	1999Q4	2006Q4	2003Q1	1999Q1	1998Q4	1999Q3	2001Q4
P	2008Q1	2008Q3	2008Q4	2008Q1	2008Q1	2009Q2	2008Q3	2008Q3	2008Q2	2008Q3	2008Q3	2007Q2	2004Q2	2007Q4	2007Q3	2008Q2	2008Q1
T	2009Q2	2009Q3	2010Q1	2010Q2	2009Q4	2009Q4	2009Q1	2010Q3	2009Q4	2009Q2	2009Q1	2008Q2	2004Q3	2009Q3	2010Q3	2009Q4	2009Q1
P	2011Q1		2012Q2	2011Q2	2011Q4	2014Q4	2010Q4		2011Q2	2011Q4		2010Q1	2012Q3	2014Q4			
T	2013Q1		2012Q4	2014Q1	2012Q4	2015Q1	2012Q3		2013Q1	2013Q1		2011Q4	2013Q1				
P					2013Q3							2012Q2					
T					2015Q1												

Source: Authors' calculations.
Notes: "P" denotes a peak, "T" denotes a trough. The economy is in expansion in the time between a trough and peak, whereas it is in contraction in the time between a peak and trough.

Table 6: Financial cycle dates

	Euro area	Macedonia	Bulgaria	Croatia	Serbia	Albania	BIH	Romania	Slovenia	Czech Rep.	Slovakia	Hungary	Poland	Estonia	Latvia	Lithuania	Turkey
P													2001Q3				
T										1996Q4			2002Q1				
P		2001Q1		1998Q4						1997Q2		2006Q3	2004Q1	1998Q3			
T		2001Q3		2000Q1						2002Q3		2007Q1	2004Q3	1999Q2			1994Q4
P		2002Q3		2008Q4				2008Q3	2008Q4		2009Q1	2009Q1	2009Q1	2008Q2	2008Q3	2008Q3	1998Q2
T		2003Q1		2009Q3				2009Q3	2009Q2		2009Q4	2009Q4	2009Q4	2013Q2	2014Q2	2014Q4	1999Q4
P	2009Q1	2009Q1	2009Q1	2010Q3			2008Q4	2010Q1	2010Q3		2011Q3	2010Q2	2011Q4		2014Q4	2015Q3	2000Q3
T	2010Q1	2009Q3	2011Q1	2011Q1			2010Q1	2011Q2			2012Q2	2011Q1	2012Q3				2002Q2
P	2011Q3	2012Q2	2012Q2	2011Q4	2012Q1	2012Q1	2014Q2	2011Q4				2011Q3					2008Q3
T	2014Q2	2012Q4	2013Q2	2014Q3	2014Q1	2014Q1	2015Q1	2014Q4									2009Q2
P	2015Q1		2014Q3	2015Q1	2015Q1	2014Q4											2015Q2

Source: Authors' calculations.
Notes: "P" denotes a peak, "T" denotes a trough. The time between a trough and peak represents financial upturn, whereas the time between a peak and trough represents a financial downturn.

5.3.2 Synchronization between real business and financial cycles

In this section we formally investigate the synchronization of business and financial cycles by the means of the concordance statistic proposed by Harding and Pagan (2002). We calculate the concordance index between business and financial cycles first on an individual country basis, and then we present a summary statistics for the CESEE region as a whole and the separate sub-regions (Tables 7 and 8). In the tables that follow $\hat{\rho}$ represents the estimated correlation coefficient, whereas CI stands for the computed concordance indices.

The results suggest that output and credit tend to be pro-cyclical in all of the analyzed countries, with concordance above 0.5 for all cycle pairs. However, the results are statistically significant only in six of the CESEE countries: Macedonia, Bulgaria, Croatia, Estonia, Lithuania and Turkey. In all of these countries output and credit cycles appear to be most highly synchronized, with the highest concordance registered in Macedonia (0.89). This means that in the case of Macedonia both output and credit are concurrently in the same phase of the cycle

about 90% of the time. This result suggests that fluctuations in credit are very important for the Macedonian real economy, i.e. expansion in real credit goes together with expansion in real GDP and vice versa. Taking into account the underdeveloped financial market in the country and the practical non-existence of other forms of financing of the investment projects of firms[11], this appears to be a reasonable finding. Moreover, the concordance that Macedonia displays is found to be even higher than the statistic for the euro area (0.78). Turkey displays second highest concordance index of 0.86, followed by Bulgaria (0.77), Croatia (0.76), Estonia (0.72) and Lithuania (0.56). It is interesting that very high concordance indices are also observed in two other countries (Slovakia and Poland), but they are not found to be statistically significant. This is in contrast with the lower but statistically significant concordance statistic for Lithuania. Harding and Pagan (2006) offer an explanation according to which "what might appear to be a high degree of association between cycles can be misleading, as it is simply an artifact of expansions lasting for long periods of time relative to the sample" (p.11)[12]. Hence, the high concordance in Slovakia and Poland is most likely to be a result of the high mean value of the states of the cycles, rather than of a strong correlation between phases. In fact, as it can be seen from the table below, the estimated correlation between the output and credit cycles is actually negative in these countries.

