

Research on the Credit Cycle and Business Cycle with a Focus on Ten States from Central, Eastern, and Southeastern Europe

Constantin-Marius Apostoaie, Stanislav Percic, Vasile Cocriș, and Dan Chirleşan

ABSTRACT: By performing an econometric analysis of the credit cycle and business cycle from an individual as well as a comparative perspective, with a focus on ten relevant economies from the areas of Central, Eastern, and Southeastern Europe, this research offers a fresh view regarding the importance of banks in promoting long-term economic growth through their lending capacity. The purpose is to better understand the behavior (the short- and medium-term dynamics) of the credit cycle and business cycle and the effects of the interactions between them. The results of this study offer valuable insights for both academics and policymakers and provide a warning to regulators not to overregulate or put too much pressure on banking activity.

KEY WORDS: amplitude, business cycle, causality, Central Europe, credit cycle, Eastern Europe, guided cycle, Southeastern Europe, unidirectional synchronicity, volatility.

The financial crisis beginning in 2008 again focused academic debates on variables such as monetary aggregates and credit fluctuations and their macroeconomic importance in the amplification, propagation, and even generation of severe shocks during calm periods as well as during times of financial turmoil. Hence, an understanding of the credit cycle, or “leverage cycle,” and its connections with business cycles is much needed, especially during these times of distress, both for academic circles and for decision makers who are striving to find a solution to the current financial turbulence. Moreover, a comprehension of these cycles is even more important when we are dealing with bank-dominated financial systems in which credit is the single most important factor in the analysis of growth cycles.

This study is aimed at performing an econometric analysis of the credit cycle and business cycle from both an individual (each cycle taken separately) and a comparative (involving both cycles) perspective, with a focus on ten economies from the areas of Central, Eastern, and Southeastern Europe (CESEE). The purpose is to gain an understanding of the behavior of the cycles, the effects of the interactions between them, and the main implications resulting from these interactions. To achieve this objective, this study is structured into two important parts, thus delineating the two strategic objectives of the paper: (1) We analyze the short-term dynamics (from one quarter to another) of the relationships between credit expansion and economic growth in order to better understand

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which variable influences the other, and (2) we investigate the nature of the relations that appear within and between the cyclical components of the two main variables in order to highlight their behavior (on the long term) and to emphasize certain features regarding their volatility, amplitude, persistence, and cross correlation.

Studies on credit and business cycles are not a novelty, but research on the dynamics of lead-lag relationships is relatively new and provides valuable information for formulating monetary policy actions. These actions could help banks provide the necessary fuel for economic growth (by servicing the credit needs of the economy). Findings in this area are also important in formulating macroprudential policies.

A Brief Literature Review

When we speak of a cyclic phenomenon, we usually refer to a sequence of events that repeat in time. Business cycles are sequences of economic booms and recessions that are specific to the market economy. Credit cycles are cyclic fluctuations of bank crediting in time (expansions and contractions of loans), which may lead to an accumulation of systemic risks.

Several important studies focus on the relationship between the credit cycle and the business cycle. Many economists connect credit cycles with business cycles, with important effects on the world's economy. The most representative include Haberler (1938) and Schumpeter (1939) with their analyses of the business cycles, Keynes (1930) with his study of the credit cycle, and Wicksell (1936) with the theory of cumulative process. What these theories have in common is that cyclical fluctuations appear when there is a discrepancy between the interest market rate and the natural rate of interest. A prolific study is provided by Aikman et al. (2010). After studying the credit cycles and the business cycles in twelve developed economies belonging to the Organization for Economic Cooperation and Development, they notice that the credit cycle in these developed countries has a regularity that is well defined at an empirical level, has been functioning for over a century, and has been influenced not only by the business cycle but also by other factors such as financial liberalization and competition. In addition, their analysis shows that while the amplitude of a credit cycle is twice the amplitude of the gross domestic product (GDP), the frequency of the credit cycle is five times that of the business cycle.

The current literature views the credit cycle as playing either a passive role (see, e.g., the financial accelerator model of Bernanke et al. 1996) or an active role (see, e.g., Geneakoplos 2010; Gerali et al. 2010; Gorton and He 2008), acting as a shock by itself, in influencing the real economic activity. Some economists even argue that the credit cycle is the main factor in and the driving force of a business cycle. Among them are the Austrian and post-Keynesian scholars. Busch states that “credit cycles are at the heart of business cycles with the potential to amplify the swings of the latter” (2012, p. 2). Aikman et al. claim that “credit lies at the heart of crises” (2010, p. 1). The relationship between the credit cycle and the business cycle is the closest it has ever been, and is challenging the common perception that credit is merely an epiphenomenon of the business cycle (Jordà et al. 2011). The complexity of the credit cycle imposes the calibration and implementation of new capital and liquidity requirements.

