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Institute of Economic Studies

Bachelor Thesis

2012 **Ján Malega**

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Countercyclical capital buffers in a new regulatory framework

Bachelor Thesis

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Abstrakt

Táto práca sa zaoberá vhodnosťou návrhu proticyklických kapitálových vankúšov ako novým nástrojom bankovej kapitálovej politiky. Koncept kapitálových vankúšov spočíva v tvorení dodatočných kapitálových rezerv v čase rastu ekonomiky, ktoré sa využívajú na stlmenie dopadov v období recesie. Práca rozoberá hlavné predpoklady a kľúčové premenné, ktoré pomáhajú určiť obdobie, tzv. nadmerného úverovania, teda čas, kedy by mali byť kapitálové rezervy uvoľnené. Konkrétne sa zameriava na metódu Hodrick-Prescott filtrovania, kde skúma, či metóda navrhnutá Basilejským výborom pre nastavenie kapitálových vankúšov je vhodná z pohľadu krajín strednej a východnej Európy, špeciálne v prípade Českej republiky. Za týmto účelom bol zavedený nový súbor ukazovateľov, ktorý určuje obdobie nadmerného rastu úverov v danej ekonomike. Na základe získaných výsledkov môžeme usúdiť, že vyhladzovací parameter navrhnutý Bazilejským výborom pre bankový dohľad použitý v Hodrick-Prescott filtri je v prípade konvergujúcich ekonomík nadhodnotený a môže viesť k nesprávnemu nastaveniu proticyklických kapitálových vankúšov v daných ekonomikách.

Abstract

This thesis discusses the relevance of the countercyclical capital buffer proposal as a new tool of bank capital policy. The concept of buffers is based on creating additional capital reserves at a time of economic growth, which are released in order to offset the impact in a recession. In this paper are discussed main assumptions and key variables that help to determine the excessive credit period, hence the time when should be the capital reserves released. Specifically it is focused on the method of *Hodrick-Prescott filter*, where examines, whether the method proposed by the Basel Committee for adjusting the capital buffers is appropriate from the perspective of Central and Eastern Europe, especially in the case of Czech Republic. For this purpose was introduced a new set of indicators that determines the period of excessive credit growth in the economy. Based on the results we conclude that the smoothing parameter suggested by the Basel Committee on Banking Supervision used in the Hodrick-Prescott filter in the case of converging economies is overestimated and may lead to improper adjustment of the countercyclical capital buffers in given economies.

Kľúčové slová:

Basel III, nadmerné úverovanie, Hodrick-Prescott filter, ukazovateľ pomeru úverov ku HDP, krajiny strednej a východnej Európy

Keywords:

Basel III, excessive credit, Hodrick-Prescott filter, credit to GDP ratio, Central and Eastern Europe countries

Volume: 72 000 characters including spaces

Declaration of authorship

1. I hereby declare that I have written this bachelor thesis on my own under the guidance of my supervisor using only literature and other sources listed in reference list.
2. Furthermore, I declare that I have not used this thesis to acquire another academic degree.
3. I acknowledge and agree with lending and publishing of the thesis for study and research purposes.

Prague, May 17, 2011 Ján Malega

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Bachelor Thesis Proposal

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TEZE BAKALÁŘSKÉ PRÁCE

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Garant studijního programu Vám dle zákona č. 111/1998 Sb. o vysokých školách a Studijního a zkušebního řádu UK v Praze určuje následující bakalářskou práci

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Countercyclical capital buffers in a new regulatory framework

Předběžná náplň práce:

Nedávna finančná kríza viedla k mnohým zmenám v politikách týkajúcich sa finančného sektora. Medzi nimi je vznik doporučení Bazilejskej komisie týkajúcej sa tvorenia dodatočných kapitálových rezerv, ktoré by banky mali zriadiť v časoch ekonomického rastu a následne ich využívať v období recesie. Tento koncept kapitálových rezerv by mal obmedziť proticyklickosť bankového sektora na hospodárskom cykle. Táto práca sa bude zaoberať opodstatnenosťou konceptu proticyklických kapitálových vankúšov ako nástrojom novej kapitálovej politiky. Budeme rozoberať hlavné predpoklady, empirickú evidenciu a predovšetkým to, kedy by malo byť pravidlo kapitálových vankúšov aktivované a následovne uvoľnené. Analýza bude spočívať v hľadaní vhodných premenných, na ktorých by mal byť proticyklický vankúš založený, najmä pre konvergujúce ekonomiky ako je Česká republika a zároveň overiť, či pomer úverov ku HDP je z pohľadu týchto krajín najvhodnejším indikátorom.

Předběžná náplň práce v anglickém jazyce:

Recent Financial crisis led to many different changes in policies related to financial sector. Among them is the emergence of the Basel committee recommendations regarding to the creation of additional capital reserves that banks should set up in times of economic growth and subsequently use them in times of recession. This concept of capital buffers should limit countercyclicality of the banking sector on economic development. This thesis will discuss the validity of countercyclical capital buffers concept as the tool of new capital policy. We will discuss main assumptions, empirical evidence and mainly when should be capital buffers rule activated and when it should be afterwards released. The analysis will try to find appropriate variables on which should be countercyclical buffer based on, especially for converging economies such as the Czech Republic and whether the credit to GDP ratio is the most appropriate indicator for these countries.

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…… ……

PhDr. Jakub Seidler Ján Malega

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List of Abbreviations

BCBS	Basel Committee on Banking Supervision
BOE	Bank of England
CEE	Central and Eastern Europe (countries)
CEMFI	Centre for Monetary and Financial Studies (Spain)
CEPR	Centre for Economic Policy Research (Spain)
CNB	Czech National Bank
CRSG	Credit Risk Standing Group (United Kingdom)
CZK	Czech crown
FSA	Financial Services Authority (United Kingdom)
HP	Hodrick-Prescott (filter)
IFS	International Financial Statistics (IMF)
IMF	International Monetary Fund
MNB	Magyar Nemzeti Bank (Hungarian National Bank)
NBP	National Bank of Poland
NBS	National Bank of Slovakia
RWA	Risk Weighted Assets
WB	World Bank

Introduction

Recently we have experienced one of the greatest financial strain period also referred to as Global Financial Crisis. Previous exposure to the crisis has proved that regulation based on improving resilience of credit institutions is not sufficient. This incentive has started many attempts to create policy which will make current financial system more resistant. Objectives for the future are to analyze regarding factors and prevent the whole financial sector by limiting the systematic risk to ensure to not to repeat such an incident again.

The Basel Committee introduced new capital adequacy rules which will be issued in Basel III regulatory standards and will deal with problem of procyclicality of the financial system (Borio et al., 2010: 1). These standards will be more strict, including improvement of Tier I and Tier II capital, higher capital requirements and introduction of the new policy proposal called *countercyclical capital buffer* aimed as protection of the banking system from times of excessive credit growth. The purpose of Basel III regulatory is primarily to reinforce the resilience of the financial system and promoting stability and sustainable economic growth. This should be obtained by better risk coverage, higher capital requirements and tighter capital definitions and also by building up the capital buffers. Basel III will be phased in period between 2013 – 2023. Capital buffers should be introduced between 2016 – 2018, but the phase-in will likely be in this case accelerated (Harmsen, 2010: 98).

The proposal of *countercyclical capital buffers* should encourage banks to build up buffers in financial good times in order to release them in case of bad times to ensure that credit institutions will be able to deal with stressful periods when are hit by high losses. If any of the institutions will fail to follow the capital buffer rules, they will be prohibited to distribute their profits as for example dividend payments (Repullo and Saurina, 2011: 5). The idea of buffers is to gradually increase capital requirements in case when credits expand faster than GDP growth. This instrument is supposed to prevent banks and make them more resilient in times of economic downturn. Relax the creating of credit bubbles and avoid the situation when banks have to raise new capital in the worst times. Main objectives of the buffers are to smooth the business and

financial credit cycle in financial sector and limit the risk of the losses by raising its resilience against shocks (Borio et al., 2011: 1–3).

There are still many open questions about the features of the buffers. As the time of releasing, what means also correct identification of good and bad times; size of the buffer large enough to cover losses without making any other strains; international applicability and possibility to create automatic stabilizer in order to avoid manipulation. Also the cost of implementation (which should be low), transparency and simplicity of this framework should be considered (Borio et al., 2010: 1).

In this thesis we examine these questions and we analyze suitable conditional variables which will help us to estimate the time of release of the buffer in the case of Central and Eastern European countries, especially Czech Republic. We discuss advantages and disadvantages of the *Hodrick-Prescott filter* method, consult other approaches and try to find out what is the most precise method in estimation of the credit excessiveness. Finally determine under what conditions is the *credit-to-GDP ratio* appropriate indicator for excessive credit growth in this type of countries by comparing our results with other approaches.

The thesis is structured as follows. The second section, Literature review discusses the issues which can arise from excessive credit growth and the problem of procyclicality of economic sector and its impacts on given economy. The third part of this section is aimed on description of main features and approaches of an effective tool against the excessive credit expansion, discussing also suitable leading variables as indicators of potential credit booms. The third section Methodology introduces *Hodrick-Prescott filter* method also as its advantages and disadvantages. This chapter also presents different approaches in determining the smoothing parameter lambda and introduces our sample of the Central and Eastern European countries and the problems associated with them. Next section the *Calculation of countercyclical capital buffers* illustrates detailed step-by-step computation of the *Credit-to-GDP indicator* in case of United Kingdom as a good representative of this method and also discuss its drawbacks in case of CEE countries. The fifth chapter is devoted to introduction of new set of indicators and their features and also consults their results comparing them to Financial Stability Reports from the national banks of given countries. Following section *The appropriate lambda for CEE countries* analyzes the appropriateness of smoothing λ

parameter in case of Czech Republic by comparing various approaches and proposes a final suggestion. The summary attempts to describe obtained results and proposes other possible approaches in this topic.

Literature review

Excessive credit growth

Rapid credit growth in some developing countries caused many concerns about its consequences to macroeconomic stability. Losses in the banking sector can be extraordinarily high when a depression is enhanced by preceding period of excessive credit growth (BCBS, 2010c: 57).

Unreasonable high credit loans have significant impact on aggregate demand by indirect support of consumption in private sector. Problems which can arise from excessive credit growth are substantial, causing overheating of the economy; they influence indirectly inflation, interest rates and also real exchange rates. Changes in real exchange rates, especially its depreciation can also raise problems with credit loans on foreign exchange market and their financing from foreign sources. It will cause outflows of short-term foreign funds and flowingly inflating the credit bubble what can cause serious financial problems (Geršl and Seidler, 2011: 114).

The reason of this risky lending behavior is called moral hazard. As we now with rising profitability is rising also profiteering and hence risky behavior of financial institutions thus their expectations about the future borrowers´ solvency are unreasonably optimistic. Especially in the case of "*too big to fail*" institutions, where their self-confidence is secured by reliance that government cannot afford to let them fall.

The probability of having crisis after lending booms is about 75% higher comparing to normal times. Expectation to have banking crisis before a lending boom is slightly lower than during the normal times (Gourinchas et al., 2001: 14). Therefore many questions raised about the possible relation between credit growth and financial instability in that time. One reason for excessive credit growth in transition economies can simply imply their convergence in numbers to the advanced nations. However, it is

hard to decide what the exact definition of excessive credit growth in given countries is (Hilbers et al., 2005: 10).

In 2004 – 2007 the central banks and supervisory authorities proclaimed the situation as threatening and introduced series of special instruments for restricting excessive credit growth. There was a range of tools that includes from very soft until hard restrictions. For example an increase risk weights on selected loans or even restriction on credit portfolio growth. It is hard to discuss the efficiency of these instruments, mainly because they were released only short period before the global financial crisis raised. So the relevance of their usefulness is uncertain. Many studies which are interested about this problem claimed that before-mentioned instruments for restriction of credit growth are considerably ineffective (Geršl and Seidler, 2011: 113).

These interactions emphasize the importance of building up appropriate capital defenses in times when risk in financial sector is growing remarkably (BCBS, 2010c: 57).

Problem of procyclicality

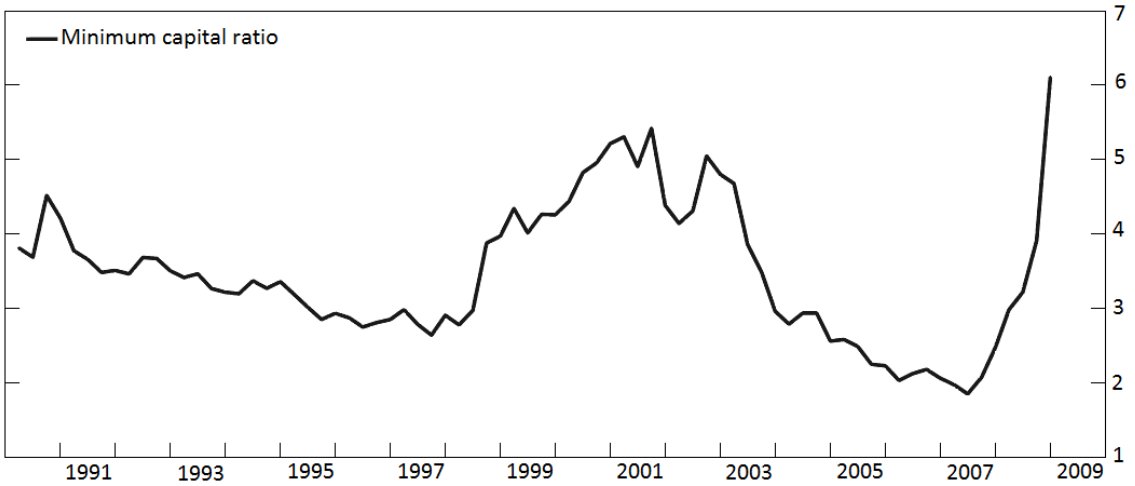
Financial procyclicality can be described as reciprocally strengthening interactions between the financial and real state of economy that incline to amplify the business cycle. This causes very often a financial volatility (Borio et al., 2011: 2).

