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Excessive Credit Growth and Countercyclical Capital Buffers in Basel III: An Empirical Evidence from Central and East European Countries

Nadměrný růst úvěrů a proti cyklický kapitálový polštář v Basel III: empirická evidence ze zemí střední a východní Evropy

ADAM GERŠL, JAKUB SEIDLER[1]

Abstract
Excessive credit growth is often considered to be an indicator of future problems in the financial sector. This paper examines the issue of how best to determine whether the observed level of private sector credit is excessive in the context of the "countercyclical capital buffer", a macroprudential tool proposed in the new regulatory framework of Basel III by the Basel Committee on Banking Supervision. An empirical analysis of selected Central and Eastern European countries, including the Czech Republic, provides alternative estimates of excessive private credit and shows that the HP filter calculation proposed by the Basel Committee is not necessarily a suitable indicator of excessive credit growth for converging countries.

Keywords
credit growth, financial crisis, countercyclical capital buffer, Basel III

JEL codes
G01; G21; G18

Abstrakt
Nadměrný růst úvěrů je často považován za indikátor budoucích problémů ve finančním sektoru. Tento článek se věnuje otázce, jak nejlépe určit, zda pozorované zadlužení privátního sektoru je již nadměrné v souvislosti s makroobezřetnostním nástrojem navrhovaným Basilejským výborem pro bankovní dohled v novém regulačním rámci Basel III, tzv. proticyklickým kapitálovým polštářem. Empirická analýza na vybraných zemích střední a východní Evropy včetně ČR ukazuje alternativní odhady indikátoru nadměrného zadlužení privátního sektoru a naznačuje, že výpočet pomocí HP filtru navrhovaný Basilejským výborem nemusí být pro konvergující země vhodným indikátorem nadměrného růstu úvěrů.

Klíčová slova
růst úvěrů, finanční krize, proticyklický kapitálový polštář, Basel III

Introduction

The Basel III reforms to the banking sector regulatory framework agreed in 2010 contain an important macroprudential element intended to dampen the potential procyclicality of the previous capital regulation. The Basel Committee on Banking Supervision (BCBS, 2010a) has introduced a "countercyclical capital buffer" aimed at protecting the banking sector from periods of excessive credit growth, which have often been associated with growth in systemic risk. In good times, banks will – in accordance with set rules – create a capital reserve which

[1] The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and do not represent the views of the institution where the authors work.

can then be used to moderate contractions in the supply of credit by banks in times of recession.

One region that recorded a boom in lending to the private sector in the lead-up to the global financial crisis was the Central and East European (CEE) countries.[2] The observed credit expansion was driven by many factors relating to both the demand and supply side of the credit market. Although the credit growth in these transition economies started from very low levels, the rate of growth in many countries has raised concerns about how sustainable such growth is in the medium term and whether it poses significant risks to the stability of the financial sector.

This paper aims to draw on the historical experience of the CEE countries with credit expansion and, using the method proposed by the Basel Committee, to calculate and discuss what the countercyclical capital buffer level these countries might have had if the newly proposed regulation on the creation of capital buffers had existed before the crisis. The motivation for this analysis is to determine how suitable the Basel Committee's proposed method for calculating excessive credit using the Hodrick-Prescott (HP) filter is for the countries of Central and Eastern Europe. In these countries, rapid credit expansion may simply mean convergence to values typical of the advanced nations, and not excessive borrowing. For this type of country, we propose to use a method involving estimation of the fundamental-based equilibrium private credit level. Given that different countries have different characteristics, the Basel Committee allows national regulators to exercise discretion and specify different methods for setting the countercyclical capital buffer.

The paper is structured as follows. Section 2 discusses the risks associated with excessive credit expansion, looks at the situation in selected EU countries before the global financial crisis broke out, and briefly examines the logic of the countercyclical capital buffer as proposed by the Basel Committee. Section 3 takes a closer look at the disadvantages of applying the HP filter method and proposes an alternative technique for calculating excessive credit – the out-of-sample method. Both these calculation methods are then used on data for ten CEE countries. Section 4 illustrates the different implications of the alternative indicators of excessive credit growth for the countercyclical capital buffer settings of the banking sectors of the countries analysed. The conclusion attempts to generalise the results of the analysis and formulate recommendations for the national authorities responsible for macroprudential policy.