Many researchers have studied the linkages between financial components and economic development. Regarding the business cycle, Mitchell (1927) was the first economist to empirically analyze the relationship between the business cycle and economic

development. Levine and Zervos (1998), using cross-national studies, find a positive and significant correlation between the initial level of banking development and future rates of economic and productivity growth over a period of eighteen years. Focusing on the same type of instrumental variables, Levine et al. (2000) emphasize a strong connection between the exogenous component of financial intermediary development and long-run economic growth. Jordà et al. (2012), after studying fourteen developed economies during the period 1870–2008, conclude that financial factors play an important cyclical role. After an analysis that gathers data from more than 100 countries over a period of forty years, Braun and Larrain (2005) conclude that industries that are more dependent on external finance are hit harder during recessions.

Several empirical studies address the business cycle and credit cycle in CESEE countries. Using a Markov-switching error correction model, Eller et al. (2010) analyze the long- and short-run determinants of domestic bank lending to the private sector in eleven CESEE countries, concluding that deposits and equity are the main short-run determinants of credit growth. They argue that the regime switches are mostly driven by differences in the short-run credit supply factors rather than by the adjustment to the credit equilibrium. Süßmuth and Woitek (2004) analyze business cycle characteristics for a sample of eleven European and Middle East and North Africa (MENA) economies in the Mediterranean region and find differences across business cycles, as well as changes of comovement, between the European and MENA economies.

Égert et al. (2006), analyzing the equilibrium level of private credit to GDP in eleven Central and Eastern Europe (CEE) countries, emphasize that nominal interest rates, the inflation rate, and the spread between lending and deposit rates are the major determinants of credit growth for CEE-5 (Czech Republic, Hungary, Poland, Slovakia, and Slovenia), while GDP per capita is the only variable that enters the estimated equations in a robust manner for the other six countries (the Baltic and Southeastern Europe countries). Kiss et al. (2006) reach similar conclusions. Using instrumental variable technique, they study the credit growth in Central and Eastern Europe and conclude that major determinants of credit are GDP per capita (representing the effect of economic development), the real interest rate (measuring the cost of credit), and inflation (capturing the effects of inflation volatility and liquidity constraints).

The statistical features that researchers usually consider when assessing the properties of a cyclical component extracted from time series are volatility, amplitude, persistence, and cross correlation of cycles. Gallegati et al. (2004) examine the business cycle characteristics of Mediterranean countries using a set of macroeconomic aggregates (GDP and demand components, money, and prices) for fifteen Mediterranean countries over the 1960–2000 period. They suggest that there are various regularities in the characteristics of business cycles of countries that are similar in their stage of development or geographical contiguity. Male (2011) examines the business cycle characteristics and synchronicity for thirty-two developing countries with Japan, the United Kingdom, and the United States as benchmarks upon which to compare the characteristics of the developing country cycles and also to examine the degree of synchronization between developed and developing countries.

We start from the considerations of the European Banking Federation (EBF), mentioned in a study conducted in 2010 (Economic and Monetary Affairs Committee of the EBF 2011) on eleven European states plus the United States. According to this study, the credit cycles are generally independent from the business cycles, at least in terms of synchronicity and amplitude. Nevertheless, the amplitude of the credit cycle decreased in

most of the analyzed economies from the second half of 1990, thus involving the alignment of monetary creation with the real economy through the crediting process. Because of the international financial crisis of 2008–9, and its aftermath, there is a scarcity of research on the topic regarding the interlinks between the credit cycle and the business cycle on CESEE countries. Hence, our study conducted on a sample of countries from the area over the period 2000–2012 (ten states) is meant to complete and, at the same time, to confirm or to raise questions about the results obtained by the European Banking Federation’s Economic and Monetary Affairs Committee.

Data and Methodology

Data Employed

In this analysis, we use sets of data with a quarterly frequency of real GDP and of the total volume of credits given to the nonbanking private sector by the credit institutions from ten CESEE countries: Hungary (HU), Poland (PL), Slovakia (SK), and Slovenia (SI) from Central Europe; Estonia (EE), Latvia (LV), and Lithuania (LT) in Eastern Europe; Bulgaria (BG), Greece (GR), and Romania (RO) in Southeastern Europe.

The sample period covers thirteen years, from 2000 (first quarter) to 2012 (fourth quarter), or 2000:1–2012:4. The primary data sources are the Eurostat database (for real GDP and the GDP price deflator) and the European Central Bank (ECB) Statistical Data Warehouse (for bank loans). In cases where data for bank loans are not fully available through the ECB for the entire period, the remaining variables are searched either in the Eurostat database (Bulgaria for 2000:1–2003:4; Hungary for 2000:1–2002:4; Latvia for 2000:1–2002:4; Lithuania for 2000:1–2003:4; Poland for 2000:1–2003:4; Slovakia for 2000:1–2005:4; Slovenia for 2000:1–2003:4) or from the quarterly data reports provided by the central banks of the individual countries (the cases of Estonia for 2000:1–2007:4 and Romania for 2000:1–2004:3).

Methodology Used

The first step of the research is to update the total volume of credits for each country so that it takes into consideration the level of inflation. This is done by using the GDP deflator.