„Procyclicality, in this context, is a term which refers to the tendency for regulatory capital requirements to rise with downswings in the economy and to fall with upswings. It is associated mainly with credit risk, as it is generally assumed that changes in operational risk are not correlated with the economic cycle.“ (FSA, 2004: 2, 21.3.2012)

In 2004 was established second set of recommendations and regulations for banks known as Basel II. The idea was to achieve more risk-sensitive capital requirements in order to lower the incentives of excessive risk-taking and also help to protect system during the times of economic downswings. The goal was to reduce excessive risk-taking behavior and prevent lending in times when economy falls into a recession (Repullo et al., 2010: 105).

„Even in the old Basel I regime of essentially flat capital requirements, bank capital regulation had the potential to be procyclical because bank profits may turn negative during recessions, impairing bank's lending capacity. Under the internal ratings-based (IRB) approach of Basel II, capital requirements are an increasing function of the probability of default (PD) and the loss given default (LGD) estimated for each borrower, and these parameters are likely to rise in downturns. So the concern about Basel II is that the worsening of borrowers' creditworthiness in recessions will increase the requirement of capital for banks and lead to a severe contraction in the supply of credit." (Repullo et al., 2010: 105, 21.3.2012)

Graph 1: Procyclical assessment of credit risk



(Source: Borio et al., 2011: 3)

In the graph 1 we can see the procyclicality of the credit risk measure applied on hypothetical credit portfolio based on the risk-weights. Method used is called Internal rating based approach (IRB) we mentioned before. In the picture we can see the credit risk is lowest right before the crisis in 2007 and right after this point it shoot up rapidly. It is clear demonstration of mutual interactions between financial and real cycles (Borio et al., 2011: 3).

This problem of procyclicality can considerably worsen the negative influence on bank´s supply of credit and also whole economy during the time of economic downturns (Repullo et al., 2010: 106). A vulnerable financial system is no more able to

absorb losses without cutting down the risk and credit lending, what leads to fire sales and credit crunches (Borio et al., 2011: 2).

Main difference between Basel I and Basel II is that Basel II is trying to strengthen the stability of banks, making them more credit-sensitive, therefore there is a much more lower probability of bank failures (Pausch and Welzel, 2011: 17).

So we identify three main goals broadly speaking about countercyclical approaches. The most difficult is to smooth the business cycle by the capital requirements setting tool, in other words demand management tool. Second goal is to smooth financial or credit cycle and last one is to generally raise the resilience of the banks against the shocks without any changes in these two cycles (Borio et al., 2011: 3).

Main features of an effective tool

We spoke about the problems of procyclicality of the financial system and generally proposed some main objectives of countercyclical policies. The aim of *countercyclical capital buffer* is to ensure that banking sector is covered and has a sufficient capital buffer supposing to preserve system against the future potential losses (BCBS, 2010c: 57).

More precise definition of what criteria have to be fulfilled in order to make our *countercyclical capital buffer* instrument effective is needed. Effectivity in this case means that this tool will be able to prevent banks against systematic risks by amplifying their defenses. So the releasing buffer will be in financially bad periods facilitating the credit supply strains. From this view we should focus on these four main criteria (Borio et al., 2011: 6):

I. *Timing:* In order to make our tool the most effective, the exact amount has to be launched and released at proper time with the right speed. This implicate that we need to precisely define good and bad times (Borio et al., 2010: 5).
II. *Size of the buffer:* We should ensure that size of the buffer accumulated will be sufficient to cover all losses in stressful times without making whole system to suffer from bigger strains.

III. *Robust to regulatory arbitrage:* There should be no possibility to manipulate this tool by individual institution, also applicability of this instrument is expected to be abroad without any problems.

IV. *Rule-based as possible, transparent, cost effective tool:* In order to prevent it from manipulations and other things which can disrupt functionality.

(Borio et al., 2011: 6)

Let's describe these criteria more closely:

Approaches in identifying good and bad times

Good and bad times usually match the cycle of the economy thus its expansion and contraction stages. However the financial cycle in real economy is hard to measure.

There are quite lot of variables which can be useful:

- Measures of bank performance: e.g. earnings, losses, various asset prices
- Financial activity: credit condition surveys
- Cost of availability of credit: credit spreads, funding spreads
- Real GDP growth
- Statistical data indicating ability of entities to meet their debt obligations on time…

(Borio et al., 2010: 5; BCBS, 2010b: 4)

However looking for precise measures is very hard, for example measures for losses are hardly to get, mainly because accounting rules in differentiate across the countries and usually deform them. Also we often face the problem of lagging, what makes our measures often useless. Other possibility to measure bad times is to use historical data of banking crisis as proxy variable for this measure. Advantage of this approach is that there is very good historical database for all the countries, what can lead us to really good results, if the right method is used (Borio et al., 2011: 7).

There is also other suggestion for another approach: Transition from good to bad times is in our case more critical, because most important is to release the buffer quickly enough and also in the sufficient amount.

This change could be identified by two factors:

- Normalized measure of aggregate gross losses
- Indicator which measures whether the banking sector is a source of credit contraction or not

Table 1: Criteria to identify bad times

		Banking sector source of credit contraction	
		Yes	**No**
Bank losses	**High**	Bad times	Bad times[1]
	Low	Bad times	Good times

(Source: Borio et al., 2010: 6)

In order to determine these two measures we can use proxy variables. As appropriate proxy variable for aggregate gross losses we can use for example bank charge-offs. On the other hand proxy that indicates credit contractions will be harder to get, but we can still use some surveys (e.g. Senior Loan Officer Survey) (Borio et al., 2010: 7).

Accumulating and releasing phase

Suitable variables have to be find to provide sufficient guide how to accumulate buffers at proper speed and flowingly release them at a proper time. Promptly release of the buffer in bad times can lower the risk of the supply of credit, which is limited by the capital requirements. Also the proper authorities should inform about the time, how long they expect the release to last in order to help banks in future to lower their uncertainty about capital requirements. As BCBS (2010b) mentioned we can face several problems here:

One of them could be that it is hard to acquire actual "temperature" of the good and bad times. The good leading variable which will estimate it and therefore release the buffer at proper timing and amount should be during the build-up phase copying its

[1] Although are the bank losses high, credit supply is still not restricted, because banks are still trying to protect customer relations.

long-term average with the minimum variation. Ideal leading variable can be for example proxy for the build-up of the risk in good times (Borio et al., 2010: 8).

Borio and Drehmann (2010) consider credit booms as the best single-variable leading indicator of banking distress, or even better is combination of credit and asset price deviations from long-term trends.

Other problem comes with the question whether we can find single-variable which will be both, best leading and contemporaneous indicator of financial strains. If this variable exists, it will be exactly what we are expecting as the best indication point for the accumulation a release stage. There are a number of possible variables.

We can divide them into three main groups and so: Macroeconomic variables, measures of banking activity and proxy variables for cost of funding (Borio et al., 2010: 9).

Next section briefly describes adepts for the conditional variables.

Macroeconomic variables:

Between the most common macroeconomic variables belong measures of aggregate output, credit or asset prices. Advantage of using these variables in comparing with others is that there is no possibility for strategic manipulating or influence from individual institutions. Other advantage is the very good availability of these indicators all over the countries. On the other hand they can still be manipulated with the mutually controlled behavior of the banking sector. First most known basic variable for measuring the strength of given economy is *Real GDP growth* (Borio et al., 2010: 9).

Real GDP growth: Measure which indicates the value of all goods and services produced by all residents in a given year, net of inflation, expressed in base-year prices (World Bank, 3.4.2012). However financial strains are not conditional to recessions, it means that they do not have to occur after every recession (Borio et al., 2010: 9).

Aggregate real credit growth: This variable indicates real growth in supply of credit over some period from all of the sources, not only bank sector. This measure is interesting because expansion periods are usually accompanied by period of credit

booms and stressful times are reversely accompanied by decreasing of credit supply (Borio et al., 2010: 10).

Asset price growth: Advantage of this estimator is that there is a tendency for these indicators to rise in time close before the systematic banking crises. Otherwise, in financially bad period they tend to decline rapidly. As an *asset price growth* we consider changes in specific property prices depending on economic cycle. As the indicator is usually used the difference of aggregate property prices from their long-term trend, also referred as asset price growth gap ratio (Borio et al., 2010: 10). This indicator is useful in predicting build-up phase. Although some problems can arise especially because deviations have tendency to narrow long time before financial strains emerge and this can cause releasing buffer earlier as needed. Nevertheless, the past of these indicators can be still useful in assessing the need to release the buffer in stressful times (BCBS, 2010b: 9).

Credit-to-GDP ratio: This ratio is normalized credit ratio where we are also taking in account changes in demand and supply of credit with fluctuations in economy what is indicated by the *GDP growth*. Importance of this ratio lies in the fact that historically based during the crises was growth of the credit-to GDP faster than average growth. Same as we mentioned for asset price growth index, we use differences or deviations of *credit-to GDP ratio* from its long-term trend, also referred as *credit-to-GDP gap* (Borio et al., 2010: 10). This ratio acts very well in foreseeing the bad times going up fast before materialization the strains. It inclines to move up quickly above the trend before the serious episodes. Although neither *credit-to-GDP ratio,* nor *aggregate real credit growth ratio* are good indicators of the release phase, in words of timing or volume of the release. In many cases they just respond too slowly, creating lags what makes big problems in case of financial emergency. Last crisis is good example of it (Borio et al., 2010: 12).

Banking sector activity:

Indicators which measure activity in banking sector have tendency to be dependent on business and financial cycle. Variables like *growth rate of lending, bank income* or *losses* are measured more narrowly comparing with financial sector as whole and therefore they can tell us more specific data. Generally in periods of high bank

profitability we can usually see incentives from banks rising their credit activities even though they are facing a higher risk (Borio et al., 2010: 10).

Bank credit growth: Measure growth of credit issued by banks, normalized by GDP (Borio et al., 2010: 10).

Banking sector profits: Main indicator of given sector efficiency. Generally profits are high in financially good times and reversely they decline very fast in bad times. Although there is also possibility of manipulation from strategic management, so the numbers do not have to exactly show real image of current situation (Borio et al., 2010: 11). We can use this measure as predictor of build-up phase, however sometimes our results are unequal. This indicator is working very well in case of the United States or United Kingdom. Otherwise for Spain it performs poorly, probably because of different accounting practices (BCBS, 2010b: 9).

Aggregate losses: This measure focuses on the cost part of banking sector. For example *non-performed loans*, *provisions*, *write-offs* or *charge-offs* and *losses* mostly associated with issuing credit loans. They use to fluctuate depending on current financial cycle. The reason for *countercyclical capital buffers* is exactly to eliminate these losses in stressful times by releasing the buffers accumulated in times when the losses are low (Borio et al., 2010: 11). However the performance of proxy variables for bank losses is not very precise in good times. Generally they fail to differentiate in financial good period because of absence of losses, what makes call for very high buffers very soon in the expansion (BCBS, 2010b: 9).

Cost of funding

This group of variables focuses on costs of banks related to raising funds. Thought is that banks should raise their funds in financially stabilized period when they are much more cheaper comparing to the stressful times when their price is rising significantly. Then they can use them later as reserves in these bad times in order to save money (Borio et al., 2010: 11). In last crises we faced, these measures acted very well. Signal is that they are below their long-term average and as strains are coming they tend to grow very quickly. Although, in measuring the multiple cycles, for example from data of the United States there is lack of precision (BCBS, 2010b: 9).

Banking sector credit spreads: Credit spread is difference between yields of various securities because of different quality. Spreads are indicators of vulnerabilities in financial or banking sector. In analysis are used averages of credit spreads from the biggest banks in each country (Borio et al., 2010: 11).

Cost of liquidity: Measures of the average cost which has to be paid by banking sector when it wants to raise short-term liquidity. These indicators help us to see bank's health condition. While in good times there are no problems with distribution of liquidity by interbank markets in bad times we can feel how tension emerges. These measures could be also good indicators for identifying passing from good to bad times. On the other hand there is still space for strategic manipulating of these ratios because many of them like *Libor* are not transition-based measures, they are only based on agreement among these banks (Borio et al., 2010: 11).

Corporate bond spreads: Is the difference between yields of corporate bonds comparing to government bonds. Their aggregate averages are used in analysis. It is the indicator of credit quality of the economy as a whole and as well as point-in-time measure of the credit risk. Generally the boom periods are accompanied by lower spreads then their average levels, but stressful periods are on the other hand characterized by fast-widening spreads. Also spreads can be seen as measure of the cost of borrowing in the economy, therefore it can be used as a tool that focuses on smoothing the costs of funding (Borio et al., 2010: 12).

Conclusion

Above mentioned possible indicator variables are further discussed in BCBS (2010b). *The Credit-to-GDP gap ratio* was the best performing indicator in this analysis. As we mentioned above, the analysis uses a specific form of this ratio also called *Credit-to-GDP gap*. It has many advantages over the *Aggregate real credit growth* measure. Expression as a GDP ratio, normalize our variable by the size of our economy we are working in. This also helps to annul the influence by the normal cyclical patterns of credit demand.

The taxonomy of possible plans

Any plan or scheme requires two components: Conditioning variable which tell us the time for build-up and release phase of the capital buffers. The first one we have

discussed above. The second is the adjustment factor that signalizes how to transfer changes in the conditional variable into capital variables, what are we going to analyze now (Borio et al., 2010: 2).

There are two basic types of buffer creation:

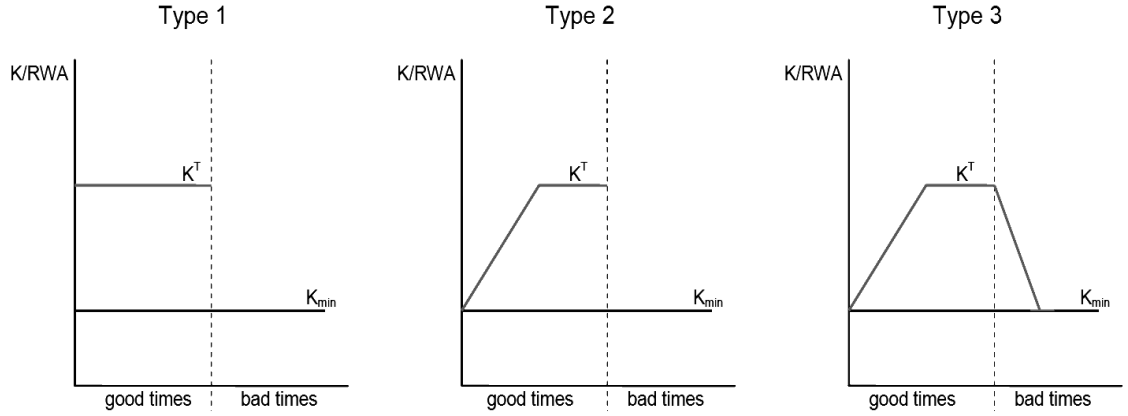
Minimum capital requirements:

This approach includes countercyclical moving of the capital requirements, that is rising in good times or differently said in expansion stage and reversely falling in the release stage. When capital requirements are falling in the release stage the buffer is indirectly increasing, thus uprising by freeing capital. In order to have efficient buffer, speed of falling of capital minimum has to be higher than speed at which losses are incurred. Problem comes, when falling of the capital requirements in bad times drops under the current minimum, what violates fundamental constrains.