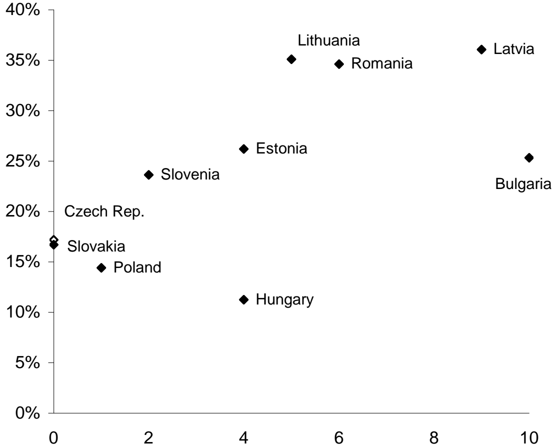
1 Excessive Credit Growth

Credit growth in CEE countries has caught the attention of many studies over the past decade. These studies have tried to identify not only the determinants of credit growth, but also its equilibrium level (Enoch and Ötker-Robe, 2007; Égert et al., 2006). The credit boom in some transition economies was strong enough to raise concerns about whether this trend was simply a manifestation of convergence to the average credit levels in advanced nations, or whether it was a case of excessive growth posing a risk to macroeconomic and financial stability (Hilbers et al., 2005). The central banks and supervisory authorities of some countries even assessed the situation as critical and in 2004–2007 introduced a series of tools for limiting credit growth (Dragulin, 2008; Herzberg, 2008). These tools ranged from "soft" measures, such as increased risk weights on selected loans and the introduction of guidelines and limits

[2] In this study, the group of CEE countries consists of Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

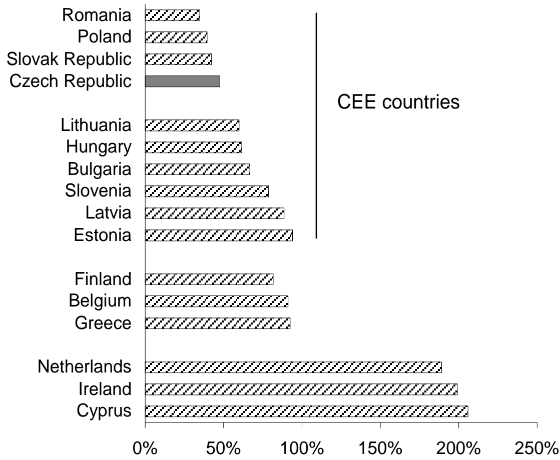
(e.g. Estonia), through to very "hard" administrative restrictions on credit portfolio growth (Bulgaria). The extent of the measures, as measured by the number of different tools used to limit credit growth, was correlated to a large degree with the credit growth rate (see Figure 1). However, it is difficult to assess the effectiveness of the tools used, since most of them were applied just before the global financial crisis erupted. The decline in credit growth observed since then may thus have been due more to the sharp economic contraction and reduced demand for loans. The studies conducted up to now tend to conclude that the aforementioned tools are pretty ineffective and that credit booms can be limited in only a very limited way during good times (Kraft, 2005; Herzberg, 2008).

Figure 1:
Credit growth and number of tools applied to limit credit booms (number of measures on x-axis; average year-on-year real credit growth in 2005–2007 on y-axis)



Source: IMF, national authorities' websites

Figure 2:
Private credit ratios in selected EU countries (as % of GDP; 2007 Q4)



Source: IMF IFS, authors' calculations

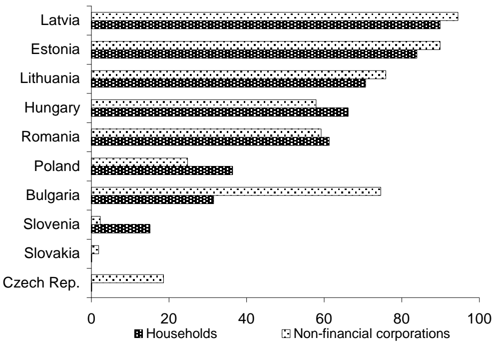
Despite the comparatively strong credit boom observed in 2003–2007, the stock of loans in many CEE countries in the pre-crisis year 2007 was still relatively low, especially in comparison with other EU countries (see Figure 2). Nevertheless, in terms of the private-credit-to-GDP ratio, some countries of the region had reached levels typical of some euro area countries. The question therefore arises whether they were already showing excessive credit levels. One limitation of this comparison is that is based solely on data on domestic bank loans. This indicator understates total private credit, as it neglects loans provided by non-bank financial intermediaries and loans provided directly from abroad.

Excessive credit growth can threaten macroeconomic stability in many ways. Given that lending supports consumption, growth in private sector loans can over-stimulate aggregate demand beyond the framework of potential output and cause the economy to overheat, with knock-on effects on inflation, the current account deficit, interest rates and the real exchange rate.