Second, we deseasonalize the data referring to real GDP. This is necessary because the graphical representations show that seasonality occurs in all sample countries. This is done using the Tramo/Seats methodology (also employed by Eurostat). The Census Bureau’s X-12 seasonal adjustment program is also used as an alternative method (to test the robustness of the results), and findings are similar.

Third, after deseasonalizing real GDP, we extract the natural logarithms from the raw data sets. The data series are then decomposed into cycle and trend terms (see Apostoae and Percic 2012). We use the filter proposed by Hodrick and Prescott (1997) (the HP filter), which is the most common trend-cycle decomposition technique in the literature. The robustness of the results is verified using the BK filter (Baxter and King 1999), with a frequency of six quarters, to offer an alternative perspective.

The HP filter (technically, a two-sided linear filter) was originally developed for monthly data. Since we use quarterly series, the procedure is modified in line with Everts (2006) and Harding and Pagan (2002).

The original method proposed by Hodrick and Prescott (1997), first used in a working paper to analyze postwar U.S. business cycles, consists of decomposing a time series (y_h) into a trend component (s_h) as well as into a cyclical component through the minimization of the value of Expression (1):

$$\sum_{h=1}^K (y_h - s_h)^2 + \lambda \sum_{h=2}^{K-1} [(s_{h+1} - s_h) - (s_h - s_{h-1})]^2, \quad (1)$$

where λ is the penalty parameter, taking value in $[0, \infty)$, and controls the smoothness of the series. The first term of the expression ($y_h - s_h$) represents the cyclical component, while the second term penalizes variations in the growth rate of the trend component. The larger the value of λ , the smoother the series. When λ takes extreme values toward ∞ , s approaches a linear trend. Generally, $\lambda = 100$ when dealing with annual data, $\lambda = 1,600$ when working with quarterly data, and $\lambda = 14,400$ when the data has a monthly frequency. Therefore, we use in this paper the value $\lambda = 1,600$ in order to make the results comparable with the literature.

The method proposed by Baxter and King (1999) relies on the use of the symmetric finite odd-order $M = 2K + 1$ moving average so that

$$y_t^f = \sum_{h=-K}^K a_h y_{t-h} = a_0 y_t + \sum_{h=1}^K a_h (y_{t-h} + y_{t+h}). \quad (2)$$

When applying formula (2) to the data sets (with quarterly frequency), the BK filter takes the form of a twenty-four-quarter moving average (for details, see Guay and St-Amant 2005) as follows:

$$y_t^f = \sum_{h=-12}^{12} a_h y_{t-h} = a(L)y_t. \quad (3)$$

Therefore, for the second part of the research, all references to the variables refer to the cyclic components of the data sets (capturing oscillations for periods longer than one year at a macroeconomic level).

Results of the Analysis of the Short-Term Comovement Between Credit Expansion and Economic Growth

First, we examine whether there is any short-term correlation between the two variables (we test for contemporaneous correlation) within the ten CESEE countries. Second, we examine if the short-term turbulences that may occur in the credit expansion process are related to economic growth, without considering the medium-term trend of the two variables (which will be analyzed further on). To establish whether there is short-term—unidirectional or bidirectional—causality between the two variables, we use the Granger analysis of causality.

Referring to a study conducted by the Economic and Monetary Affairs Committee of the EBF (2011) on a panel of twelve countries (Austria, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, the United Kingdom, and the United States), the crediting activity of the banks is generally positively correlated with indicators that describe economic activity, such as real GDP, when larger periods are involved. Thus, the hypothesis often mentioned in the literature, that credit institutions play an important role in the economy (promoting long-term economic growth), is confirmed. We will verify whether this hypothesis is also valid for our ten CESEE countries.

Table 1. Short-term correlations and Granger-type causality between real GDP growth and credit expansion in ten CESEE countries, 2000–2012

Country	Country code	Correlation value	Type of causality	VAR order	F-statistic
Central Europe					
Hungary ^b	HU	0.7816	None	—	—
Poland ^b	PL	0.9138	GDP ← Credit	1	9.599***
Slovakia ^a	SK	0.4781	GDP → Credit	1	3.920*
			GDP ← Credit	1	2.877*
Slovenia ^a	SI	0.5273	GDP → Credit	4	2.681**
Eastern Europe					
Estonia ^a	EE	0.5941	GDP → Credit	4	2.261*
Latvia ^b	LV	0.6371	GDP → Credit	4	3.625**
Lithuania ^b	LT	0.4179	GDP → Credit	4	2.420*
Southeastern Europe					
Bulgaria ^b	BG	0.5859	GDP → Credit	2	3.036*
Greece ^a	GR	0.3849	GDP → Credit	2	7.506***
Romania ^b	RO	0.7090	GDP ← Credit	1	4.384**

Notes: GDP → Credit supposes that the historical values (or lags) of economic activity contribute to the estimate of the future values of crediting activity. The vector autoregressive (VAR) order is selected using the informational criteria AIC (Akaike), HQ (Hannan–Quinn), and SC (Schwarz), with the Schwarz criterion having priority. ^a Developed country. ^b Developing country. * Significance at the 10 percent level; ** significance at the 5 percent level; *** significance at the 1 percent level.