Setting a target above the minimum:

Setting target above minimum will create gap which moves counter-cyclically. Increasing in expansion phase and declining in contraction phase. There are more ways of setting targets. One extreme would be to set fixed buffer to be percent based on the minimum. We can see it in the graph 2., type 1. (Borio et al., 2010: 3).

Graph 2: Types of countercyclical capital buffers schemes



Note: K/RWA = ratio of capital to risk-weighted assets; K_{min} = minimum capital requirement; K^T = target (capital).

(Source: Borio et al., 2010: 3)

We must take attention and try to avoid the inducing procyclicality in case of fixed instruments.

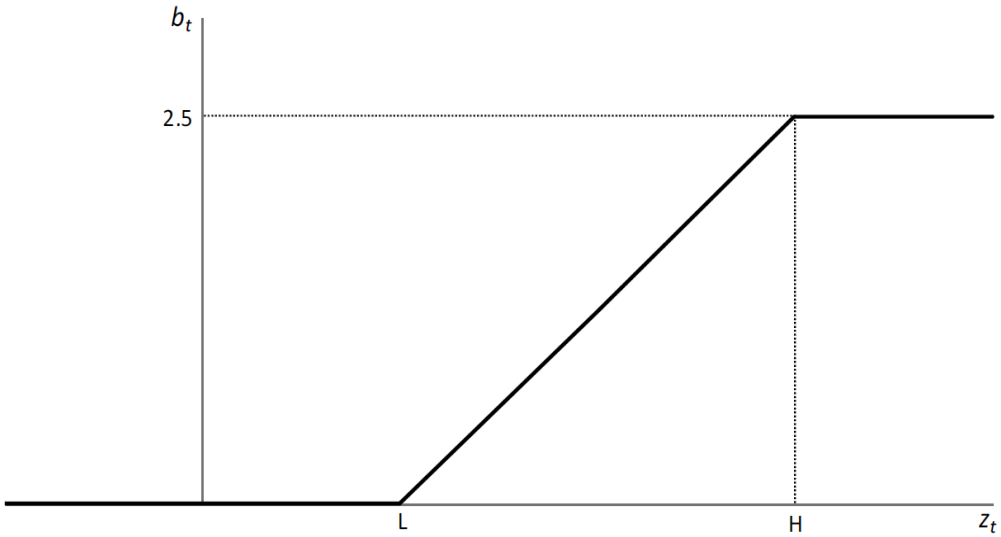
Another approach can be to increase target until any specific maximum in financially good times. Build-up phase should be connected to some conditioning variable as we discussed above (e.g. *credit-to-GDP ratio*). Question is whether to release the buffer instantly or gradually in stressful period. In the graph 2., type 2., we can see instant releasing phase, on the other hand graph 2., type 3. shows us a gradual releasing phase (Borio et al., 2010: 3).

Choosing the adjustment factor

After choosing the conditioning variable we need to link it with its adjustment factor what determine the way of building-up and releasing of the capital buffers required. There are more ways how to choose them. The adjustment factors are multiplicative and never lower than one in order to prevent the capital from dropping below the minimum capital level required (Borio et al., 2010: 19).

Theoretically the simplest functional form when we take in account constrains will look like this:

Graph 3: Relationship between the countercyclical capital buffer and credit-to-GDP gap



(Source: Repullo and Saurina, 2011: 7)

Where the b_t on vertical axis represents the buffer as percentage of RWA and z_t on horizontal axis is a *credit-to-GDP gap*.

The main objective of the *countercyclical capital buffers* is to protect banks from times of excessive credit growth. There are two important thresholds, the lower threshold usually marked as L, that starts the building phase and upper one, marked H, that limits the maximum of the buffer. The lower L and upper H threshold levels are key in determining the correct timing and the speed of releasing of the buffers (BCBS, 2010b: 13–16).

When the conditioning variable is under the level L, the adjustment factors is equal to one. This is connected with bad times. Reversely in good times, when the conditioning variable is higher than L. Function itself is linear to the conditioning variable (Borio et al., 2010: 20).

Criteria for determining lower and upper thresholds:

Minimum threshold (L) level should be on one hand low enough, to ensure that buffer will start to accumulate sufficient time before a potential crisis, on the other hand it also should be high enough, to not to provide additional not required capital in normal times.

While maximum threshold (H) upper level should be low enough to ensure that the buffer will be available on its maximum prior to major crises (BCBS, 2010a: 26).

Recommended values of thresholds by BCBS are not binding for all monetary authorities. They provide just simple guide to determine them correctly, but their setting depends entirely on monetary authorities in given country (BCBS, 2010b: 16). As the whole topic is very broad, in this thesis we will focus only on the method of determining the period of excessiveness.

Methodology

Hodrick-Prescott filter

The purpose of the research of *Hodrick-Prescott filter* (later *HP filter*) was to document main properties of aggregate economic fluctuations, also known as business cycle. It is based on hypothesis that growth component of aggregate economic time series deviate over the time. Movements of cyclical components are significantly different comparing to movements of the corresponding variables in macroeconomic

time series. *HP filter* is a tool designed to detrend given time series data, thus separate their cyclical component. Equation used in this filter is:

$$min \sum_{t=1}^{T} (y_t - \tau_t)^2 + \lambda \sum_{t-2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \quad [1]$$

Where given time series $y_t = g_t + c_t$ is sum of a growth component g_t and a cyclical component c_t for all $t = 1, \dots, T$. First part of the equation is the sum of the squared deviations. Second part is the sum of the second differenced squares of the trend components τ_t, multiplied by the parameter λ. The parameter λ is a positive constant that works as a smooth adjustment of the trend. The larger the λ is, the smoother is the resolution of the series (Hodrick and Prescott, 1997: 1–3).

Problems of using Hodrick-Prescott filter

Time series data used in computation of a trend by *HP filter* are significantly dependent on the length of given time series and also on the parameter lambda which has to be selected as well. This can expose us to end-point bias problem, which produces a highly uncertain estimation at the end of the data period. There is way to deal with it by extending the time series by its prediction in to the future, what on the other hand can cause even more uncertainty and therefore even worse our estimation and explanation of macro prudential policy (Geršl and Seidler, 2011: 115).

Authorities in every country should take into account also other variables and compare them whether are consistent with the results of the *credit-to-GDP ratio*. Good examples of useful indicators are *financial* or *total assets* in private sector, *funding or CDS spreads*, *real GDP growth* or credit condition surveys. We can consider also any proxy variable for solvency and others which could be also appropriate substitutes for measuring the excessive credit growth (BCBS, 2010a: 8).

Other significant criticism of *HP filter* is that this method does not include any economic fundamentals which affect the equilibrium stock of loans. There is another approach to measure and estimate the equilibrium of private credit level related to key economic variables, for example the level of development of given economy. As proxy variable we can use the *real GDP per capita* as some standard for living. This implicates that countries with the same level of economy or development should be on

the same level of their equilibrium for the private credit. Proportionally poorer countries should have lower levels of equilibrium than rich countries generally said with higher level of development. As some analyzes show, this is not always fulfilled (Geršl and Seidler, 2011: 116).

Determination of λ parameter

There are more approaches in technical literature about the setting lambda parameter. Papers from Ravn and Uhlig (1997) suggest to set lambda according to the expected duration of the cycle and frequency of its observations. Hodrick and Prescott (1997: 7) recommend to anchor lambda for quarterly data at level $\lambda = 1600$, what become standard indicator for business cycles. Analysis has shown that length of quarterly time series in business cycles should be around 7,5 years. Data available for credit cycles are within the range from 5 up to 20 years, it indicates that credit cycles are generally three or four times longer than the business cycles, which are in medium 5 years long.

Another approach suggests the setting of λ by comparing the length of credit and business cycles.

Let´s assume four options:

- The lenght of credit and business cycles is the **same** $\rightarrow \ \mathbf{1}^4 * 1600 \Rightarrow \lambda = 1600$
- The lenght of the credit cycle is **two** times longer comparing to business cycle $\rightarrow \ \mathbf{2}^4 * 1600 \Rightarrow \lambda = 25000$
- The lenght of the credit cycle is **three** times longer comparing to business cycle $\rightarrow \ \mathbf{3}^4 * 1600 \Rightarrow \lambda = 125000$
- The lenght of the credit cycle is **four** times longer comparing to business cycle $\rightarrow \ \mathbf{4}^4 * 1600 \Rightarrow \lambda = 400000$

(Borio et al., 2010: 28)

The empirical analysis done by Borio, Drehmann, Gambacorta, Jimenez and Trucharte (2010: 28–30) assumes that $\lambda = 400000$ works well in case of excessive credit period determination in a private sector.

Hodrick-Prescott filter and CEE countries

First of all we will briefly describe Central and Eastern European countries (shortly CEE countries). In this analysis we will discuss in detail following group of nations:

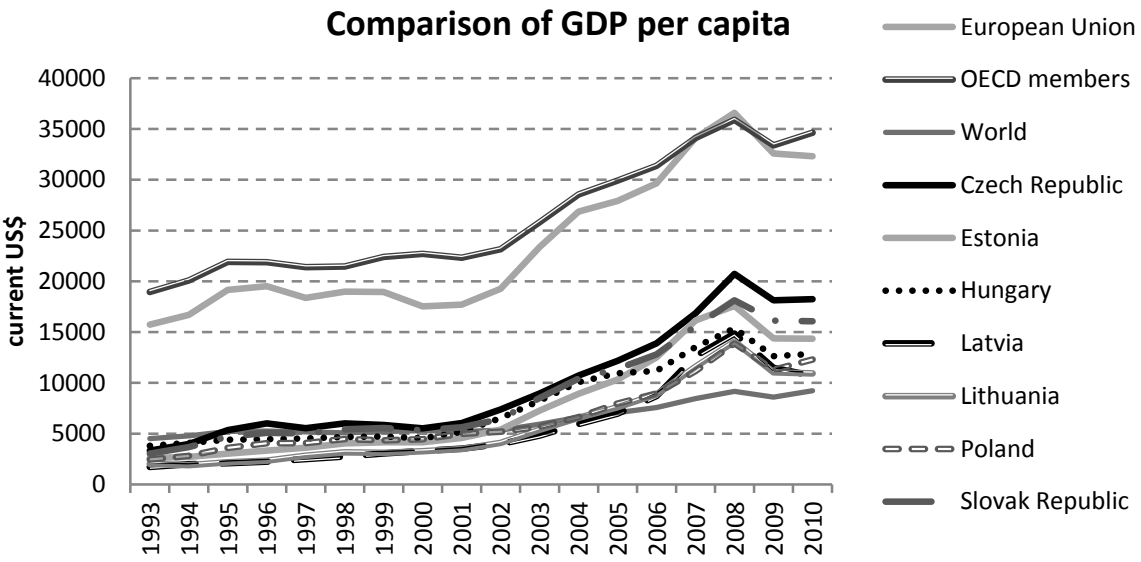
Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovak Republic.

The main reason for picking the CEE countries is that this region recorded a significant credit boom in private sector, before the global financial crisis, especially Baltic States reported significantly excessive credit growth (Backé et al., 2006: 5).

Financial position of CEE countries

CEE countries are considered as transition economies. All CEE countries are members of European Union, but only two of them are members of Euro zone and so: Estonia and Slovakia.

Graph 4



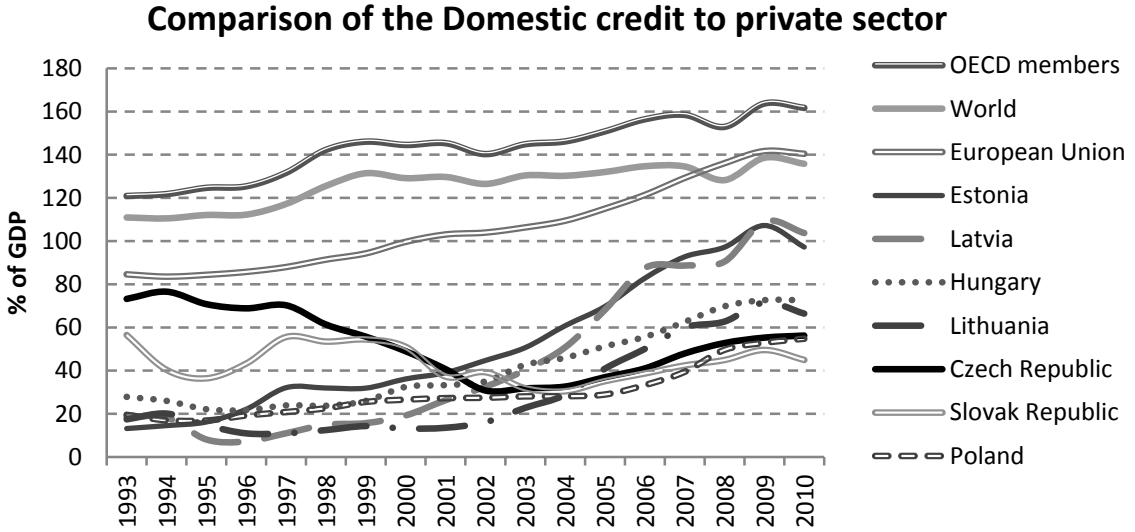
(Source: World Bank data database)

As we can see in the graph above economic output of CEE countries is similar, however comparing to an average between OECD members or European Union as a whole they are still significantly behind.

Using just *credit-to-GDP ratio* in the case of CEE countries could be misleading, because in this type of countries can rapid excessive credit growth be only a reason of convergence to levels of advanced economies (Hilbers et al., 2005: 10).