At the same time, lending institutions can, in an economic growth phase, have over-optimistic expectations about borrowers' future ability to repay their debts and therefore very often lend to high-risk borrowers. The upshot is that the bulk of "potentially" bad loans arise during upward phases of the credit cycle. In some CEE countries, private loans were provided in foreign currency because foreign interest rates were lower (see Figure 3). This further increases the risks for the banking sector, because if the domestic currency depreciates, the

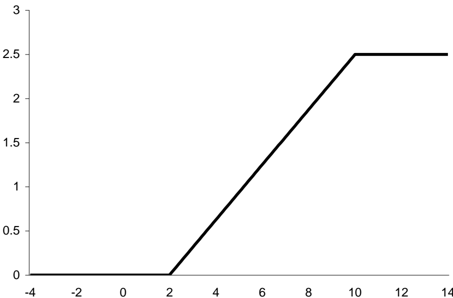
volume of credit expressed in the domestic currency rises, debt servicing costs go up, and foreign exchange risk turns into credit risk. In many cases, therefore, the aforementioned measures to contain credit growth were targeted primarily at reducing growth in foreign currency loans (Steiner, 2011). Furthermore, if a domestic credit boom is financed from foreign sources, as was the case in several CEE countries (except for the Czech Republic, Slovakia and Poland), the risk of the domestic banking sector having insufficient balance-sheet liquidity (roll-over risk) increases. In economic bad times, domestic banks face a high risk of outflows of short-term foreign funds that cannot be financed by the sale of liquid assets (Hilbers et al., 2005).[3]

Figure 3:
Shares of foreign currency bank loans (as of end-2009; as % of total loans to given sector)



Source: ECB
Note: Slovak Republic and Slovenia were already members of the euro area in 2009, so their foreign currency loans comprise currencies other than EUR.

Figure 4:
Countercyclical capital buffer (% of RWA as function of credit-to-GDP gap in p.p.)



Source: CNB

A bursting of the credit bubble and negative macroeconomic developments, leading to external financing constraints and growth in non-performing loans (NPL), can therefore cause the banking sector serious difficulties. IMF (2004) estimates that more than 75% of credit booms were followed by banking or currency crises. This fear is consistent with existing studies in the field of early warning signals, according to which excessive credit growth can be considered one of the most reliable indicators of future problems in the banking sector (Borio and Lowe, 2002; Borio and Drehmann, 2009; Jimenez and Saurina, 2006; Saurina et al., 2008).

As part of the preparation of the new Basel III regulatory framework for banks, the Basel Committee (BCBS, 2010a, 2010b) has proposed several tools for reducing the procyclical behaviour of the banking sector.[4] One of the key tools is a proposal for banks to create countercyclical capital buffers during credit booms.[5] Such buffers, expressed as a percentage

[3] In this regard, the Czech Republic has a very favourable deposit-to-loan ratio. For a comparison with other EU countries, see CNB (2010, section 1.3.1).
[4] The issue of procyclicality of the financial system and its sources and potential consequences was discussed in a thematic paper in Geršl and Jakubík (2012).
[5] With regard to the objective of reducing the procyclicality of the financial system, the Basel Committee stated explicitly in its December 2009 consultative document (BCBS, 2009) that the aim of this buffer was to

of risk-weighted assets (RWA) and covered by high quality capital (Tier 1, or even core Tier 1), would be set by the regulator within the range of 0% to 2.5%. As a guide for the setting of the buffer, the Basel Committee is proposing to use and regularly publish the difference between the current private credit ratio as a percentage of GDP and its trend value estimated using the HP filter (the "credit-to-GDP gap"). However, regulators may also use other methods to calculate the trend and other variables, such as the prices of various relevant assets and credit conditions. In bad times, this capital buffer would be "released" in order to slow any fall in the credit supply and thereby reduce the procyclicality of the financial system. The Basel Committee document itself (BCBS, 2010b) proposes to use the aforementioned guide as follows. The capital buffer would start to be created when the credit-to-GDP gap exceeded two percentage points. If the gap reached 10 percentage points or more, the buffer would reach the aforementioned maximum of 2.5% of RWA. For gaps of between 2 and 10 percentage points, the buffer would vary linearly between 0% and 2.5%. For example, for a gap of six percentage points the buffer would be 1.25% of risk RWA (see Figure 4). For cross-border exposures, the buffer set by the regulator in the foreign jurisdiction would apply. For cross-border banking groups, the capital buffer would be applied on both a solo and a consolidated basis.

It became clear during the discussion phase within the Basel Committee that a simple filtering technique would in many cases not necessarily lead to reliable estimates of excessive credit, so the final version of Basel III (BCBS, 2010b) gives regulators considerable discretion to set the buffer. The primary aim of the buffer, however, is not to restrict credit growth, but to create a capital reserve to give the banking sector greater protection from sudden changes in the credit cycle. At the same time, the Basel Committee documents emphasise the complementarity of this buffer with other macroprudential tools (BCBS, 2010b, p. 5), such as various limits on key indicators of borrowers' ability to repay loans (the loan-to-collateral and loan-to-income ratios).