The comovement between credit expansion (upward or downward changes of the logarithmic values of the total volume of credit adjusted with the GDP deflator) and real GDP growth (dynamics of the logarithmic values of real GDP seasonally adjusted), analyzed using simple correlation analysis (see the results in column 3 of Table 1), is very strong in countries such as Hungary, Poland, and Romania (the values exceeding the threshold of 0.70) and quite weak in countries such as Greece, Lithuania, Slovakia, and Slovenia.

Therefore, in the first cases mentioned above (in countries such as Hungary, Poland, and Romania), one can speak of a dynamic that is almost coordinated (the degree of interdependence between the two variables is high). Although the results are not uniform in any of the analyzed geographic regions, there seems to be a higher interdependence between the two variables in the developing countries (e.g., Hungary, Poland, and Romania) and a lower interdependence in the developed economies (e.g., Greece, Slovakia, and Slovenia).

Although there is strong evidence of comovement between the credit expansion and real GDP growth, this does not imply that one variable influences the other. Therefore, further analysis should be employed to establish the causality. The Granger analysis of causality can show whether the short-term causality relationships between two variables are unidirectional or bidirectional. At the same time, the Granger analysis will also enable us to test whether a particular variable (either economic growth or credit volume) can be treated as endogenous or exogenous. An important aspect of the Granger test of causality is that, if it is applied on nonstationary data sets, the results can be inconclusive (a stochastic process is stationary if its average and covariance are constant in time, which

means that they oscillate around a certain value). For these reasons, we determine the level of stationarity using the augmented Dickey–Fuller (Dickey and Fuller 1979; Said and Dickey 1984) and Phillips–Perron (Phillips and Perron 1988) tests for the variables used (with and without a constant and including a linear time trend). The robustness of the results is verified using the Elliot, Rothenberg, and Stock Point Optimal test (Elliot et al. 1996) and the Kwiatkowski–Phillips–Schmidt–Shin test (Kwiatkowski et al. 1992). The results (which for space-saving reasons are not included in this paper but can be delivered upon request) show that, at a level of relevance of 5 percent, the order of integration is at least 1 or the set is $I(1)$ (nonstationary). Given that the data sets are nonstationary, in determining the Granger-type causality, we use the values in first difference of both the analyzed variables. The results of the Granger analysis of causality are depicted in Table 1. Although Granger-type causality tests are objective in nature, a lead-lag analysis is best done on the cyclical components extracted from the time series.

According to the results in Table 1, in almost all the CESEE countries (with the exception of Hungary), there is evidence of a short-term lead-lag relationship between real GDP and the crediting process. Nevertheless, such a relation is not uniform (“a one-way street”) in the analyzed economies (overall); that is, the relation of Granger-type causality is not a unique (unidirectional) one that could be described only by movements that start from crediting activity and slide toward economic activity (or the other way around).

In most of the countries analyzed (e.g., Bulgaria, Estonia, Greece, Latvia, Lithuania, and Slovenia), real GDP is the variable that influences in a decisive manner the credit expansion, in the sense that a growth of economic activity is followed (in an interval period from one to four quarters) by an increase in the volume of credits granted (credit expansion). Moreover, in Slovakia, there seems to be a feedback from the crediting activity toward the real economy. Therefore, in this economy, its growth in real terms, registered at a certain point, leads in the next quarter to an expansion of crediting activity, which, in its turn and in the near future, determines a higher growth of economic activity. In Hungary, there is no apparent short-term causal relationship (lead-lag type) between GDP growth and credit expansion. Therefore, upward or downward alternations in crediting activity do not appear to be caused by modifications in the real economy (through real GDP) or vice versa. Relations of short-term Granger-type causality from crediting activity toward economic activity are registered only in Poland and Romania (both for an interval of one quarter). Unlike the first relation, where the effect of an increase in real GDP is felt in the volume of credits during the following one to four quarters, credit expansion transfers to real GDP very quickly (i.e., the effect is more rapid). Here, the higher level of indebtedness of the banking system boosts the economic activity and the business cycle.

Results of the Analysis of the Medium-Term Relations Between the Business Cycle and the Credit Cycle

This second part of the research aims at performing statistical analysis of the cyclical components of the data sets referring to the ten CESEE countries; that is, we analyze the relationship between the business cycle and the credit cycle.

The research proceeds with the statistical analysis of the features that are commonly referred to when assessing the properties of a cyclical component extracted from time series: (1) Volatility (V) and relative volatility (Rv) reflect the magnitude of fluctuations of the analyzed variables and are measured as percentage standard deviation for both cycles (Rv is computed for the credit cycle and is measured as the ratio between the

volatility of the credit cycle and the volatility of the business cycle); (2) persistence (P) is computed as the AR(1) coefficient of the cyclical components of the data series (its significance is measured using the Ljung–Box portmanteau (Q) test for white noise); (3) cross-correlation (C) reflects the degree of comovement of the credit cycle with the business cycle and is computed as the contemporaneous cross-correlations between the detrended values of real GDP and credit, $p(j)$ where $j \in \{0, \pm 1, \pm 2, \dots\}$. The credit cycle is considered procyclical if $p(j)$ is positive, acyclical if $p(j)$ is null, and countercyclical if $p(j)$ is negative. In this research, the HP filter with $\lambda = 1,600$ is used. The accuracy of the data is subsequently verified using the BK filter (which, for space-saving reasons, is not included in this paper but is available upon request).