Table 7: Concordance and correlation statistics of output and credit cycles, by country

Country	$\hat{\rho}$	CI
Euro area	0.61	0.78***
Macedonia	0.59	0.89***
Bulgaria	0.93	0.77***
Croatia	0.62	0.76***
Serbia	0.25	0.64
Albania	-0.06	0.56
BIH	-0.02	0.61
Romania	0.30	0.61
Slovenia	0.29	0.64
Czech Republic	-0.21	0.59

[11] In spite of the underdeveloped domestic capital market, it should be noted that intercompany lending is an alternative source of firms' financing in Macedonia.

[12] Hardin and Pagan (2006) show that in the case of independent random walk processes, $\rho_S=0$ so that the concordance index equals 0.5 when the empirical average of the states of the two series also equal 0.5. However, if the two random variables are with drifts so that the empirical average of the states of the two series equal 0.9, in that case the concordance index equals 0.82. However, since the variables have been sampled independently, there should be no relation between them. Thus, a high value of the concordance index relative to 0.5 should not imply a high degree of synchronization. That is why Harding and Pagan argue that it is necessary for the concordance statistic to be mean corrected, which is what happens if one estimates the correlation coefficients and uses them for inference.

Slovakia	-0.18	0.81
Hungary	0.08	0.68
Poland	-0.19	0.80
Estonia	0.54	0.72**
Latvia	0.31	0.57
Lithuania	0.54	0.56**
Turkey	0.85	0.86***

Source: Authors' calculation.
** and *** indicate significance at the 5% and 1% level, respectively.

Table 8 presents the synchronization of real business and credit cycles by sub-regions. It is evident that output and credit are pro-cyclical in all sub-regions, with the two series being 69% of the time on average in the same state of contraction or expansion in the CESEE region as a whole. The concordance indices are very similar for the CEE and SEE sub-regions, with only the Baltic region lagging somewhat behind the average CESEE statistic. However, as it can be seen from Table 7, none of the CEE countries exhibit significant concordance, as opposed to the SEE region where around 40% of the countries have highly statistically significant cycle synchronization. In fact, in most of the CEE countries there is a negative correlation between the output and credit cycles. Although below the average, in two out of the three Baltic countries there is statistically significant concordance evidenced. With concordance statistic of 0.86, Turkey (as a sub-region) is characterized with the most synchronized real and financial cycles when compared to the other CESEE regions and also when compared to the euro area. In all other sub-regions the mean synchronization of cycles is found to be below the one observed in the euro area.

Table 8: Concordance of output and credit cycles, by regions

	CESEE	**CEE**	**SEE**	**Baltics**
mean	0.69	0.70	0.69	0.62
max	0.89	0.81	0.89	0.72
min	0.56	0.59	0.56	0.56
standard deviation	0.11	0.10	0.12	0.09

Source: Authors' calculation.

5.3.3 Synchronization of real business cycles

In this section the analysis is extended to examine the degree of synchronization between the real business cycles of the CESEE countries and the euro area. Ex ante, one might expect that the CESEE business cycles will be synchronized with the euro area business cycle, given that

the euro area is their important trading partner[13]. Table 9 contains concordance statistics and correlations for all countries versus the euro area. Surprisingly, concordance is found to be statistically significant only for the minority of the CESEE countries, suggesting a high risk of asymmetric shock transmission. The strongest link with the euro area business cycle is found in Slovenia, with the two outputs coinciding in the same phase of the cycle about 95% of the time. The other member-countries of the euro area display non-concordance, even though in the literature it is argued that joining a currency union should increase business cycle synchronization[14]. However, Slovenia has been the longest of all other respective countries in our sample a member of the Economic and Monetary Union, so this might lend support to the significant coincidence of their cycles. Of the other non-euro area CEE countries, a strong degree of business cycle synchronization is observed also in the Czech Republic (0.87) and Poland (0.78), which suggests that they are in line with this criterion for optimal currency zone[15]. Turning to the SEE region, it is evidenced that output cycles with the euro area have overlapped to a significant extent in Bosnia and Herzegovina (0.84), Croatia (0.83), Bulgaria (0.81) and Serbia (0.73). The concordance index for Macedonia is relatively high (0.75), but it is not statistically significant given the low correlation coefficient. Furthermore, the Baltic countries and Turkey are also found not to be significantly concordant with the euro area business cycle.