2 Methods for Estimating the Equilibrium Credit Level

A major problem in constructing an excessive credit growth indicator is determining what level of credit is excessive and might pose a threat to the financial sector. One traditional method is to apply the statistical Hodrick-Prescott (HP) filter, which obtains the trend from a time series. By comparing the actual credit-to-GDP ratio with its long-term trend obtained using the HP filter we can then estimate whether or not the credit level is excessive. This method is used quite routinely in the literature (Borio and Lowe, 2002; Borio and Drehmann, 2009). Hilbers et al. (2005), for example, consider a credit-to-GDP gap of greater than five percentage points to be an indicator of excessive credit in the economy.

Although the HP filter method is used quite often to determine trends in macroeconomic variables, it does have its drawbacks. A time series trend is dependent to a significant extent on the length of the chosen time series and the calculation is very sensitive to the smoothing parameter (lambda). A big problem as regards practical application in macroprudential policy is "end-point bias", which generates a highly unreliable estimate of the trend at the end of the data period.[6] Macroprudential policy, which, by contrast, requires assessment of the trend on the basis of current (i.e. end-of-period) data, would therefore be reliant on indicators subject

"achieve the broader macroprudential goal of protecting the banking sector from periods of excess credit growth".

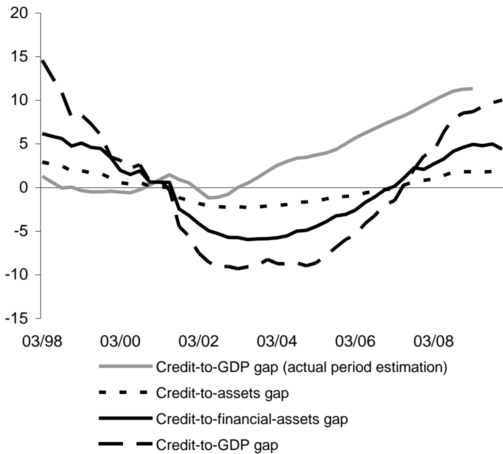
[6] One way of dealing with end-point bias is to extend the time series into the future by means of prediction. This, however, can introduce further uncertainty into the estimate linked with the quality of the prediction.

to a high degree of uncertainty. In the case of some CEE countries with relatively short time series, credit growth is incorporated directly into the trend itself by the HP filter, i.e. credit growth excess is counted as a trend (Cottarelli et al., 2005). Another relevant question is whether the credit ratio should take into account other denominators besides GDP, such as financial assets or total assets of the private sector. Although GDP is correlated to a significant extent with private sector income and therefore serves as an indicator of the ability to repay a given amount of loans, holdings of financial assets (deposits and securities investments) and non-financial assets (e.g. real estate) are also relevant to the evaluation of excessive credit.

Figure 5 presents credit gaps with alternative denominators (GDP and financial assets and total assets of the private sector) calculated using the HP filter on data for bank loans in the Czech Republic with a high lambda parameter equal to 400,000. Such a high value of lambda was proposed in Basel III with an argument that credit cycle is usually longer than the business cycle. The filter is applied to quarterly data for the period 1998–2010, which, however, is regarded as relatively short from the international perspective (Basel III recommends at least a 20-year period). The estimates indicate that the current level of bank loans is above the long-term trend. However, the trend estimate is subject to a range of problems related to the short time series and above all to extraordinary factors linked with a fall in credit volume in 1998–2002 caused by a banking crisis in the 1990s and the clean-up of bank balance sheets ahead of the privatisation of large banks.

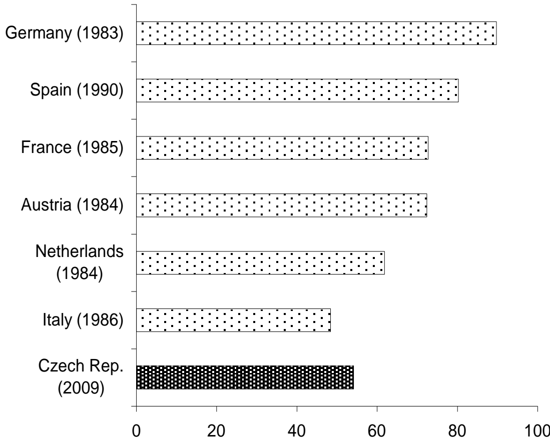
As regards simulating possible macroprudential policy in the past, it makes more sense to apply the HP filter recursively, i.e. in each past period using only the data that were available in that period (at the end of 2005, for example, the trend value and therefore also the gap between the observed credit level and the trend is calculated on 1998–2005 data). This simulates the situation that the macroprudential policy-maker would hypothetically have found itself in had it been required to decide whether excessive credit growth was emerging. The calculated credit gaps expressed as a percentage of GDP indicate that the Czech Republic would have found itself in a situation of excessive credit as early as 2004 (see Figure 5). However, the aforementioned drawbacks of the HP filter play an even greater role in the calculated gap, as the problem period of 1998–2002 influences the trend.