The business cycle from each country is the deviation of real GDP from its long-term trend. The credit gap is quantified in percent representing the deviation from its long-term trend (regarding the credits given by the banking system). After the extraction of the cyclic component from the economic and crediting activity for each of the ten states by using the HP filter with $\lambda = 1,600$, the data are centralized. Their graphical representation is presented in Figure 1.

One can see in Figure 1 the dynamics of the cyclic components for the two analyzed variables: economic activity (represented, in our case, by real GDP) and crediting activity (the total volume of credits given by the banking system from each state to the private sector). Consequently, the two cycles can be identified: the business cycle (the dashed line) and the credit cycle (the solid line).

The positioning of the business cycle above the line representing the null value (which means that the output gap takes positive values) suggests that the economic activity has a period of sustained growth and exceeded the long-term trend a while ago (in the majority of the cases, between 2007 and 2009). Consequently, the economic activity is in a stage of expansion. For the majority of the cases, there are at least two important periods of expansion: at the beginning of 2000 and between 2006 and 2007 (or up until the start of 2008, for some countries).

The positive values of the credit gap suggest that the crediting activity goes through an expansion stage that exceeds its long-term trend; this means that there is an increased availability of credits in the economy. Unlike the business cycle, the credit cycle has a higher volatility in time in most analyzed cases.

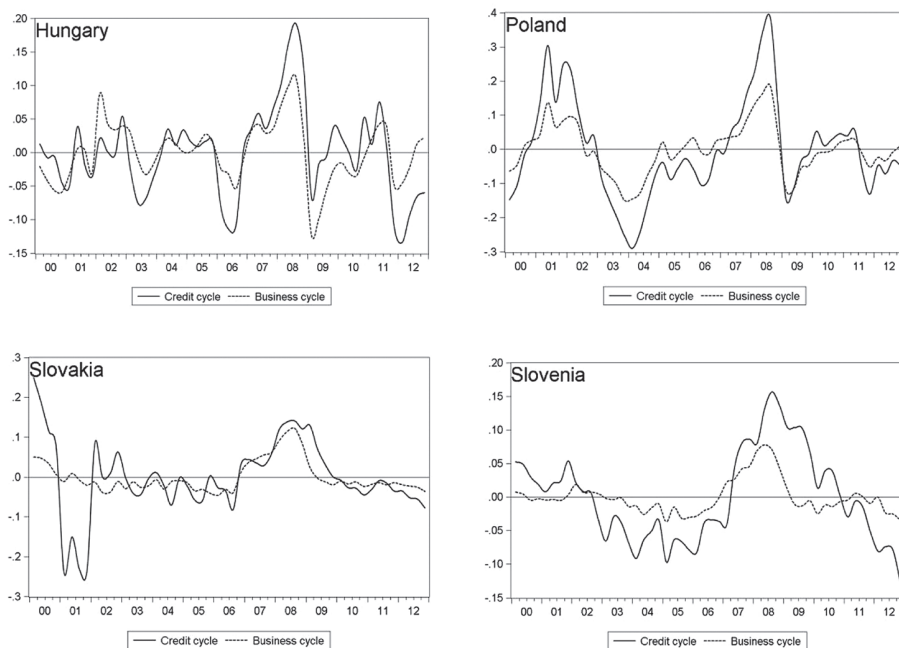
The business cycles in these countries tend to correlate with the credit cycle (registering similar behaviors). The close relationship possibly suggests the relevance of credit variables for the aggregate business cycles. The importance of credit mechanisms becomes more obvious when emphasizing that these countries have (overall) developing financial markets and agents facing credit constraints.

Once the data are deseasonalized and detrended, the statistical features referring to volatility (V) and relative volatility (Rv), persistence (P), and cross-correlation (C) of the two cycles are computed. The results are presented in Table 2.