Table 9: Concordance and correlation statistics of real business cycles, by country

Country	**Euro area**	
	$\hat{\rho}$	CI
Macedonia	0.12	0.75
Bulgaria	0.76	0.81***
Croatia	0.57	0.83**
Serbia	0.34	0.73*
Albania	-0.31	0.52
BIH	0.99	0.84***
Romania	-0.12	0.69
Slovenia	0.90	0.95***
Czech Republic	0.56	0.87**
Slovakia	0.04	0.75
Hungary	0.29	0.78
Poland	0.70	0.78**
Estonia	0.40	0.82

[13] See European Commission (1990) for more about the expected influence of trade on cycle co-movement.

[14] Formal models supporting this claim are presented in Corsetti and Pesenti (2002) and Ricci (2006). Engel and Rose (2002) for example, show empirically that there is a positive effect of currency unions on the correlation of business cycles.

[15] Business cycle similarity is among the criteria defined within the theory of optimum currency areas.

Latvia	0.14	0.75
Lithuania	0.19	0.82
Turkey	0.25	0.72

Source: Authors' calculation.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Summary of the concordance statistic between the real cycles of the CESEE sub-regions and the euro area is given in Table 10. It is evident that the CEE countries are characterized by the most concordant business cycles with the euro area, followed by the Baltic countries. However, as it was previously said, although high, none of the Baltic countries concordance indices are statistically significant. SEE countries have the second lowest concordance indices on average, and exhibit highest variation in the statistic. Apart from being not statistically significant, Turkey's cycle is the least concordant on a regional level with the euro area.

Table 10: Concordance of real business cycles with the euro area, by regions

	CESEE	**CEE**	**SEE**	**Baltics**
mean	0.78	0.83	0.74	0.80
max	0.95	0.95	0.84	0.82
min	0.52	0.75	0.52	0.75
standard deviation	0.09	0.08	0.11	0.04

Source: Authors' calculation.

5.3.4 Synchronization of financial cycles

Analogous to the previous section, here we proceed with the analysis by examining the co-movement of the financial cycles between the CESEE countries and the euro area. In this regard, one should expect concordance between the two financial cycles, given that most of the CESEE countries are either part of the euro area, or their monetary policies are very closely linked to that of the euro area and their banking systems have large presence of foreign capital from the EU[16]. The calculated concordance indices and estimated correlations are given in Table 11. As expected, we find concordance in 75% of the CESEE countries, which is much higher than in the case of business cycle synchronization. Interestingly, the highest significant concordance is observed in Hungary, a country with independent monetary policy, where the two cycles overlap for 88% of the time. It should be however noted that for the most of the period under observation, Hungary has been operating under some form of a peg regime. Significant concordance is evidenced in all of the Baltic countries and in all CEE countries with

[16] Slovenia, Slovakia and the Baltic countries are part of the euro area; Macedonia has a euro peg whereas Bulgaria and Bosnia & Herzegovina have euro-based currency boards. Croatia, Serbia and Albania operate under some type of flexible exchange rate regimes but are subject to practical constraints in the monetary policy conduct given the high euroization in the countries.

the exception of Poland. However, there is one peculiar finding when it comes to the CEE countries. Namely, a low and statistically significant concordance index is obtained for the Czech Republic, which indicates that the relationship between this country's credit cycle and the euro area credit cycle is significantly countercyclical. Specifically, the concordance value for the Czech Republic is 0.48, which implies that 52% of the time the Czech financial cycle is in different phase compared to the euro area. The negative correlation between the two cycles further supports this countercyclical behavior. When it comes to the SEE region, a strong positive co-movement of the financial cycles is evidenced in all countries, with the exception of Macedonia and Bosnia and Herzegovina. Not surprisingly, we do not detect a significant synchronization between the financial cycles of Turkey and the euro area.

Table 11: Concordance and correlation statistics of financial cycles, by country

Country	**Euro area**	
	$\hat{\rho}$	CI
Macedonia	0.11	0.77
Bulgaria	0.39	0.72*
Croatia	0.63	0.83***
Serbia	0.92	0.85***
Albania	0.93	0.85***
BIH	0.36	0.60
Romania	0.69	0.68***
Slovenia	0.77	0.77***
Czech Republic	-0.32	0.48**
Slovakia	0.98	0.74***
Hungary	0.75	0.88***
Poland	0.44	0.79
Estonia	0.43	0.75**
Latvia	0.75	0.81***
Lithuania	0.62	0.74***
Turkey	-0.08	0.58

Source: Authors' calculation.