Figure 5:
Credit gaps in the Czech Republic with alternative denominators (in %)



Source: CNB, authors' calculations

Figure 6:
Credit-to-GDP ratios for a similar level of economic development (in %; GDP per capita in 2005 USD = USD 17,000 approx.)



Source: IMF IFS, authors' calculations

The main criticism of the HP filter technique, however, is that this method does not take into account economic fundamentals that affect the equilibrium stock of loans. An alternative method is to estimate the equilibrium private credit level in relation to key economic variables (such as the level of development of the economy measured in terms of real GDP per capita). In nutshell, this method says that if GDP per capita – as a proxy for the standard of living of an economy – is the main and only economic fundamental, all countries with the same level of development should have a similar equilibrium credit level. Poorer countries should have a lower equilibrium credit level than wealthier countries. A comparison of bank loans as a percentage of GDP for the Czech Republic in 2009 and selected euro area countries in years when they were at a similar level of economic development indicates, in contrast to the HP filter findings, that the credit ratio in the Czech Republic is below the level consistent with its economic level (see Figure 6).[7]

Given that the CEE countries started from very low private credit levels, however, the estimation of a suitable econometric model on data for these countries would capture the rapid growth caused by convergence towards the average level of the advanced nations. As Égert et al. (2006, p. 14) point out, such estimated elasticities of the relationships between fundamentals and credit would be overstated. At the same time, the estimates would reflect not the equilibrium level, but only the present relationship between economic fundamentals and private credit.

For this reason, the existing literature suggests using out-of-sample (OOS) panel estimation, i.e. estimating the model on a different sample of countries (so called in-the-sample countries) and applying obtained elasticities to the data for the countries for which the equilibrium credit level is being estimated (so called out-of-sample countries). This approach assumes a priori that the stock of credit of "in-the-sample" countries, which serve for estimating elasticities, is at equilibrium on average, which is quite a significant assumption. Therefore, one needs to choose suitable group of "in-sample" countries that best meets the need to estimate the correct equilibrium relationships between economic fundamentals and private credit. The existing studies on this topic therefore normally use the developed countries of the EU or OECD as appropriate countries for comparison (Kiss et al., 2006; Égert et al., 2006). For this study, the advanced EU countries were used as "in-sample" countries. Owing to the current debate regarding the excessive debt of the PIIGS[8] countries, these countries were omitted from the calculation of the equilibrium credit level.[9]

A variety of econometric methods can be used for OOS estimation. Given the properties of the variables used, however, traditional panel methods run into the problem of nonstationary time series, mutual regression of which can lead to spurious results. The traditional solution to the problem of nonstationarity of variables involves differentiating them. This step allows us to obtain the short-run relationship between the variables by regression, but the longer-run relationship is lost in the differentiation. The long-run relationship between nonstationary variables can be better estimated if the variables are cointegrated. This fact is used by the

[7] This comparison of the level of economic development is based on average GDP per capita expressed in real USD and can be interpreted as the same volume of goods that could be bought in the USA with the average GDP of the given country in the given year.

[8] Portugal, Italy, Ireland, Greece and Spain.

[9] However, nations that are structurally quite different from the CEE countries, such as the United Kingdom, remain in the sample of control countries. This may skew the results of the analysis towards higher equilibrium credit values for a given set of economic fundamentals.

ECM (error correction model) method, which estimates not only the long-run relationship between the cointegrated variables, but also the potential short-run deviations from this long-run relationship.
We use the PMG (pooled mean group) estimation method, introduced for panel estimates by Pesaran et al. (1999). It, too, is based on this principle of short-run deviations from the long-run trend. This method can be used to estimate the long-run relationship between the credit-to-GDP ratio and other variables, which is identical for all countries, whereas the short-run deviations from this relationship can differ across countries. The PMG model therefore allows heterogeneity of the estimates for individual countries in the short run. However, the long-run relationship of the cointegrated variables is common to all the countries in the sample (more technical details regarding estimation method is available in the Appendix).

The data used for the OOS method were obtained from the International Monetary Fund's IFS (International Financial Statistics) database, which provides the required macroeconomic data with a sufficient history (which is vital for estimating long-run relationships). For this reason, we used data for a 30-year period (1980–2010). The available statistics on bank loans to the private sector were used as the credit indicator. These statistics slightly underestimate the total credit of the private sector, as they do not include non-bank financial intermediaries (e.g. leasing) and cross-border loans. Data on aggregate household consumption, government debt, short-term interest rates, unemployment, inflation measured by the GDP deflator, and GDP per capita in dollar terms were also used.

A long-run cointegration relationship between the credit-to-GDP ratio, the household consumption-to-GDP ratio and GDP per capita in USD was identified for the set of in-sample countries. The GDP per capita variable in the long-run relationship captures the different degree of wealth of the economy, which therefore also influences the equilibrium private credit level (Terrones and Mendoza, 2004).