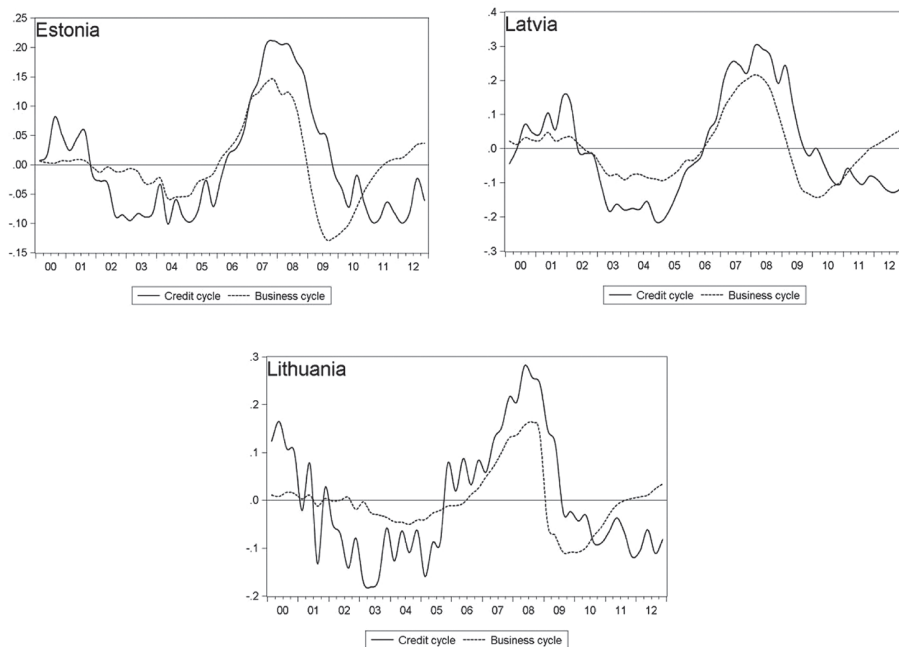
The main conclusions regarding the statistical analysis of the two cycles can be summarized as follows:

1. On average, credit is twice as volatile as output in the analyzed countries. Latvia, Lithuania, Romania, and Poland have the highest volatility of both output and credit. Greece and Slovenia have relatively low volatility of both cycles. Moreover, there are no uniform results regarding the volatility of the cycles across geographic regions; that is, in every geographical region, some countries present a high volatility of the credit or business cycle, and some countries

Central Europe



Eastern Europe



(continues)

Figure 1. Dynamics of the business cycle and credit cycle in ten CESEE countries, 2000–2012 (using the BK filter)

Southeastern Europe

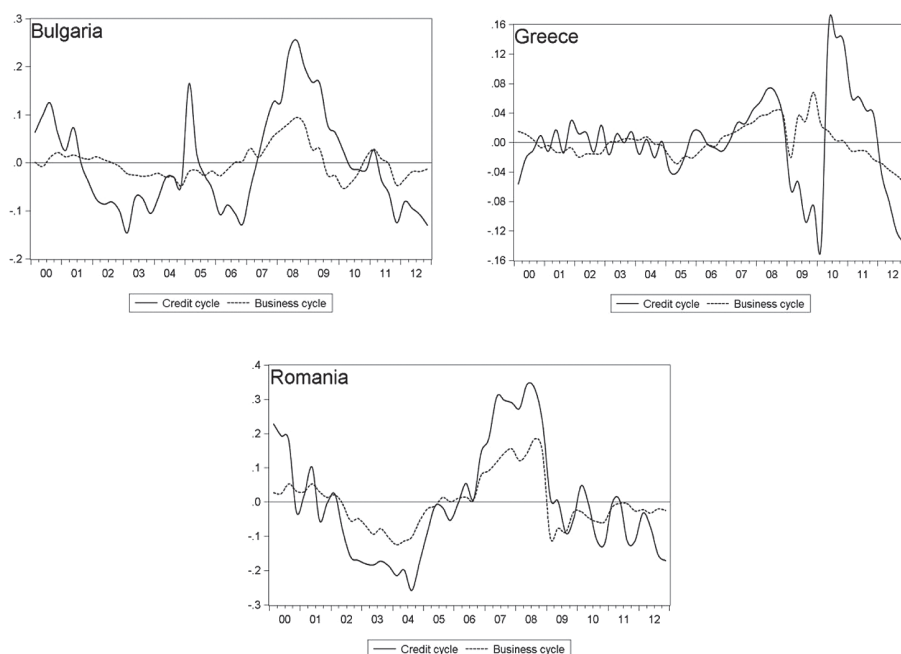


Figure 1. Continued

present a low volatility. Another important feature is the amplitude of the cycles. Given that the relative volatility of the credit cycle is greater than one in the majority of the cases, the credit variable has greater cyclical amplitude than the aggregate business cycle. The highest amplitude of the credit cycle is encountered in Bulgaria (the credit cycle exceeds three times the business cycle). Because of recent economic and financial turmoil, the volatility and amplitude of both the credit cycle and the business cycle register high values in all the countries (Figure 1).