Here (Graph 5.) we can clearly see the difference in *private-to-GDP ratio* between CEE countries, European Union, World and OECD members. Although CEE countries are approaching, still the difference is significant.

Graph 5



(Source: World Bank data database)

Setting the λ parameter

Although the technical literature usually suggests to set $\lambda = 400000$ for computations in private sector, we can face few issues in case of CEE countries. According to the proposal of Borio et al. (2010: 28–30), $\lambda = 400000$ works very well for countries with long data history, as this method was estimated on long time series of advanced nations. Good example is United Kingdom where we can use quarterly data even from 1960, what in case of CEE countries is not possible. As we described before, determining of lambda is significantly dependent on length of time series data.[2]

Problem lies then in shortage of time series data availability. In the early 90s started process of transition of economic systems from the socialistic planned economy

[2] see part Determination of λ parameter

in order to set up free market in the CEE countries and thus converge to the advanced economies from Western Europe.

CEE countries experienced a difficult economic period after era of socialism. Publication of statistical data was in many cases limited or even prohibited. Problem of data limitation was partially solved by estimation what on the other hand lead to biased results. Also influence of bad loan inherited from old regime and privatization in 90. years resulted in inaccurate statistical indicators in this period (Takata, 2005: 1–15).

Therefore quality data for CEE countries are generally available just from one decade ago. In our analysis we have chosen Czech Republic as the representing country of the CEE countries.

The data used in calculations were obtained mainly from the International Financial Statistics (IMF) database of the International Monetary Fund (IMF). The main reason of choosing was that it provides sufficiently long quarterly data in long time series. However it applies only for the advanced countries (United Kingdom, Germany or France), but in case of CEE countries the compact data are available just from 90. years. As another source of data we used World Bank's database.

Calculation of countercyclical capital buffers

As it is stated in BCBS (2010a: 21–23), the *countercyclical capital buffer* proposal, there are three steps in determining the buffer, based on *credit-to-GDP ratio*.

First step is to calculate the aggregate private *credit-to-GDP ratio*. Second part is to determine the *credit-to-GDP gap* and last part is transformation of these data into a *countercyclical capital buffer*.

I. Calculation of the aggregate private credit-to-GDP ratio

We consider time series data with period t for each country. The *credit-to-GDP ratio* is calculated as follows:

$$Ratio_t = \frac{Credit_t}{GDP_t} * 100\% \qquad [2]$$

Where GDP_t is a *nominal domestic GDP* in period t. $Credit_t$ is an indicator that measures nominal credit of the private, non-financial sector in a given period t. The empirical analysis states that a broad definition of credit is a better predictor of stressful period than a narrow one. This means that there should be included not only domestic credit, but also credit provided by international banks and non-bank institutions (BCBS, 2010b: 10).

II. Calculation of the credit-to-GDP gap

Calculation of the *credit-to-GDP gap* is based on comparing *credit-to-GDP ratio* with its long term trend. The gap can be easily calculated as:

$$Gap_t = Ratio_t - Trend_t \quad [3]$$

Where $Ratio_t$ is above mentioned *credit-to-GDP ratio* in period t. $Trend_t$ is long term trend in given period achieved by the *HP filter*. The smoothing parameter lambda is generally set to 400 000 (Borio et al., 2010: 28–30) However setting lambda is up to each jurisdiction, we have already discussed.

III. Transformation of the credit-to-GDP ratio into a countercyclical buffer

The real size of the buffer is expressed as percentage of risk-weighted assets. The buffer is equal zero when the *credit-to-GDP gap* is below a certain lower threshold (L) level. The size of the buffer is linearly increasing with rising values of *credit-to-GDP gap* until certain level called upper threshold (H) where it approaches its maximum.

BCBS analysis has discovered that thresholds at levels L=2 and H=10 provide sensible and robust specification based on historical experience with financial crises. Indeed it depends not only on adjusting the threshold levels, but also on selecting of the smoothing parameter lambda and the length of the available time series data.

We have three situations for certain *credit-to-GDP gap* values:

- $Gap_t < 2\% \Rightarrow Buffer_t = 0$
- $Gap_t > 10\% \Rightarrow Buffer_t = Max$
- $2\% < Gap_t < 10\% \Rightarrow Buffer_t = x$; where x is linearly distributed in interval $< 0, Max >$

This example demonstrates how is the *countercyclical capital buffer* calculated in case of United Kingdom from the period right before the financial crisis in 2008.

Table 2: Calculation of the countercyclical capital buffer for United Kingdom

Year	GDP Adjusted, Nominal, Billions £	Claims on Private Sector, Billions £	Credit-to-GDP in %	gap in % λ=20000	trend in % λ=20000	gap in % λ=400000	trend in % λ=400000	Buffer as % of RWA (λ=400000)
2003 Q1	1089,877	1509,897	138,538	-3,874	142,412	-7,063	145,602	0
2003 Q2	1106,159	1538,277	139,065	-4,781	143,846	-7,704	146,769	0
2003 Q3	1121,734	1586,289	141,414	-3,896	145,310	-6,525	147,939	0
2003 Q4	1139,441	1624,635	142,582	-4,222	146,804	-6,531	149,113	0
2004 Q1	1155,714	1688,749	146,122	-2,204	148,326	-4,167	150,288	0
2004 Q2	1171,426	1719,809	146,813	-3,061	149,874	-4,653	151,467	0
2004 Q3	1186,841	1774,429	149,509	-1,939	151,448	-3,139	152,647	0
2004 Q4	1202,370	1807,598	150,336	-2,708	153,044	-3,494	153,830	0
2005 Q1	1215,231	1852,256	152,420	-2,242	154,662	-2,594	155,015	0
2005 Q2	1228,018	1893,616	154,201	-2,098	156,299	-2,000	156,201	0
2005 Q3	1240,689	1934,505	155,922	-2,031	157,952	-1,467	157,389	0
2005 Q4	1254,292	1994,865	159,043	-0,578	159,621	0,465	158,578	0
2006 Q1	1272,063	2104,526	165,442	4,139	161,303	5,673	159,769	1,148
2006 Q2	1290,585	2153,974	166,899	3,904	162,995	5,939	160,960	1,231
2006 Q3	1309,877	2200,149	167,966	3,270	164,696	5,814	162,153	1,192
2006 Q4	1328,597	2256,205	169,819	3,416	166,402	6,473	163,345	1,398
2007 Q1	1345,451	2369,952	176,146	8,032	168,114	11,607	164,539	2,5
2007 Q2	1365,096	2431,827	178,143	8,315	169,828	12,411	165,732	2,5
2007 Q3	1385,911	2544,302	183,583	12,039	171,544	16,658	166,926	2,5
2007 Q4	1405,796	2625,880	186,790	13,529	173,261	18,670	168,119	2,5

(Source: IMF IFS, author's calculations)

The data used in this calculation were acquired in International Monetary Fund's statistical database. We are working with data between periods 1970 – 2007 in order to make our estimations as precise as possible. As variables for *credit-to-GDP indicator* was used *Claims on private sector* as a credit indicator and *nominal value of GDP* in given period. This variable slightly underestimates true value of the credit, because non-bank providers are not included. However for our computations it is not crucial, whereas the financial system in Czech Republic is mostly bank-based, therefore the

most of loans is provided by the bank institutions. According to Czech National Bank's Financial Stability Report (2007: 46) bank institutions represented 74, 2% of the financial sector assets.

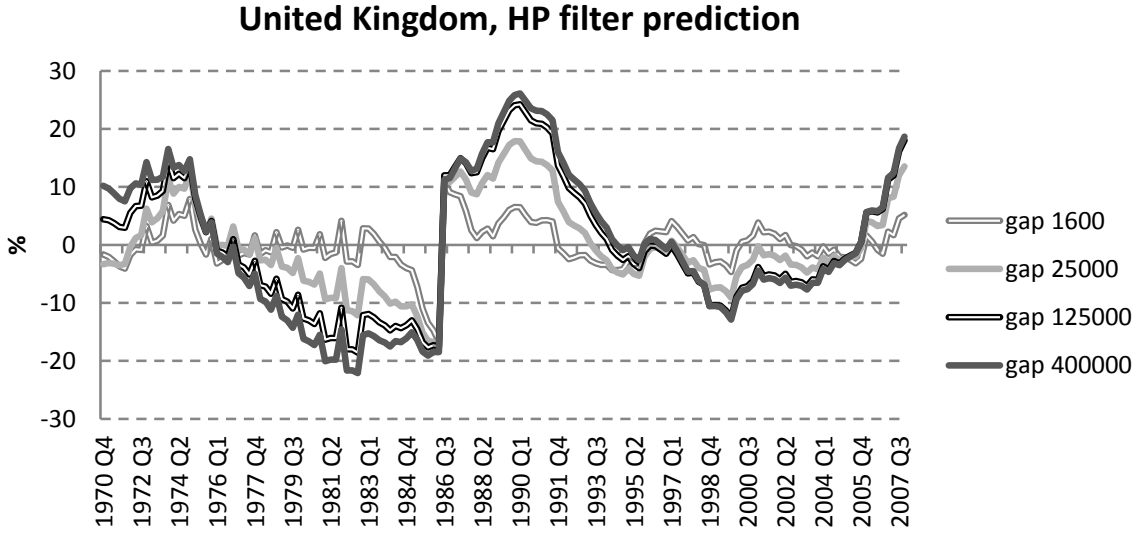
Long-term trend was obtained by *HP filter* in statistical program *STATA* with different levels of lambda (25000, 400000). We selected especially these two levels of lambda to clearly demonstrate their differences in computation.

Individual thresholds of build-up phase are distinguished by different colors. As Max[3] percentage of *Risk Weighted Assets* (RWA) we considered 2, 5% as was recommended by BCBS (2010a: 2). National authorities can adjust this upper maximum as it is best for them. It will cover only their national banks, but international institutions will not be included in this regime.

The estimation by *HP filter* based on data available before the crisis using suggested value λ=400000 showed us that build-up phase should started at maximum level in the first quarter of 2007. This result is considered as the optimum.

Here is a comparison of different levels of λ:

Graph 6



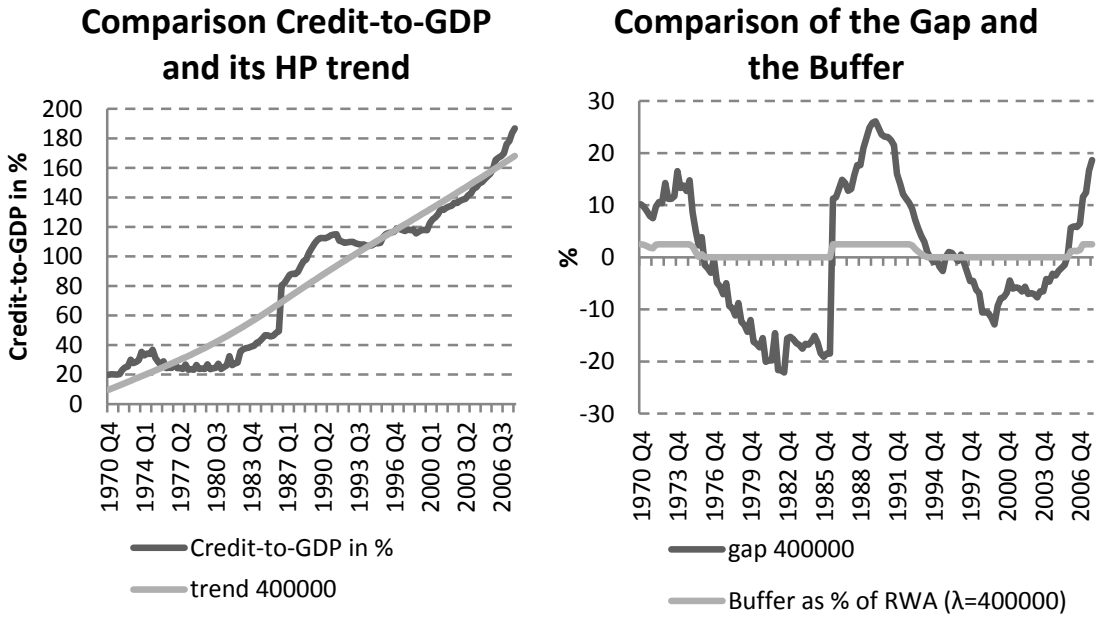
(Source: IMF IFS, author´s calculations)

Variations between different lambdas are significant. Assuming that λ=400000 is an appropriate parameter for determining build-up phase in case of United Kingdom,

[3] See also *Transformation of the credit-to-GDP ratio into a countercyclical buffer* at previous page.

the build-up phase at maximum (means 10% of Risk Weighted Assets), should be released at the first quarter of 2007.

Graph 7&8



(Source: IMF IFS, author's calculations)

In the graph 7 we can see the comparison of the *credit-to-GDP ratio* and its long-term trend calculated by *HP filter*. Periods of financial strains are characterized by major deviations from its long-term trend.

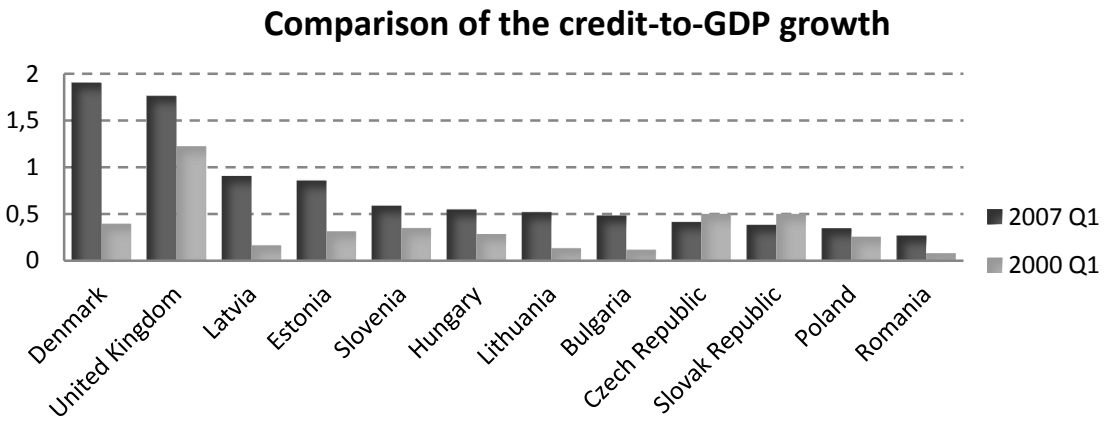
The graph 8 above shows us demonstration how *countercyclical capital buffers* works. When the *credit-to-GDP gap* exceeds 2%, buffer is automatically created. In period when values of the gap are negative, we can see that buffer is equal zero.