The following equation gives estimates of the coefficients of the long-run relationship between the cointegrated variables and the values of the coefficients in the short run, which are given as the mean of all the estimates for the relevant countries.[10]

$$\Delta\,(credit/gdp)_t = \underset{(**)}{-0.035}(credit/gdp_{t-1} + \underset{(***)}{0.7}cons/gdp_t + \underset{(***)}{0.013}\,gdp/pop_t) + \quad \text{\}long-run relationship}$$

$$+\ \underset{(**)}{0.87}\Delta(cons/gdp)_{t-1} \underset{(*)}{-0.07}inf_{t-1} + \underset{(***)}{0.014} \quad \text{\}short-run deviations}$$

*Note: *, ** and *** denote significance of the estimated coefficients at the 10, 5 and 1% levels respectively*

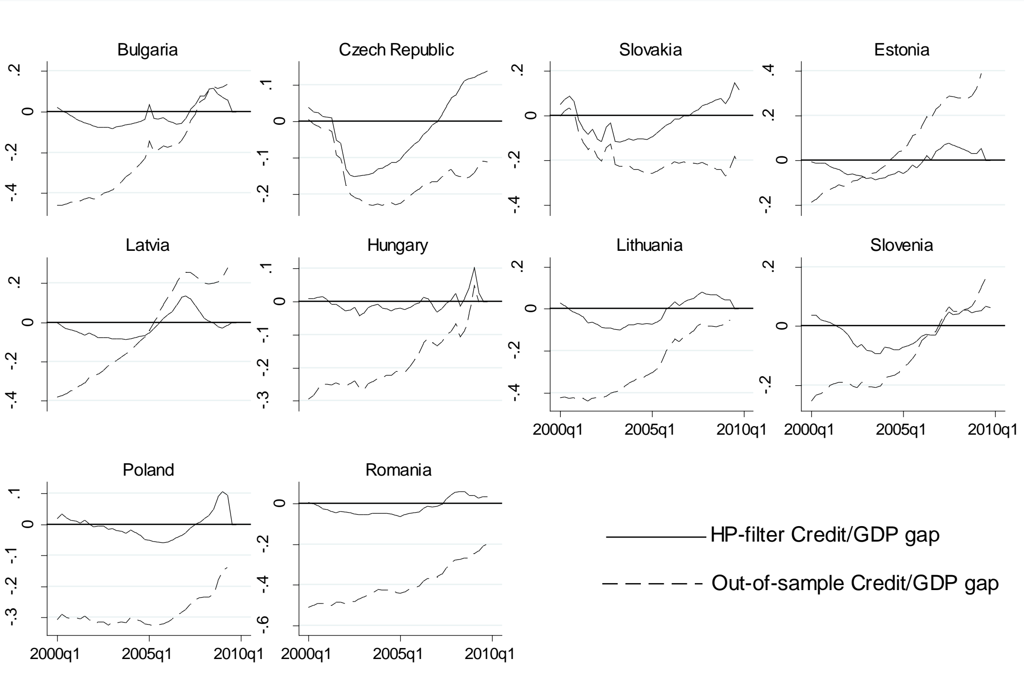
Credit/gdp represents the ratio of private sector credit to GDP, *cons/gdp* denotes the ratio of household consumption to GDP, *gdp/pop* is GDP per capita in thousands of dollars and *inf* is the change in the price level, expressed as the year-on-year change in the GDP deflator.

[10] Based on the Hausman test, we can not reject null hypothesis of PMG being efficient estimator, thus PMG is preferred compared to the mean-group (MG) counterpart. MG estimator is a simple non-weighted mean of regression estimates for each individual country. Hausman statistic $\chi^2(2)$ is equal to 0.9 (p-value = 0.637). Further, in the estimated equation only those variables were kept that were significant at least at a 10 % confidence level. Also, more empirical approach was used as in Sekine (2001), therefore in short-run part of the equation inflation is present, which is not in the long-run part.

Besides the aforementioned variables, other factors that might affect the explained *credit/gdp* ratio were included in the model. For example, the government debt-to-GDP ratio might capture any crowding out of bank lending to the private sector.[11] Also, the real interest rate, or changes therein, should, as the cost of financing, be in a negative relationship with the explained variable. However, as the final specification of the model indicates, these variables were not significant even at the 15% level.[12] On the basis of the model, short-run deviations from the long-run trend are given as a function of the change in the consumption-to-GDP ratio and as a function of inflation. Based on the estimated coefficients, we can conclude that in the long-run relationship the credit-to-GDP ratio increases with increasing wealth of the economy and with an increasing consumption-to-GDP ratio. This factor then positively affects the explained variable in the short-run relationship as well, while inflation acts in the opposite direction. These conclusions are in accordance with intuition as regards the effects of the variables used on the credit-to-GDP ratio.