2. The persistence of the cyclical components of real GDP and crediting activity is statistically significant at a level of 1 percent according to the Ljung–Box portmanteau (Q) test for white noise. The results in Table 2 reveal a significant overall persistence of the output as compared to the credit variable. In the majority of the countries (Hungary, Poland, Romania, and Slovenia being the exceptions), the average autocorrelation coefficient at lag one for the cyclical component of real GDP is greater than that of the crediting activity. Across regions, there is clear evidence that at lag one, the persistence of real GDP is greater than that of the crediting activity (with the highest value, 0.92 for output and 0.89 for credit, registered in Eastern Europe). Across countries, the persistence of output and credit is significant at lag one for Estonia and Latvia; in Greece and Hungary, the magnitude of persistence is lower but nevertheless high in comparison with values registered in other developing and developed countries (for additional results, see Alp et al. 2012; Male 2010, 2011). In conclusion, there is significant persistence of output and credit fluctuations in

Table 2. Basic statistical features of the credit cycle and business cycle in ten CESEE countries, 2000–2012

V			Rv	P – GDP			P – Credit		C		
Country	GDP	Credit	Credit	Lag 1	Lag 2	Q	Lag 1	Lag 2	Q	Level (raw data)	First difference
Central Europe											
Hungary ^b	4.5	6.6	1.4	0.637	0.161	22.3***	0.664	0.293	24.2***	0.69***	0.78***
Poland ^b	7.4	14.6	2.0	0.794	0.497	34.6***	0.811	0.548	36.2***	0.94***	0.91***
Slovakia ^a	4.0	9.5	2.4	0.869	0.695	41.6***	0.617	0.362	20.9***	0.61***	0.41***
Slovenia ^a	2.6	6.8	2.7	0.861	0.709	40.8***	0.871	0.752	41.7***	0.72***	0.38***
Average	4.6	9.4	2.1	0.79	0.52	—	0.74	0.49	—	0.74	0.62
Eastern Europe											
Estonia ^a	6.4	9.3	1.5	0.938	0.791	48.4***	0.920	0.844	46.5***	0.65***	0.48***
Latvia ^b	9.3	14.6	1.6	0.948	0.823	49.4***	0.927	0.832	47.2***	0.79***	0.59***
Lithuania ^b	6.3	12.2	1.9	0.884	0.699	43.0***	0.814	0.786	36.4***	0.65***	0.33**
Average	7.3	12.1	1.7	0.92	0.77	—	0.89	0.82	—	0.70	0.47
Southeastern Europe											
Bulgaria ^b	3.3	10.2	3.1	0.847	0.666	39.5***	0.834	0.689	38.3***	0.66***	0.49***
Greece ^a	2.3	6.1	2.6	0.721	0.611	28.6***	0.578	0.301	18.4***	0.21	0.23*
Romania ^b	7.5	16.1	2.1	0.838	0.658	38.6***	0.853	0.700	40.0***	0.89***	0.64***
Average	4.4	10.8	2.6	0.80	0.65	—	0.76	0.56	—	0.59	0.45

Notes: ^a Developed country. ^b Developing country. * Significance at the 10 percent level; ** significance at the 5 percent level; *** significance at the 1 percent level.

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the majority of the countries analyzed (as specific to other industrialized and developing countries).

3. The values of the contemporaneous cross correlation coefficients reveal that there is a particularly strong relationship between the cyclical components of the two variables, in the levels of the data as well as in the first differences. In other words, the degree of comovement between the cyclical components of both the variables in all the countries is given by the magnitudes of the correlation coefficients, which in our cases are particularly large. The positive values of the contemporaneous cross correlation coefficients reveal also that real GDP and the credit component are procyclical; that is, credit moves in the same direction as output. This affirmation is backed by the visual representation of the business and credit cycles in Figure 1. When analyzing the timing of the most-significant cross correlation coefficients in order to establish the dynamics of the relationship between the two cycles (which cycle leads/lags the other), the following conclusions are drawn: (1) In Bulgaria, Hungary, Poland, Slovakia, and Romania, given that the largest significant cross correlation coefficients appear at lag zero, the business and credit cycles are synchronous; (2) in the remaining countries, the largest significant cross-correlation coefficients appear at a lag greater than zero. Thus, the business cycle leads the credit cycle (in Latvia, Lithuania, and Slovenia, the business cycle leads by one quarter; in Estonia it leads by two quarters; and in Greece the business cycle leads the credit cycle by more than three quarters). Therefore, in the countries from Eastern Europe, the business cycle leads the credit cycle; in the other two geographic regions, the results are not uniform across countries.

To verify the accuracy of the data, we use the Baxter–King filter for the extraction of the cyclic components, but for reasons of space, the results are not incorporated in this paper. Nevertheless, according to the new output, the previously mentioned results are confirmed.

Conclusions

The relationships between economic growth and credit expansion documented in this research paper are mostly unconditional. Overall, these outline the list of possible explanations for the data observations. The study also includes Granger-type causality tests, which highlight some of the possible causal implications on the short run for a better understanding of credit as an indicator of business cycles. For this reason, we draw attention mainly to the characteristics and statistical properties (or stylized facts) of the credit and business cycles, which could form the basis for more elaborated research aimed at identifying the exact mechanisms generating the observed outcomes and the direction of the causal relationships and could be regarded as a starting point for the construction and validation of theoretical credit and business cycle models.