Disadvantages of Credit-to-GDP gap indicator

As we mentioned before, using *Credit-to-GDP indicator* with *HP filter* can cause several problems when we apply it for CEE countries. First thing worth of consideration is value of smoothing parameter λ, which is generally designed to be 400000, what is probably in case of CEE countries considerably overestimated.

As we have already mentioned CEE countries tend to converge in values of *credit-to-GDP ratio* to developed nations as for example United Kingdom.[4] It may happen that our results of estimation can be biased, because of upper mentioned convergence. Here is comparison between the CEE countries and United Kingdom as a representative of developed countries in the first quarters of 2000 and 2007:

Graph 9



(Source: IMF IFS, author's calculation)

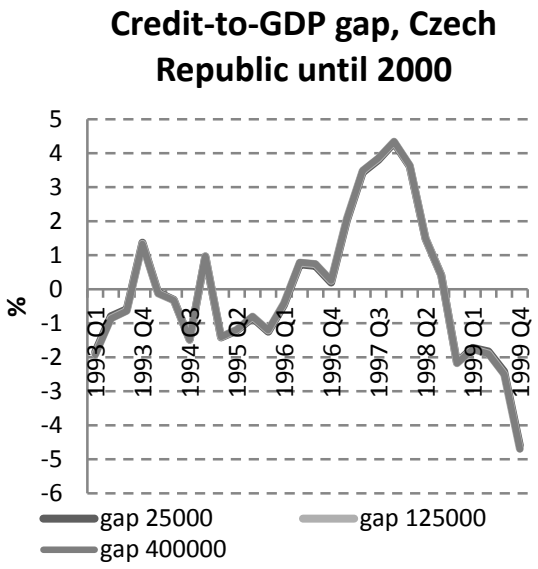
In the graph above the differences between advanced countries represented e.g. by United Kingdom or Denmark and CEE countries are still relatively apparent. It is worth to note also the significant growth between these two periods, especially in case of the CEE countries Latvia, Lithuania and Estonia, meanwhile the rest of them appears to be relatively stable.

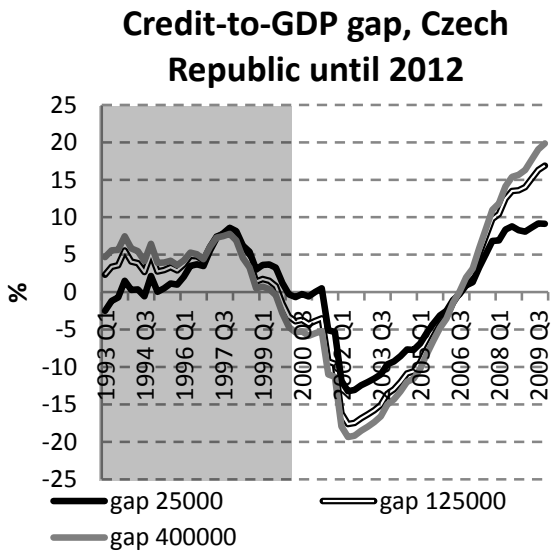
Another disadvantage of the estimator using *credit-to-GDP gap* is its ambiguous representation of the results in previous periods. The *HP filter* significantly distorts results from periods before the current one. It means that looking back to history we are sometimes unable to locate previous periods of financial strains, because numbers depending on whole data period are biased.

Here is an comparison of *credit-to-GDP gap* after whole period until 2012 and only with data until 2000:

[4] Example of United Kingdom is suitable because of two reasons. One is historicaly sufficient long time series data and second is a possibility to compare results with other literature (see [Borio et al., 2010])

Graphs 10&11





(Source: IMF IFS, author's calculation)

First considerable difference is that *credit-to-GDP gaps* are in first picture almost the same, copying each other, though in second one (shadow zone denotes the same period), we can see different fluctuations. This might be caused by not sufficient observations in the first case.

Other difference is when we compare values in one period. For example results for λ=400000 in 1993 Q4 in the first picture is 1,33 on the other hand second graph shows us for the same period 7,45, what is considerably different.

Determination of the excessive level of credit

The main problem in creating an excessive credit level indicator is that it is not straightforward to estimate which level of credit can pose a given country into the risk. There are more approaches available. Traditional approach is to use the *HP filter*. The *HP filter* obtains the trend from a time series of *credit-to-GDP ratio*. Comparing the actual ratio with its long term trend obtained by *HP filter* we can determine whether is the level of credit in economy excessive or not. The advantage of using the *HP filter* is that it tends to give higher weights to the more late observations what acts more effectively in case of structural breaks (BCBS, 2010b: 13).

In order to compare the results of the *HP filter* with other indicators and ensure us about the correctness of the predictions of excessiveness we proposed another set of indicators for excessiveness. Another reason is that *credit-to-GDP ratio* can be in case of CEE countries misleading as they can only converge to levels of advanced economies (Hilbers et al., 2005: 10).

Although there are many different methods we, as many others before us: Backé et al. (2006) or Kiss et al. (2006), consider *credit growth* as a one of key variables in estimation of excessiveness, thus it can be also good estimator of coming recessions and financial strains.

In our indicators we used as a variable *nominal credit* in given countries, specifically *Claims on private sector*. Data were obtained from IMF IFS database in quarterly period. This variable omits loans which are provided by other non-bank institutions or from abroad, therefore it underestimates real value of private credit, but this is in our case not crucial. We have already mentioned before that financial system in Czech Republic is mostly bank-based (CNB, 2007: 46). Core of these indicators lies in a calculation of the nominal quarterly credit growth between two adjacent periods. For estimation of excessive credit growth we applied two different methods to confirm their correctness.

Average credit growth indicator

The first method proposed is based on determination of quarterly credit growth for all periods and calculation of the average of all obtained non-negative values. [5]Threshold (denoted as ω) for determination of state of excessiveness is different for every country as it is equal to the average of obtained values multiplied by given parameter (denoted as ρ). The parameter ρ is fixed for all countries and depends on the length of the time series used. The longer sample of observations we have, the higher parameter we need to set.[6] The period of excessiveness is defined as the period when quarterly growth between two periods is higher than given threshold value.

The threshold ω was set as an average of all growth values multiplied by parameter ρ:

[5] As we will mention later, this condition is hepful in cases where given countries have experienced period of consolidation, it does not influence other countries.

[6] Comparison of different levels of the parameter ρ is demonstrated in following the Graph 12. Additional comparison based on times series length is incuded in Appendix C.

$$\omega = \rho * average \quad [4]$$

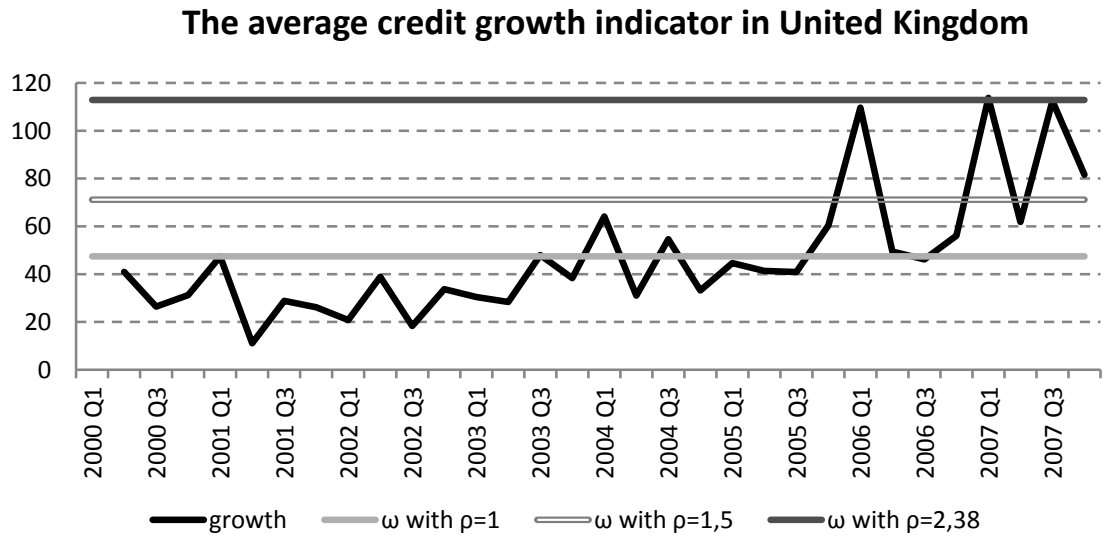
Function used to determine excessiveness is:

$$excessive_t : growth_t > \omega \quad [5]$$

Main advantage of this method is that, it is not so biased by period of consolidation, which was typical for some of the CEE countries. Decrease in credit provided during the end of 90. years and also beginning of 2000 was due to the fact that banks were cleaning their portfolios and selling bad loans to the consolidating agencies in order to solve the poor management of credits during the socialistic era (Vencovský, 1999: 509). Among the countries having problems with consolidation are mainly Czech Republic, Slovakia and Baltic countries, but not in such an extent. We found it out on the basis of credit statistics.[7] However negative values in credit especially in case of Czech Republic and Slovakia make averages distorted. Therefore in order to obtain results with the highest accuracy, these negative values were not included. We will discuss this problem also later, especially in the case of the *Average trend credit indicator*.

However this method has the same problem with data interpretation as the *Credit-to-GDP indicator* and so: As the threshold values ω is depended on all observations, from a long-time horizon is hard to determine past periods of excessiveness. Therefore we have to determine it recursively as in the case of *HP filter* method.

Graph 12



(Source: IMF IFS, author's calculation)

Parameter ρ was determined after empirical analysis, supposing to highlight just significant differences. As we can see, lower parameter ρ has caused frequently occurring period of excessiveness, on the other hand too high parameter will not give us any results neither. By gradually setting of ρ parameter we reached the result that for this length of time series is appropriate to set it from the interval $\rho \in (1{,}5; 2{,}6)$. In order to observe coming periods of excessiveness in advance, we recommend to run this indicator on several different levels of the parameter from the given interval.

Table 3: The Average credit growth indicator's results comparison for other countries

period	Estonia	Latvia	Lithuania	Czech Republic	Hungary	Poland	Slovakia	United Kingdom
2005 Q1	ok	ok	ok	ok	ok	ok	ok	ok
2005 Q2	ok	ok	ok	ok	ok	ok	ok	ok
2005 Q3	ok	ok	ok	ok	ok	ok	ok	ok
2005 Q4	ok	ok	excessive	ok	ok	ok	ok	ok
2006 Q1	ok	ok	ok	ok	ok	ok	ok	ok
2006 Q2	ok	ok	ok	ok	ok	ok	ok	ok
2006 Q3	ok	ok	ok	ok	ok	ok	ok	ok
2006 Q4	excessive	excessive	ok	ok	ok	ok	ok	ok
2007 Q1	ok	excessive	ok	ok	ok	ok	ok	ok
2007 Q2	ok	ok	ok	excessive	ok	excessive	ok	ok
2007 Q3	ok	ok	excessive	ok	ok	excessive	ok	ok
2007 Q4	ok	ok	excessive	ok	ok	ok	ok	ok

(Source: IMF IFS, author's calculation)

In the previous table is illustration of how the *Average credit growth indicator* works for a selected group of countries. This table shows only important periods right before crisis, although computation is based on data from period 2000 until the end of 2007. We used parameter $\rho = 2{,}6$. As we can see Baltic countries according to our indicator have experienced periods of credit booms, also there is sign of excessiveness in Czech Republic and Poland. For example United Kingdom does not show any signs of excess, however calculation recursively until the period 2007 Q1 will show us excessiveness in this point as well.

Average trend credit indicator

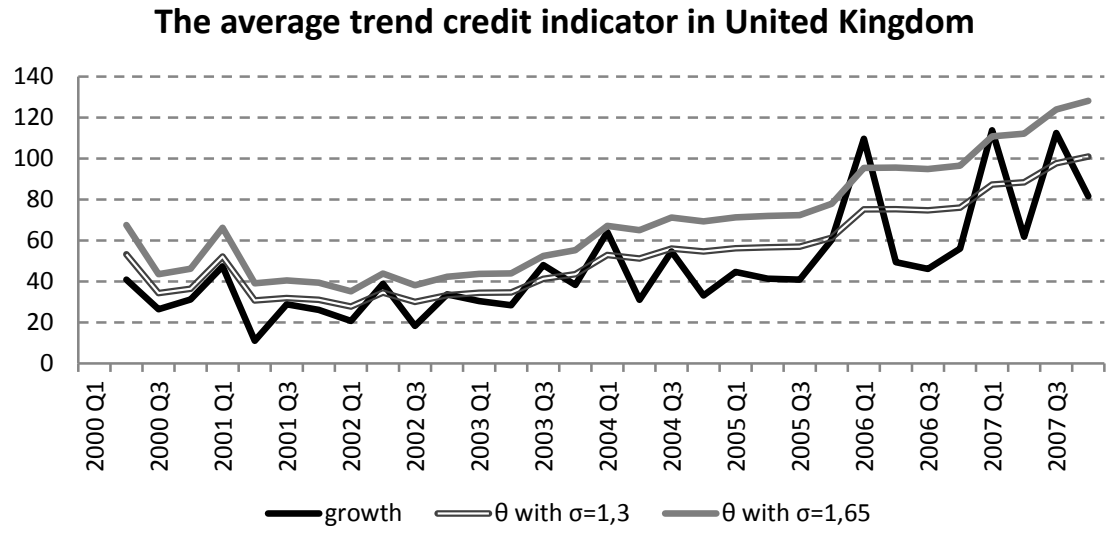
In the second method we applied credit trend as a comparative variable to the credit growth. Trend was calculated as a function of previous observations including the current value. Periods before credit booms has typically recorded unusual increase in credit growth and therefore are significantly different from their long-term trend. Again we work with the hypothesis that only the most significant differences between credit growth and its trend can lead to financial stressful period in the economy. In order to properly distinguish the periods of credit booms and period of common fluctuations we determined threshold limit as in the first indicator. Let denote threshold for the *Average trend credit indicator* θ, then threshold limit θ was determined as follows:

$$\theta = trend_t * \sigma \qquad [6]$$

Where σ is a parameter and as in the first case depends on the number of observations. As a period of the excessive credit growth is indicated the point where credit growth between two adjacent years prevails the threshold value in given period.

$$excessive_t : growth_t > \theta_t \qquad [7]$$

Graph 13



(Source: IMF IFS, author's calculation)

The same procedure as before was used to determine the parameter σ and in this case we recommend to use it from the interval $\sigma \in (1{,}5; 1{,}7)$. We draw attention once again that this is working in both cases only for this specific length of time series.