The estimated parameters of the model were applied to data for the CEE countries to obtain values of the "equilibrium" credit ratio. The OOS calculations may in some cases imply significantly different conclusions regarding excessive credit compared to the calculations using the HP filter (see Figure 7). According to the HP filter, the credit-to-GDP gap indicates excessive credit in the recent period not only for the Czech Republic, but also, for example, for Slovakia, Lithuania, Romania and Poland, whereas the econometric estimate does not confirm this excessive credit level (values in the positive part of the chart indicates excessive private credit-to-GDP ratios). By contrast, Bulgaria, Estonia, Latvia and Slovenia now have excessive credit-to-GDP ratios according to the OOS method. It is clear, therefore, that the two calculation methods used give contradictory results in some cases.

Figure 7: Comparison of credit-to-GDP ratios for various calculation methods (in p.p.)



Source: IMF IFS, authors' calculations.

[11] For this reason, we would expect a negative relationship between the government debt ratio and loans to the private sector. The fact that a less indebted government sector would be able to provide more significant support if the banking sector ran into serious problems is relevant for assessing whether the current private sector credit level is excessive with regard to financial stability.

[12] Detailed description of the available data is provided in the Appendix.

3 Simulation of the Size of the Capital Buffer

One of the questions associated with the new Basel III rules is whether the requirement to create a countercyclical capital buffer would contribute to the creation of capital reserves in those CEE countries which experienced significant problems in their banking sectors during the global financial crisis. In the following simulation, the size of the capital buffer is calculated for individual CEE countries using the two aforementioned methods, i.e. the HP filter method and the econometric OOS method. As the crisis did not manifest itself fully in the CEE countries until late 2008 and (in particular) 2009, i.e. after the collapse of Lehman Brothers in September 2008, we set mid-2008 as the starting point for the buffer calculation.

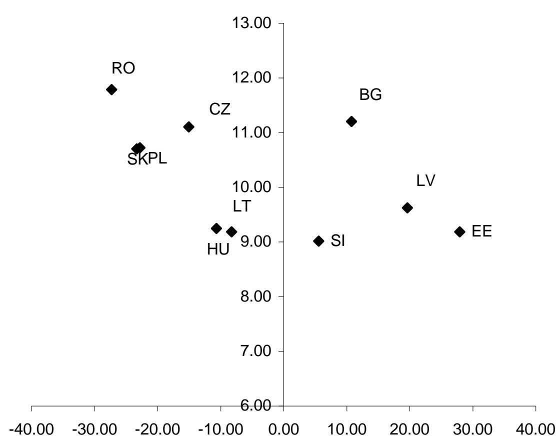
Table 1: Simulation of countercyclical buffer calculation
(data as of 2008 Q2)

	Credit-to-GDP gap (%)		Countercyclical capital buffer (% of RWA)	
	HP filter	Out-of-sample	HP filter	Out-of-sample
Bulgaria	11.4	10.8	2.5	2.5
Czech Rep.	9.5	-15.0	2.4	0.0
Estonia	5.3	27.9	1.0	2.5
Lithuania	6.9	-8.3	1.5	0.0
Latvia	1.0	19.6	0.0	2.5
Hungary	-1.4	-10.7	0.0	0.0
Poland	3.0	-23.3	0.3	0.0
Romania	6.1	-27.3	1.3	0.0
Slovakia	6.1	-22.8	1.3	0.0
Slovenia	5.4	5.5	1.1	1.1

Source: authors' calculations

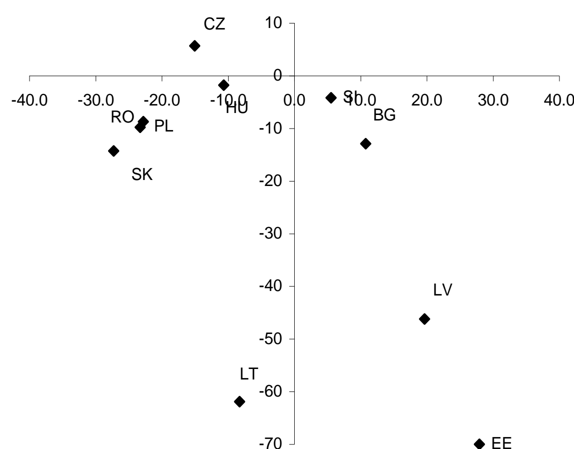
The results of this simple simulation indicate that only four countries needed a countercyclical capital buffer according to the OOS method (Bulgaria, Estonia and Latvia needed the maximum possible 2.5% of RWA, while Slovenia needed 1.1% of RWA).

Figure 8:
Credit-to-GDP gap via out-of-sample and Tier 1 ratio in 2008
(gap in p.p.; Tier 1 capital ratio in 2008)



Source: IMF, authors' calculations

Figure 9:
Credit-to-GDP gap via out-of-sample and change in RoE
(gap in p.p.; change in RoE of banking sector in p.p.)