In the first part of the research, the focus is on the short-term relation of correlation and causality between the crediting activity of the banking system and economic growth in ten CESEE economies over a thirteen-year period (2000–2012). The findings reveal that we cannot speak of a relation of unidirectional causality (of a unique type) between the two variables across all the countries (not even across geographic regions). In six economies (Bulgaria, Estonia, Greece, Latvia, Lithuania, and Slovenia) real GDP (the chosen indicator of economic growth) is the variable that influences, in a decisive man-

ner, credit expansion, in the sense that a growth of economic activity is followed by an increase in the volume of credits granted. Such causality (“output to credit”) provides clues on the procyclicality of credit. The absence of bidirectional causality in these countries can be considered as a success of macroprudential measures. Nevertheless, in Slovakia there seems to be a feedback effect, from the crediting activity toward the real economy, indicating bidirectional causality.

In Hungary, there is no apparent short-term causal relationship between GDP growth and credit expansion. The absence of causality may indicate a need for more directed flow of and easy access to credit in the entire economy so that the monetary policy conducted by the Central Bank has the desired effect on output growth.

Relations of short-term Granger-type causality from crediting activity toward economic activity are registered only in Poland and Romania (both for an interval of one quarter). Unlike the first relation, where the effect of an increase in real GDP is felt in the volume of credits during the following one to four quarters, credit expansion transfers to real GDP very quickly (i.e., the effect is more rapid). Hence, the higher level of indebtedness of the banking system boosts economic activity and the business cycle. From a geographic perspective, there is a common ground, at least in the case of Eastern Europe, where there is a unidirectional relationship from economic activity to crediting activity with a delay of four quarters (i.e., one year).

The second part of the research reveals that, on average, credit is twice as volatile as output in the analyzed countries. The results across countries reveal that Latvia, Poland, and Romania have the highest volatility of both output and credit. In Greece there is a low volatility of both cycles. Moreover, there are no uniform results regarding the volatility of the cycles across geographic regions. The credit cycle seems to have greater cyclical amplitude than does the aggregate business cycle. The highest amplitude of the credit cycle is encountered in Bulgaria, where it exceeds three times the business cycle. Starting with 2008 (toward the second half of the year), in most countries, the amplitude of the credit cycle has decreased substantially, implying that the credit creation process has been increasingly calibrated with the real economy.

The results also reveal a significant overall persistence of the output as compared to the credit variable. In the majority of the countries (with the exceptions of Hungary, Poland, Romania, and Slovenia), the average autocorrelation coefficient at lag one for the cyclical component of real GDP is greater than that of the crediting activity. Therefore, there are credit fluctuations and significant persistence of output in the majority of the countries analyzed. The values of the contemporaneous cross-correlation coefficients reveal that there is a particularly strong relationship between the cyclical components of the two variables (in the levels of the data as well as in the first differences). In Bulgaria, Hungary, Poland, Romania, and Slovakia, the business and credit cycles are synchronous; in the other countries, the business cycle leads the credit cycle by one, two, or five quarters.

It is well known that one of the most important causal factors behind recurrent crises since the Great Depression of the 1930s has been large imbalances in credit flows. In this context, the procyclicality of credit has been viewed as the main cause in increasing the amplitudes of the output cycles, thus exacerbating the economic cycle. The results of this paper are in line with the literature given that the credit sector is procyclical in all the CESEE countries. The procyclicality of credit in these countries can magnify the amplitudes of booms and busts within the cycles. The question that arises (and this is one of the most vigorously debated subjects) is whether credit is a leading or a lagging indicator of growth. In five of the ten CESEE countries, the business and credit cycles are

synchronous; in the other five, the credit cycle tends to lag rather than to lead the business cycle, thus revealing that fluctuations in the real economy influence credit rather than the other way around (a feature that is typical of developing countries).

Another interesting result is that the comovement among the cyclical components of the data sets is much stronger (before the third quarter of 2007) in Estonia, Greece, Slovakia, and Slovenia than in the other countries. This may be because in these countries (all of them developed countries and members of the euro area), there is stronger economic and financial market integration.

The overall results show that in time (for our panel of countries), the credit cycle and the business cycle start to move much closer, synchronize to a greater extent, and become more interconnected, revealing an increasingly tighter link between bank-credit expansion and economic growth. This observation should send a warning to regulators not to overregulate or to put too much pressure on banking activity (especially when implementing the new capital and liquidity requirements) because this will lead in turn to stifling economic growth. This is extremely important, given that the majority of the European countries are bank-based economies. In addition, there are cases (especially during financial turmoil) when the credit cycle seems to be independent from the business cycle, registering an amplitude, a synchronicity, and a volatility different from and superior to that of the business cycle in all the analyzed countries (“having a mind of its own”). It is very important for policymakers to study and understand these cycles because the positive and negative deviations from the trend growth path, as we have seen, provide valuable information for policy actions.

We intend to improve our work by extending the panel of countries and the time span and by making comparisons considering the level of economic development (developing and industrialized, or developed, countries). In addition, we intend to determine the spillover effects regarding the international disturbances in bank credit across the analyzed panel of countries. Moreover, we intend to discover to what extent and in which segments of these economies the credit is procyclical.

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