Table 4: The Average trend credit indicator's results comparison for other countries

period	Estonia	Latvia	Lithuania	Czech Republic	Hungary	Poland	Slovakia	United Kingdom
2003 Q2	ok	ok	ok	ok	ok	ok	ok	ok
2003 Q3	ok	ok	ok	ok	ok	ok	ok	ok
2003 Q4	ok	ok	ok	ok	ok	ok	ok	ok
2004 Q1	ok	ok	ok	ok	ok	excessive	ok	ok
2004 Q2	ok	ok	ok	ok	excessive	ok	excessive	ok
2004 Q3	ok	ok	ok	ok	ok	ok	ok	ok
2004 Q4	ok	ok	ok	ok	excessive	ok	ok	ok
2005 Q1	ok	ok	ok	ok	ok	excessive	excessive	ok
2005 Q2	excessive	ok	excessive	excessive	ok	ok	excessive	ok
2005 Q3	excessive	ok	excessive	ok	excessive	excessive	excessive	ok
2005 Q4	ok	ok	excessive	ok	excessive	excessive	ok	excessive
2006 Q1	excessive	ok	ok	ok	ok	excessive	ok	excessive
2006 Q2	excessive	ok	ok	ok	excessive	excessive	ok	ok
2006 Q3	ok	ok	ok	ok	ok	excessive	ok	ok
2006 Q4	excessive	excessive	ok	ok	ok	excessive	ok	ok
2007 Q1	ok	ok	ok	ok	ok	excessive	ok	excessive
2007 Q2	ok	ok	ok	excessive	excessive	excessive	ok	ok
2007 Q3	ok	ok	excessive	ok	excessive	excessive	ok	excessive
2007 Q4	ok	ok	ok	ok	excessive	ok	excessive	ok

(Source: IMF IFS, author's calculation)

The previous table shows results of the *Average trend credit indicator* for other countries. We used data only from 2003 until 2007, because we want to avoid period of consolidation in some of the countries. For computation we used parameter $\sigma = 1{,}2$. As we can see this indicator comparing to previous one seems to be more restrictive. For Baltic countries and Czech Republic results seem reasonable. Slovakia has reported period of excessiveness during the year 2005, what is probably caused by huge decline in credit in the first quarter of 2004 when it recorded a great fall of credit from 18391,4 to -428,9 millions of Slovak crowns.

However problem arises with Hungary and Poland. In this case we have to define special conditions for the proper functioning of given indicator. As it is based on

trend estimation, period with significant credit loses underestimates trend variable for several following periods what makes this indicator biased. To ensure its functionality we can use it only on time series with steadily growing credit with only small decreases, what is in the case of Hungary and Poland not fulfilled. On the other hand, United Kingdom is a good example of an appropriate adept for this method, looking on the given conditions.

Nevertheless the main advantage of this method is that it does not depend on the length of time series we use, because threshold is computed from data until the given period only. When using the *Average credit growth indicator* we have problem that longer time series distorts results from the past. The explanation is following: Amount of credit is generally an increasing function and above-mentioned indicator is using average as a threshold measure. Therefore higher values in the last years can overestimate the threshold and thus it will conceal past periods of potential excessiveness.

Following table demonstrates comparison of the results for the *Average credit growth indicator*, *Average trend credit indicator* and *Credit-to-GDP indicator* in the case of United Kingdom. Data used are from 2000 until 2008 in quarterly period. Table also shows different levels of the parameter ρ and σ and their results.

Table 5: Calculation of excessiveness by the Average credit growth indicator and The average trend credit indicator for United Kingdom

			The Average credit growth indicator		The Average trend credit indicator		Credit-to-GDP gap
period	Claims on Private Sector	growth	excess ρ=1	excess ρ=2,35	excess σ=1,5	excess σ=1,65	excess λ=400000
2000 Q1	1155,655						
2000 Q2	1196,596	40,941	ok	ok	ok	ok	ok
2000 Q3	1223,012	26,416	ok	ok	ok	ok	ok
2000 Q4	1254,261	31,249	ok	ok	ok	ok	ok
2001 Q1	1301,66	47,399	ok	ok	ok	ok	ok
2001 Q2	1312,762	11,102	ok	ok	ok	ok	ok
2001 Q3	1341,603	28,841	ok	ok	ok	ok	ok
2001 Q4	1367,753	26,15	ok	ok	ok	ok	ok
2002 Q1	1388,527	20,774	ok	ok	ok	ok	ok
2002 Q2	1427,402	38,875	ok	ok	ok	ok	ok
2002 Q3	1445,694	18,292	ok	ok	ok	ok	ok
2002 Q4	1479,428	33,734	ok	ok	ok	ok	ok
2003 Q1	1509,897	30,469	ok	ok	ok	ok	ok
2003 Q2	1538,277	28,38	ok	ok	ok	ok	ok
2003 Q3	1586,289	48,012	excessive	ok	excessive	ok	ok
2003 Q4	1624,635	38,346	ok	ok	ok	ok	ok
2004 Q1	1688,749	64,114	excessive	ok	excessive	ok	ok
2004 Q2	1719,809	31,06	ok	ok	ok	ok	ok
2004 Q3	1774,429	54,62	excessive	ok	ok	ok	ok
2004 Q4	1807,598	33,169	ok	ok	ok	ok	ok
2005 Q1	1852,256	44,658	ok	ok	ok	ok	ok
2005 Q2	1893,616	41,36	ok	ok	ok	ok	ok
2005 Q3	1934,505	40,889	ok	ok	ok	ok	ok
2005 Q4	1994,865	60,36	excessive	ok	ok	ok	ok
2006 Q1	2104,526	109,661	excessive	ok	excessive	excessive	ok
2006 Q2	2153,974	49,448	excessive	ok	ok	ok	ok
2006 Q3	2200,149	46,175	ok	ok	ok	ok	ok
2006 Q4	2256,205	56,056	excessive	ok	ok	ok	ok
2007 Q1	2369,952	113,747	excessive	excessive	excessive	excessive	excessive
2007 Q2	2431,827	61,875	excessive	ok	ok	ok	excessive
2007 Q3	2544,302	112,475	excessive	excessive	ok	ok	excessive
2007 Q4	2625,88	81,578	excessive	ok	ok	ok	excessive

(Source: IMF IFS, author's calculation)

Comparing our results with *Credit-to-GDP* method using *HP filter* we can conclude that our estimates bring similar results. *Credit-to-GDP indicator* denotes as

the period of excessiveness in United Kingdom the first quarter of 2007, what we find out also in both of our cases. On higher levels of parameters we find out also the first quarter of 2006 behave like period of excessiveness and also some periods around 2004, but this can be reduced by lower setting of the parameters and it serves like a good indicator of coming credit booms.

As we have already mentioned before, some of the CEE countries experienced period of consolidation. Therefore in the case of Czech Republic, Slovakia and all of the countries where we recorded significant, but temporary decline in credit in some years, we can still use this method, but only with time series adjusted for credit drops.[8] This means that we apply this indicator on the data after the period of consolidation. In our previous example, in case of United Kingdom, there was no problem, however in case of Czech Republic or Slovakia we had to start with period 2003 Q1 or we have to ignore periods of excessiveness in years where these conditions are not met.

Comparison of the results

In this section we compare and discuss our previous results with financial stability reports from given countries. We focus mainly on the period just before *The Great financial crisis* in 2008.

We have already mentioned that United Kingdom is one of the representative countries on which was built *Credit-to-GDP indicator*. The results of our indicators and also *Credit-to-GDP gap* method assumed that the first quarter of 2007 is an excessive credit period. The financial stability report (2007: 16, 3.5.2012) from Bank of England supports our claim by:

"Growth in loans to finance leveraged buyouts (LBOs) has been particularly strong and the proportion of sub-investment grade debt in global syndicated loan issuance exceeded 50% in 2007 Q1."

According to the *Average credit growth indicator* in Slovakia, it has not experienced excessive period, on the other hand the *Average trend credit indicator*

[8] Difference between period of consolidation and Hungary and Poland is that in the case of consolidation there is only temporal period of credit drops which can be excluded, while in Hungary and Poland we deal with this problem along the whole time series.

proclaimed the fourth quarter of 2007 as period of excessiveness. National Bank of Slovakia stated in their financial report (2007: 5–6, 3.5.2012):

"...the trend of increasing credit risks in the banking sector will be maintained, however, the rate of increase will be slower than in the previous years." And also:

"In 2007, several banks recorded a significant increase in loans..., although most banks have not yet been found to be exposed to a significant impairment of retail loans..."

Assuming no excessiveness, the excessive growth signalized by our indicator at the end of 2007 could be caused by inadequately setting of σ parameter.

In case of Poland we reported higher increase in credit in the second and third quarter of 2007. However *Average trend credit indicator* is not working here due to unfulfilled preconditions. Discussing our results with The Financial stability report (2007: 28, 3.5.2012) from National Bank of Poland we find out:

"In June 2007… a relatively high growth in the value of irregular loans was recorded at some small banks that focus on the retail market.",

However according to *Credit-to-GDP indicator* Poland does not indicate any signs of excess. Questionable in this case then is whether our indicators show reasonable results for Poland or whether the *Credit-to-GDP method* is in this case appropriate.

For Hungary, similarly as for Slovakia, *Average credit growth indicator* has not observed any period of excessiveness; due to same reason as in the Poland *Average trend credit indicator* does not function in this case. Consulting Financial stability report (2007: 29, 33; 3.5.2012):

"…in 2006, the growth rate of long-term loans also tapered off…"

"...by the end of 2006... investment financed from loans is gradually gaining ground."

In case of Baltic countries we observed excessive period by both of indicators in Estonia and Latvia mainly at the end of 2006. Lithuania indicated excessiveness in the second half of 2007. We discussed the study about the credit growth in Eastern Europe

from Backé, Égert and Zumer (2007: 73) which states that in private sectors in 2006 were *Credit-to-GDP* levels in case of Lithuania close to the lower bound of the estimated equilibrium ranges as in the case of Slovakia. Although Lithuania did not signal any period of excessiveness in 2006, at the end of 2007 indicated growth in credit as our indicators had predicted. Comparing to Lithuania, level in Estonia was more elevated and the increase was the most notable in Latvia.

Speaking about the Czech Republic both of our methods confirmed that in the second quarter of 2007 was potential period of excessive credit. Consulting with the Financial stability report (2007: 28, 29; 3.5.2012):

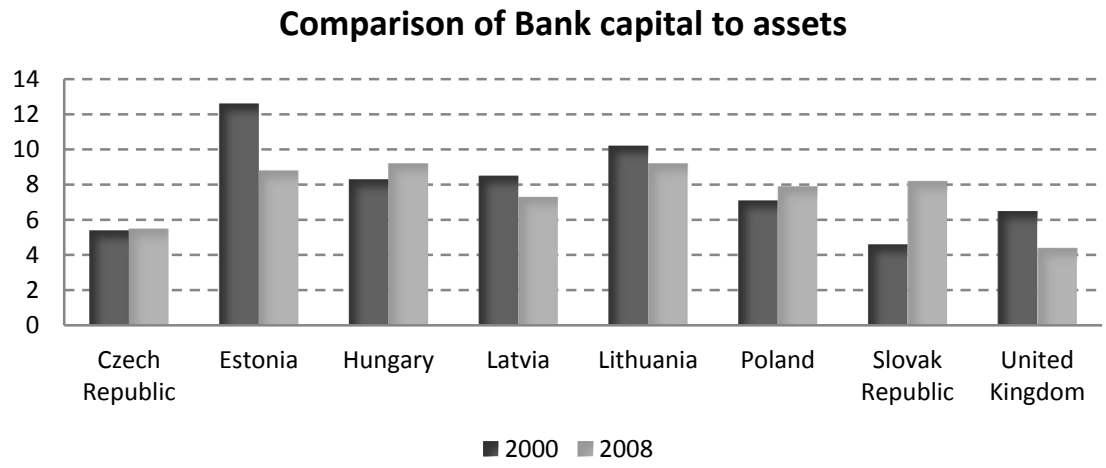
"The existing studies analyzing the equilibrium level of debt of the private sector (as measured, for example, by the ratio of loans to the private sector to GDP) confirm that the rise in debt in the Czech Republic is in line with the country's overall economic growth. This means that there is no "excessive" growth in lending that might mask certain risks to the future stability of the financial system."

Questionable now is whether the Czech Republic has experienced period of excessiveness in the second quarter of 2007 or not. According to Backé et al. (2007: 73) this period of the second quarter of 2007 was also characterized as marginally lying on the boundary signalizing excessiveness. The reason why we consider in our observations 2007 Q2 as period of excessive credit growth can be explained by the fact that we use more conservative approach and therefore we set our parameter to be more sensitive.

Bank capital to assets ratio

Another measure which is worth to mention while speaking about credit booms is Bank capital to assets ratio. Its definition is following: *"Bank capital to assets is the ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Total assets include all nonfinancial and financial assets."* (World Bank, 28.4. 2012) In other words this ratio is a criterion which determines the coverage consisting of capital against a credit risk. The following table shows the comparison of the bank capital to assets ratio between 2000 and 2008. We used the same periods as we are testing our indicators on.