Source: IMF, authors' calculations

It is relevant to ask whether the banking sectors of these countries had a sufficient capital reserve already in 2008, building a "would-be" capital buffer in anticipation of possible problems in the banking sector due to the experienced credit boom. Figure 8 indicates that with the exception of Bulgaria, which has set its minimum regulatory limit on capital adequacy higher than the traditional 8%, the countries identified by the OOS method as having excessive credit ratios (i.e. Estonia, Latvia and Slovenia) had relatively low Tier 1 capital ratios.

Several indicators can be used to compare the impacts of the crisis on the banking sectors of individual countries. In this paper, we look at the change in banking sector profits between 2008 and 2009 (in p.p. of return on equity, RoE), as profitability reflects both credit and market losses as well as impact on pre-provision income from possible higher funding costs. A simple graphical analysis reveals that the countries identified by the OOS method as having excessive credit ratios recorded large losses in their banking sectors in 2009, causing the RoE to decline dramatically (see Figure 9) and even in some cases leading to negative RoE in 2009 (Latvia). Two of the identified countries, namely Latvia and Slovenia, have seen governments stepping in and providing public support in 2009. It is worth mentioning that the HP method would not have identified the problems building up in the Latvian and Estonian economies, which were hit hard by the crisis and, especially in the case of Latvia, suffered very high real costs.

Conclusions

This paper discusses methods for calculating excessive private sector credit in the Central and Eastern European region and their suitability as regards the creation of the countercyclical capital buffer introduced by the Basel Committee on Banking Supervision (BCBS, 2010a). The BCBS has recommended the use of an excessive credit indicator based on the Hodrick-Prescott (HP) filter technique as a guide for setting this buffer.

The paper shows that the HP filter-based calculation of the excessive credit indicator is not necessarily appropriate in certain cases. For the CEE countries in particular, rapid credit expansion may simply mean convergence to values typical of the advanced nations, and not excessive borrowing. As an alternative, the paper suggests considering excessive credit calculation methods that better reflect the evolution of a country's economic fundamentals. One such method is an out-of-sample technique based on estimates for advanced EU countries which are subsequently used to calculate the equilibrium credit levels of the CEE countries.

Although statistical filtering techniques such as the HP filter do have a role to play in the analysis as a first step in the interpretation of the available data, a broader set of indicators and methods should be employed to determine a country's position in the credit cycle. Our chosen method, based on economic fundamentals, would have better identified the problem of excessive credit in those CE countries whose banking sectors recorded serious problems during the crisis. Although this calculation technique has its limitations, it can be considered as a complementary indicator of excessive credit, especially for small converging economies.

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Appendix

A) Detailed description of the data time series used:

IMF IFS: AF.ZF... National Currency per US Dollar average period
IMF IFS: 22D..Z CLAIMS ON PRIVATE SECTOR
IMF IFS: 32D..ZF... CLAIMS ON PRIVATE SECTOR
IMF IFS: 32AN.ZW... CLAIMS ON GENERAL GOVT. (NET)
IMF IFS: 222A..ZF... CLAIMS ON GENERAL GOVERNMENT
IMF IFS: 60P..ZF... Interest rate
IMF IFS: 64...ZF... Index CPI
IMF IFS: 67R..ZF... Unemployment rate
IMF IFS: 99Z..ZF... Population
IMF IFS: 96F..ZW... HOUSEH.CONS.EXPND.,INCL.NPISHS EUROS
IMF IFS: 99BIPZF... Deflator HDP (base year = 2005)
IMF IFS: 99B..ZF... Gross Domestic Product in the National Currency

Time series of interest rates for some countries were completed using the ECB and Eurostat databases and data provided by national central banks.

B) Technical details regarding used PMG and MG estimates

The pool mean group (PMG) and the mean group (MG) estimators are error correction forms of the autoregressive distributive lag (ARDL) model, where the dependent variable in its first differences is explained by the lagged independent and dependent variables in both levels and first differences. The equation is expressed as follows:

$$\Delta y_{i,t} = c_i + \rho_i (y_{i,t-1} + \sum_{h=1}^{v} \alpha_{i,h} x_{i,h,t-1}) + \sum_{j=1}^{\max 1} \beta_{i,j} \Delta y_{i,t-j} + \sum_{h=1}^{v} \sum_{j=0}^{\max 2} \gamma_{i,h,j} \Delta x_{i,h,t-j} + \varepsilon_{i,t} \ , \quad i = 1,\ldots, N, \ t = 1,\ldots, T,$$

where y is dependent variable, x represents set of v independent variables, max1 and max2 represent maximum lags used, and α, β, γ are estimated coefficients. Coefficient α represents the long-term relationship, which is specific for each cross-section in the MG estimator or the same for every country in the case of PMG estimator. Parameter ρ is the country specific error correction term, i.e. the speed of adjustment towards the equilibrium.

For more details see Pesaran et al. (1999).