As it can be seen from Table 12, real credit cycles on a regional level are found to be highly synchronized with the euro area cycle. Compared to the CESEE average, the concordance statistic for the Baltic and SEE countries is the highest, followed by the CEE countries, whereas it is the lowest for Turkey. As mentioned above, the low concordance value for the Czech Republic is the main culprit for the lower CEE average. Excluding the Czech Republic changes substantially our previous conclusion, since in this case cycle synchronization appears to be strongest precisely in the CEE region.

Table 12: Concordance of financial cycles with the euro area, by regions

	CESEE	CEE	SEE	Baltics
mean	0.74	0.73	0.76	0.77
max	0.88	0.88	0.85	0.81
min	0.48	0.48	0.60	0.74
standard deviation	0.11	0.15	0.10	0.04

Source: Authors' calculation.

5.4 Main findings on Macedonia: short summary

In this section we summarize the main findings on Macedonia regarding the properties of the business and financial cycle and their synchronization. To the best of our knowledge, we believe this is the first analysis of its kind. Our study detects three complete cycles in Macedonia for the period 1997q1:2015q3, apart from the one that is currently ongoing. Namely, according to our estimates, the Macedonian economy currently is in the expansion phase starting from the fourth quarter of 2009, following the short recession provoked by the global economic crisis. We find that general business cycle characteristics in the Macedonian economy are similar to those in developing economies with expansionary phases demonstrating much longer duration as compared to the contractionary phases of the cycle. Our estimations suggest that over the last 18 years the economy was predominantly in a booming phase with the expansionary cycle lasting for 12.4 quarters on average. The bust cycle was much shorter extending over 3 quarters on average. During recessions the activity declined by 6.2% on average which resulted in total loss in output of 10.8% for all of the bust phases. This output waste was fully replenished during the booming phases with the average rise of activity being 16.5% that has ensured total output gain of 121.1%. Such findings are in line with the convergence and catching-up processes associated with emerging and developing economies. Our findings further suggest that the financial cycle in Macedonia shares similar characteristics with the business cycle. The duration of the bust phases is estimated to last for 2 quarters on average while the booming phase expands over 13.4 quarters. As in the case of the business cycle the amplitude of the expansionary phase is much higher amounting 47% on average, which considerably outweighs the downsizing in credit during the bust phases of 3% on average. Given the similar properties, the real and credit cycle in Macedonia are found to be highly synchronized moving concordantly in 90% of the time. Such findings are intuitive given the structure of the financial sector which is predominantly bank-based, that along with the rather underdeveloped capital markets makes bank credit a leading source of financing in the country. The synchronization level of 0.89 is the highest within the sample suggesting that credit

dynamics is highly procyclical in Macedonia and represents important determinant of the business cycle.

6. Conclusions

The main goal of this paper was to quantitatively evaluate whether there is a co-movement between financial and real cycles in the CESEE region, and also between the financial and real cycles of these countries with the respective cycles of the euro area. In addition, we have provided a comprehensive description of the main characteristics of real and financial cycles. The analysis was performed by using the non-parametric BBQ dating algorithm, introduced by Harding and Pagan (2002). The key empirical findings indicate that real and financial cycles are significantly synchronized only in the minority of CESEE countries (Macedonia, Bulgaria, Croatia, Estonia, Lithuania and Turkey). Analyzed on a regional level, this result suggests that concordance between the real and financial cycle exists only in some of the SEE and Baltic countries, whereas the two cycles appear independent of each other in the CEE region. We have also found that there are a few CESEE countries which have synchronous real business cycles with the euro area. Bulgaria, Croatia, Serbia and BIH of the SEE region, and Slovenia, Czech Republic and Poland of the CEE region are significantly concordant with the euro area business cycle, which for the countries that are already EU members might mean that they are in line with this criterion for the optimal currency zone. On the other hand, there appears to be no clear pattern of clustering of peaks and troughs in the Baltic countries and Turkey. Contrary, financial cycles are found to be significantly concordant with the euro area in far larger number of the CESEE countries. Only in Macedonia, BIH, Poland and Turkey there is no clear relationship between the timing of their financial cycles with the one of the euro area. In addition, it should be also noted that when looking at the comparison of the cycle synchronization with the euro area, our study shows that in many of the analyzed countries there is no discrepancy between the synchronization of their real and their financial cycles with the respective cycles of the euro area (simultaneous synchronization of both cycles relative to the euro area). All in all, the obtained results provide useful stylized facts of the CESEE countries cycle behavior which should prove valuable to policy makers in these countries. However, it should be noted that concordance here was examined only in terms of the classical cycle definition, so a natural way of expanding the analysis is by studying the properties of the

growth and/or deviation cycle. Additionally, it would be also interesting to investigate the potential determinants underlying the synchronization of business and financial cycles.

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