Graph 14



(Source: World Bank, author's calculation)

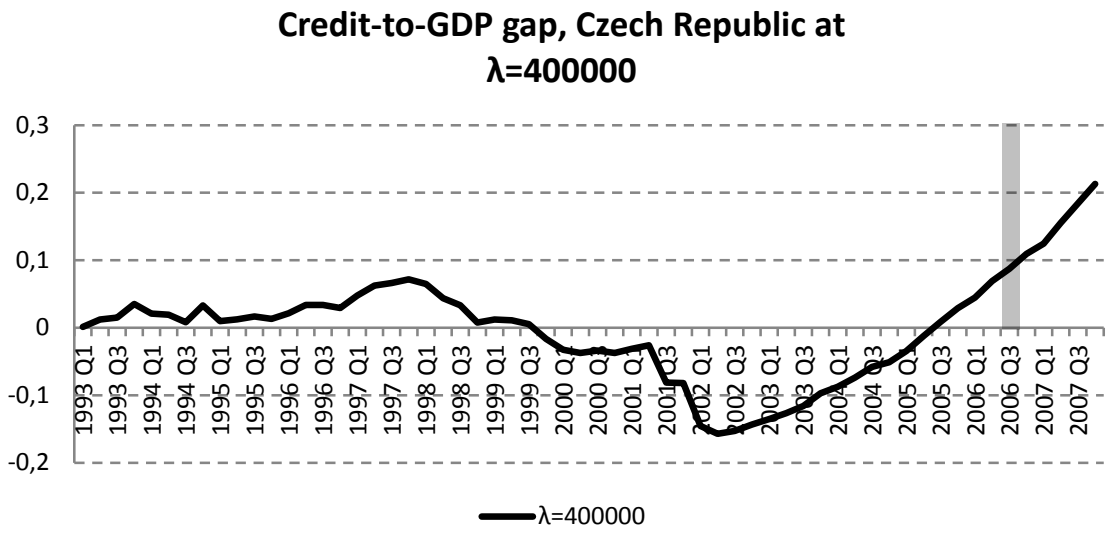
As we can see Baltic countries and United Kingdom have recorded a decrease in the bank capital to asset ratio (values on y-axis) between these two periods. Decline in this ratio can be caused by two ways. Either they recorded significant decrease in bank capital and reserves or increase in assets, respectively partially both of them. However based on the results of previous indicators we know that these countries have experienced periods of excessiveness. Although countries like Czech Republic, Slovakia, Hungary and Poland based on our indicators have also recorded some periods of excessiveness, but probably not in such an extent. Therefore we are proposing hypothesis that these significant decreases in the bank capital to assets ratio can be additional measures which can be used to verify previous results.

Appropriate lambda for CEE countries

This section is focused on the discussion of properties of the suggested parameter λ=400 000 in the case especially of Czech Republic, comparison of the results with our indicators and proper setting of the lambda parameter.

Results from Czech Republic using λ=400 000 are as follows:

Graph 15



(Source: IMF IFS, author's calculation)

We used quarterly data from 1993 until the end of 2007. According to Borio et al. (2010: 29) and their suggestion of setting lambda to 400 000 is the third quarter of 2006 (shadow zone) reported as period of excessiveness. In accordance with our set of indicators we consider as a period of excessiveness the second quarter of 2007.

From the definition of capital buffers it should be ready at the first signs of excessiveness and released in the beginning of each financial depression in order to minimalize losses and support banks to help them with lending to the economy and thereby prevent economy before credit a crunch.

Due to conservative approach assuming the fact that Czech Republic was in this period marginally lying on the boundary signalizing excessiveness (Backé et al. ,2007: 73), we can claim that λ=400 000 is no longer appropriate parameter and we recommend to adjust it.

As we have already mentioned, there are more methods how to set the λ parameter. In the chapter *Determination of λ parameter* Borio et al. (2010: 28) suggested to set λ by comparing its series length to business cycles. They also have shown that length of quarterly time series in business cycles should be around 7, 5 years. Based on this using their formula:

$$\alpha^4 * 1600 = \lambda \qquad [8]$$

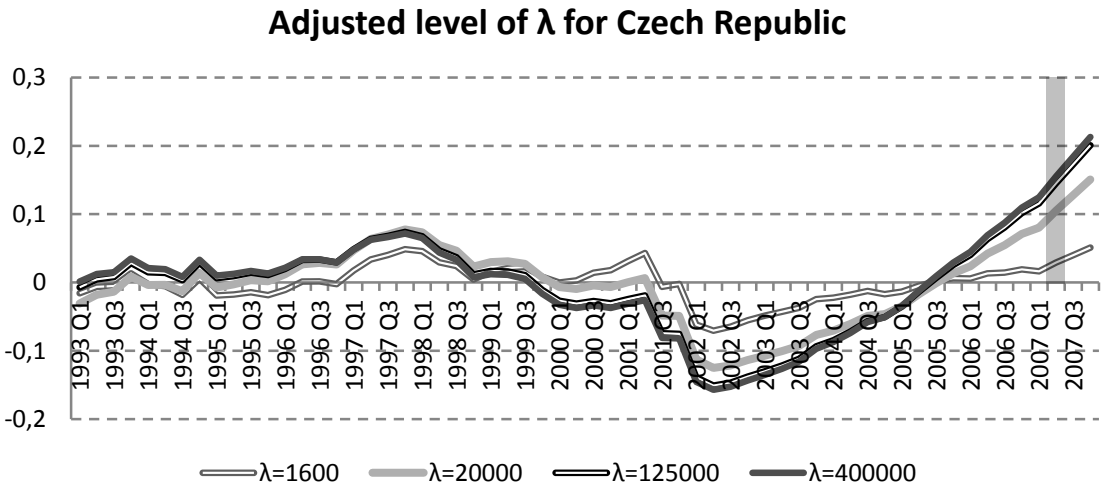
Where α is one when the length of credit and business cycles is the same, two means it is two times longer etc. In case of Czech Republic we work with data available for past 12 years in quarterly period. Proportionally calculated according to Borio et al. we get $\alpha = 1{,}6$, so:

$$1{,}6^4 * 1600 = 10485{,}76 \doteq 10500 = \lambda \qquad [9]$$

According to Ravn and Uhlig (1997) is for example λ depended only on its frequency and for quarterly data they recommend λ=1600.

After analysis based on our indicators we have reached the following result:

Graph 16



(Source: IMF IFS, author's calculation)

In the case we want to use *Credit-to-GDP gap* as the indicator of excessive credit growth in Czech Republic, although we face the problem of insufficient time series data we recommend to use λ from (10 000; 30 000) interval, assuming the fact that our estimation is correct.[9]

[9] For additional results from other CEE countries see Appendix A. Also for more detailed computation of the countercyclical capital buffer for Czech Republic see Appendix D.

Summary

The aim of our study was to analyze validity of the *countercyclical capital buffer* proposal of the Basel committee and discuss the appropriateness of the *credit-to-GDP ratio* as an indicator for converging economies, especially the case of Czech Republic.

We have discussed various features of the *countercyclical capital buffer* as a tool for prediction the periods of excessiveness. We also consulted suitability of the *Hodrick-Prescott filter* method for Central and Easter European countries, mainly the setting of smoothing lambda parameter in this method. Borio et al. (2010: 28-30) suggested $\lambda = 400000$ as an adequate parameter for determination of credit booms and proved it in the case of United Kingdom. However this parameter works well only for the countries with sufficiently long time series what is in case of CEE countries not fulfilled. Therefore we tried to propose new set of independent indicators for the estimation of excessive credit periods and use them to set up the lambda at the proper level.

We designed two new indicators based on credit variable and so: the *Average credit growth indicator* and the *Average trend credit indicator*. Both our indicators are dependent on value of given parameters that determine the level at which is given economy in excessiveness. The parameters are depended on the number of observations. These types of indicators are not suitable for every country, especially the *Average trend credit indicator*, therefore in order to ensure proper functioning of the indicators we came up with set of restrictive assumptions which excludes some of the countries.

Our obtained results were also substantiated by the *Financial Stability Reports* from given countries and the *Bank capital to assets ratio* as another potential measure of excessiveness.

We set Czech Republic as a representative of other CEE countries. Comparing our results for Czech Republic we reached the conclusion that lambda in the *Credit-to-GDP indicator* is overestimated and should be adjusted. Based on our empirical research, for Czech Republic we suggest setting lambda from interval (10 000; 30 000) as an appropriate smoothing parameter for using *Hodrick-Prescott filter* method.

As for other possible indicators of credit booms we recommend to consider additional variables for prediction for example the *Broad money indicator* or the *Bank asset ratio.* Also to try more advanced methods as the *Kalman filter* or *Out-of-sample method* and examine their properties. We also expect that the method of calculation of *HP filter* will gradually improve since data for converging economies are becoming more accessible.

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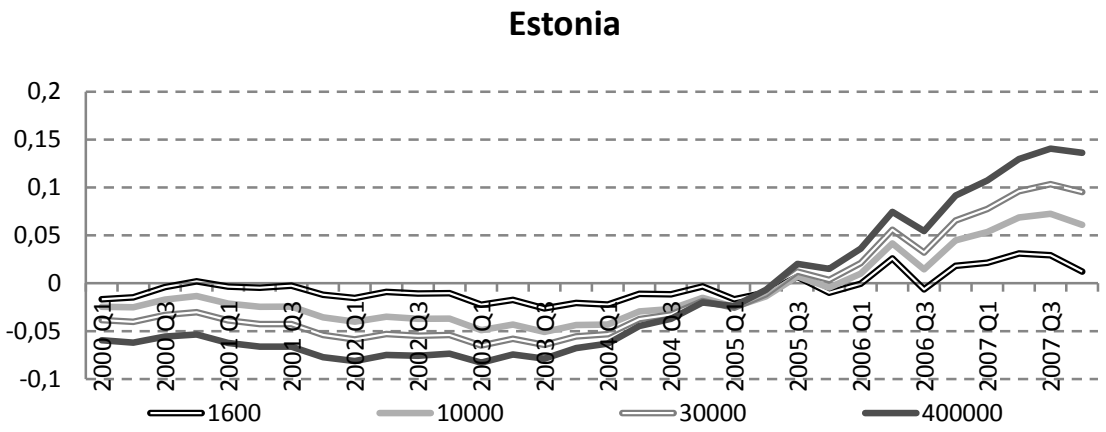
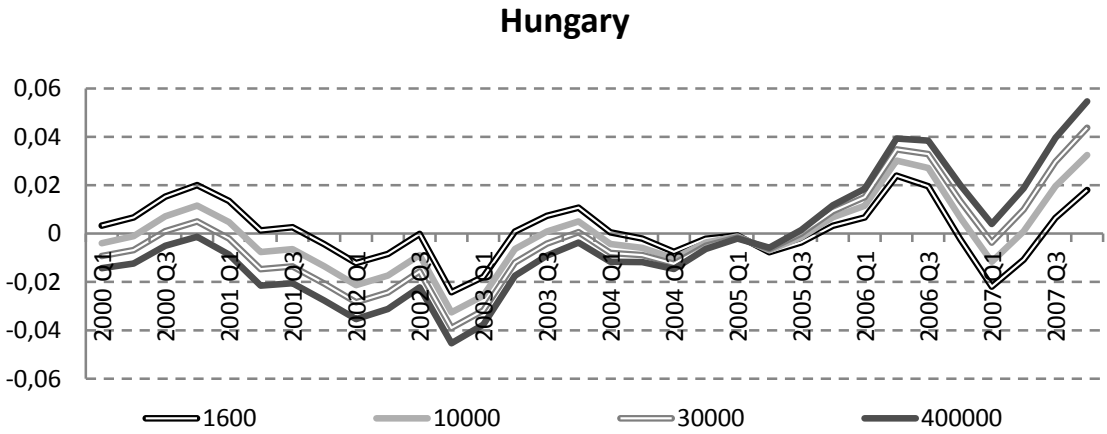
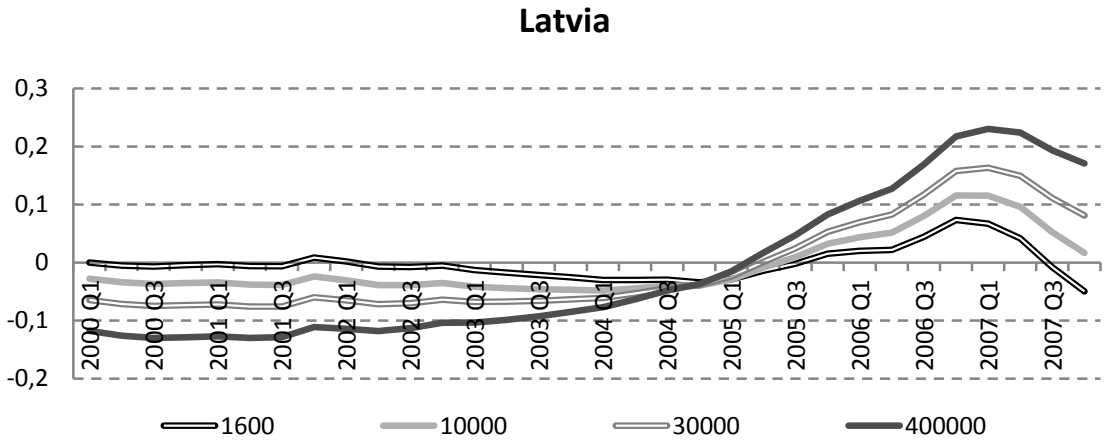
Appendix

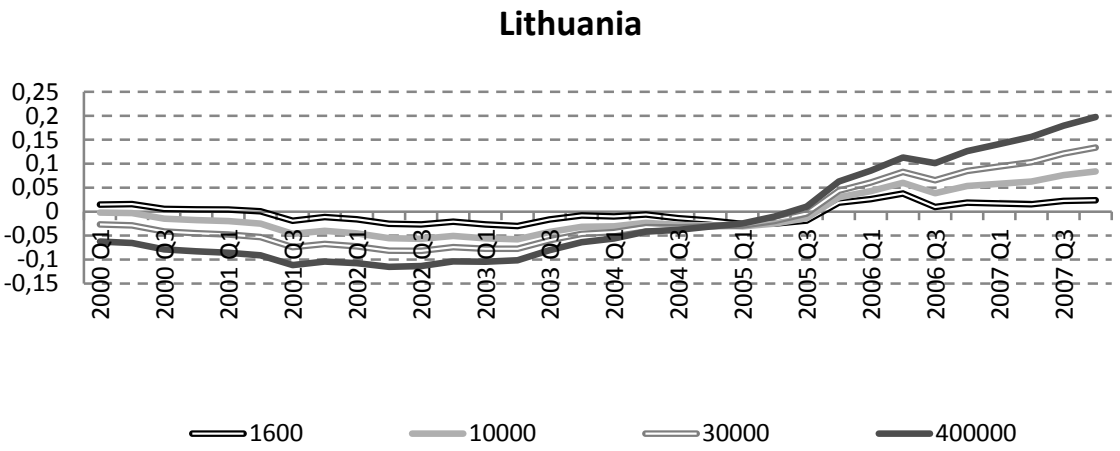
Appendix A: Comparison of different level of λ for CEE countries until 2008 (graphs)

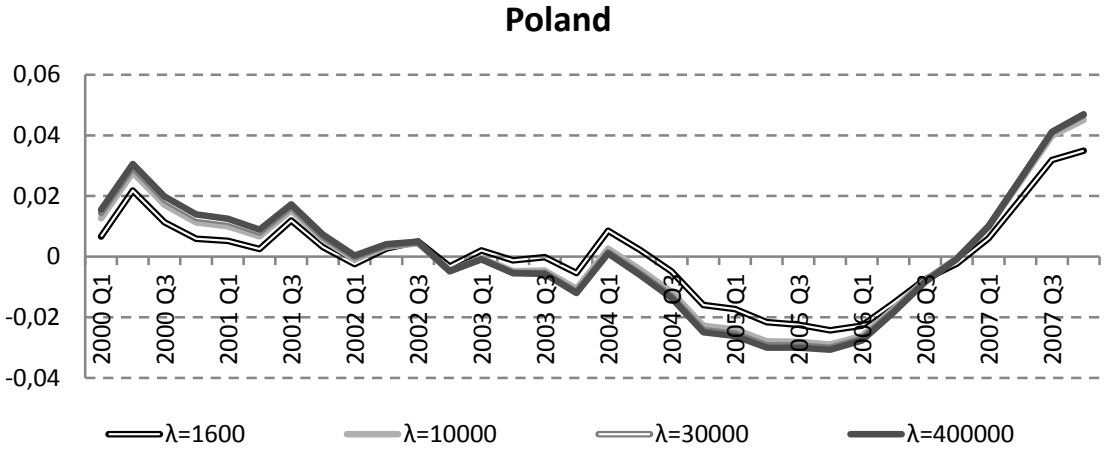


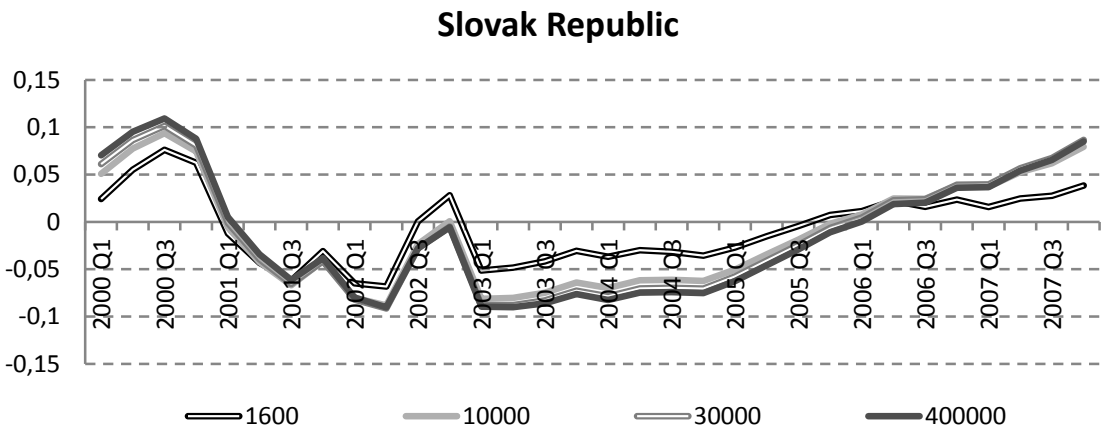




Appendix A: Comparison of different level of λ for CEE countries until 2008.







(Source: IMF IFS, author´s calculation)

Appendix B: Comparison with the countries which have experienced the period of consolidation (table)

The table shows annual growth in credit, where negative values are highlighted in gray. Substantial period of consolidation is visible mainly in Czech and Slovak Republic.

year	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Slovakia
1994 Q1	21,537	656,7	21,681	18,888	244,6	2187,2	-17364
1994 Q2	36,612	484,92	47,063	32,563	320,1	1695,4	-5009
1994 Q3	36,473	307,76	30,61	18,294	243,8	1718,4	-6444
1994 Q4	77,977	249,63	49,706	34,6	567,5	3033,6	-3832
1995 Q1	10,362	226,41	69,9	19,201	388,7	3295,8	4894
1995 Q2	47,155	758,32	-8,769	-15,431	168,4	3207	-10121
1995 Q3	38,362	653,27	22,982	-18,18	64,1	4104,26	-20710
1995 Q4	36,459	832,52	26,156	-151,73	-73,2	4430,74	36133
1996 Q1	33,604	802,97	-20,497	-7,171	-231,9	3449	26132
1996 Q2	45,289	1046,82	3,183	0,713	-59,3	4588	14736
1996 Q3	23,977	1265,09	74,351	1,258	-4,3	6481	19080
1996 Q4	14,439	2309,821	200,552	16,784	29	9729,8	8520
1997 Q1	38,238	1493,646	114,3	18,908	125,9	6662,81	115880
1997 Q2	31,074	2486,169	144,375	33,415	-7,5	6411,59	3510
1997 Q3	11,312	3766,375	115,164	49,061	77,5	7410,7	2408
1997 Q4	15,86	2189,22	182,313	69,588	550,3	5615,5	-2863
1998 Q1	-0,477	1107,551	49,949	58,601	355,4	6322,6	19204
1998 Q2	-20,185	1145,343	155,054	68,649	268,5	6598,6	-6109
1998 Q3	-6,359	637,62	150,819	62,896	355	8151,4	-2432
1998 Q4	-47,115	-160,333	7,705	0,437	201,8	7130,8	11081
1999 Q1	4,261	-811,547	91,181	18,705	367,6	9597,4	21543
1999 Q2	-8,939	-141,558	95,007	9,987	276,2	6637,8	8451
1999 Q3	-21,305	544,538	129,965	17,805	147,8	11014,6	2225
1999 Q4	-51,807	1985,66	211,468	39,932	-129,9	7080,2	7223
2000 Q1	-41,552	640,367908	406,49	48,014	-322	6630,9	-29264
2000 Q2	-16,501	1880,89955	243,288	42,749	161,8	18607,6	29065
2000 Q3	1,895	2697,72932	340,852	62,401	-278,1	8,7	23399
2000 Q4	-12,419	2875,696887	288,935	92,104	195,6	2684,2	-4425
2001 Q1	9,881	1434,462335	164,173	86,902	205,3	4746,8	-72423
2001 Q2	10,412	2203,491	139,457	81,728	111,6	2752,2	-32542
2001 Q3	-129,2117	2637,068	305,715	91,402	-598,3	10961	-22811
2001 Q4	-4,6089	1453,097	168,905	198,451	836,3	-3643,9	28226
2002 Q1	-159,1234	2073,753148	197,164	81,395	219,7	-462,7	-39278,3
2002 Q2	-39,864	3614,7932	342,839	82,402	79,8	7549,4	-9188,4
2002 Q3	-4,528	2772,477167	454,935	150,38	609,1	5157,2	72783,2
2002 Q4	7,757	3367,027601	-31,577	187,309	907,1	-3010,6	31153,5
2003 Q1	4,723	2377,452123	355,506	133,077	514,2	7621,4	-88666
2003 Q2	8,986	4414,334073	654,084	166	688,5	1596,3	4750
2003 Q3	13,181	3034,940683	467,54	193	1731,9	4911,8	9403,5

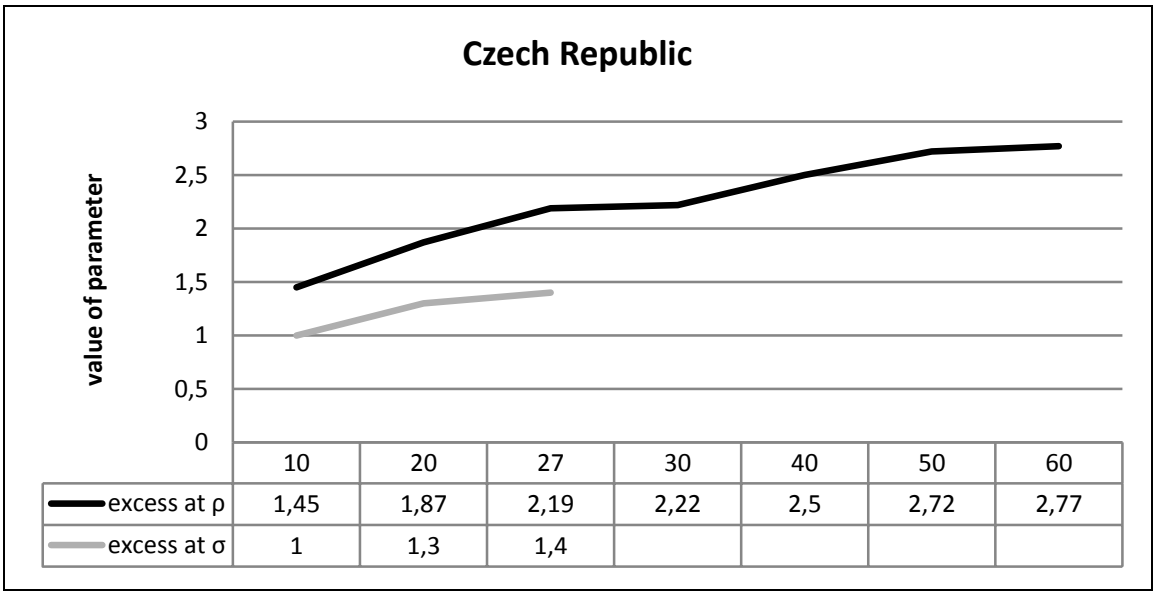
2003 Q4	34,972	4869,356022	522,574	206	1639,8	712,3	18391,4

(Source: IMF IFS, author´s calculation)

Appendix C: Relationship between the length of time series and value of parameter (graph)

This graph shows how with increasing number of observations (horizontal axis) we have to adjust the value of given parameter in order to obtain same results (in this case we compare results on the period of excessiveness in Czech Republic in 2007 Q2).

Blank spaces in the case of Average trend credit indicator are omitted due to problems with consolidation in this period (including the previous values would bias all the results).



	10	20	27	30	40	50	60
excess at ρ	1,45	1,87	2,19	2,22	2,5	2,72	2,77
excess at σ	1	1,3	1,4				

(Source: IMF IFS, author´s calculation)

Appendix D: Computation of the *countercyclical capital buffer* with λ=20000 for Czech Republic (table)

This table compares different level of lambda in case of Czech Republic and also demonstrates the amount of the buffer in different periods (method for buffer calculation is taken from BCBS (2010b: 13).

Year	GDP Adjusted, Nominal, Billions CZK	Claims on Private Sector, Billions CZK	Credit-to-GDP in %	gap in % λ=20000	trend in % λ=20000	gap in % λ=400000	trend in % λ=400000	Buffer as % of RWA (λ=400000)
2000 Q1	2103,381	1056,918	50,249	-0,671	50,919	-3,270	53,519	0
2000 Q2	2129,104	1040,417	48,866	-0,963	49,829	-3,733	52,600	0
2000 Q3	2157,419	1042,312	48,313	-0,449	48,762	-3,371	51,684	0
2000 Q4	2189,169	1029,893	47,045	-0,674	47,719	-3,726	50,770	0
2001 Q1	2224,814	1039,774	46,735	0,031	46,704	-3,125	49,860	0
2001 Q2	2264,965	1050,186	46,367	0,646	45,720	-2,586	48,953	0
2001 Q3	2306,447	920,974	39,930	-4,839	44,770	-8,118	48,049	0
2001 Q4	2352,214	916,365	38,958	-4,897	43,855	-8,191	47,148	0
2002 Q1	2388,755	757,242	31,700	-11,279	42,979	-14,551	46,251	0
2002 Q2	2420,054	717,378	29,643	-12,501	42,144	-15,714	45,357	0
2002 Q3	2441,796	712,850	29,194	-12,159	41,352	-15,274	44,467	0
2002 Q4	2464,432	720,607	29,240	-11,364	40,604	-14,341	43,581	0
2003 Q1	2486,152	725,330	29,175	-10,725	39,900	-13,524	42,698	0
2003 Q2	2516,412	734,316	29,181	-10,060	39,241	-12,638	41,819	0
2003 Q3	2546,199	747,497	29,357	-9,268	38,625	-11,586	40,944	0
2003 Q4	2577,110	782,469	30,362	-7,690	38,052	-9,709	40,071	0
2004 Q1	2629,173	800,944	30,464	-7,057	37,520	-8,738	39,202	0
2004 Q2	2683,935	830,758	30,953	-6,075	37,028	-7,383	38,336	0
2004 Q3	2745,247	869,506	31,673	-4,899	36,572	-5,799	37,473	0
2004 Q4	2814,762	886,835	31,507	-4,644	36,150	-5,105	36,612	0
2005 Q1	2859,495	923,466	32,295	-3,465	35,760	-3,459	35,753	0
2005 Q2	2903,688	978,137	33,686	-1,712	35,398	-1,211	34,897	0
2005 Q3	2945,111	1028,908	34,936	-0,125	35,062	0,893	34,043	0
2005 Q4	2983,862	1076,866	36,090	1,343	34,747	2,900	33,190	0
2006 Q1	3038,359	1118,606	36,816	2,366	34,450	4,477	32,339	0,114
2006 Q2	3091,185	1186,718	38,390	4,222	34,169	6,902	31,488	0,694
2006 Q3	3157,344	1242,967	39,367	5,468	33,899	8,728	30,639	1,084
2006 Q4	3222,369	1312,938	40,744	7,105	33,639	10,954	29,790	1,595
2007 Q1	3303,406	1367,463	41,396	8,010	33,385	12,454	28,942	1,878
2007 Q2	3384,001	1476,447	43,630	10,495	33,135	15,536	28,094	2,5
2007 Q3	3459,346	1579,176	45,650	12,762	32,888	18,403	27,246	2,5
2007 Q4	3535,460	1686,422	47,700	15,060	32,641	21,302	26,398	2,5

(Source: IMF IFS, author´s calculation)