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Financial Cycles and Macroprudential and Monetary Policies
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EDITORIAL

Issues connected with the financial cycle have gained prominence in recent decades, as they form the key component of the time dimension of the newly formed macroprudential policies. Analysis of the financial cycle covers a combination of purely theoretical models (explaining different channels of propagation of the financial cycle to the real economy) and practical applications estimating the financial cycle (directly applicable to macroprudential policies such as the setting of countercyclical capital buffers). Financial cycle issues also influence the debate of the interaction between monetary and macroprudential policies. This edition of the Bulletin presents four articles that address financial cycle issues. Two of them are theoretical, one is purely empirical and one covers issues related to the interaction of the different policies conducted within the central bank.

The first article presents the CNB's approach to estimating the position of the economy in the financial cycle. This approach is already being used as an input to the practical setting of the countercyclical capital buffer in the Czech Republic.

The second and third articles present theoretical approaches to the financial cycle within the DSGE class of models. The second article stresses the role of confidence cycles on interbank markets and evaluates the impacts of different types of central bank policy. The third article analyses the interplay of the dynamics of asset prices and the situation of the financial sector and the real economy.

The fourth article analyses the interaction between monetary and macroprudential policies. It stresses the need for coordination of the two policies.

Michal Hlaváček

Czech National Bank
Economic Research Department
Na Příkopě 28, 115 03 Prague 1
Czech Republic
tel.: +420 2 2441 2321
fax: +420 2 2441 4278
Guest Editor of the Bulletin: Michal Hlaváček
Editor of the Bulletin: Jan Babecký

IN THIS ISSUE

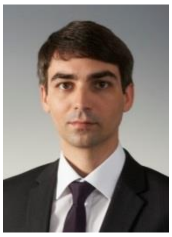
Measuring the Financial Cycle in the Czech Republic [1]

Miroslav Plašil[a], Jakub Seidler[b] and Petr Hlaváč[c]

[a] Czech National Bank

[b] ING Bank, Czech National Bank at the time the paper was written.

[c] Czech National Bank at the time the paper was written.


Recent developments in the global economy have contributed to the reassessment and elaboration of some economic notions. Arguably, one of the most conspicuous changes in economic thinking has been that related to the greater importance of the linkages between the real economy and the financial sector. These linkages can lead to significant spillovers from one part of the economy to another and trigger substantial feedback loops. In the aftermath of the financial crisis, economists have been forced to pay closer attention to the role of financial factors in business cycle fluctuations and their impact on the overall soundness of the economic system. As a consequence, macroprudential instruments and financial stability issues have become an object of central interest to policy makers (see, for example, Borio and Drehmann, 2009, Borio, 2010, and Frait and Komárková, 2012).

Even though business cycle and financial fluctuations are related, one should still be mindful of the differences in their nature and timing. The foundations of financial risks and imbalances are laid in good economic times, when expectations are running high and credit growth does not seem to raise too much concern. However, excessive credit growth is often followed by a deterioration in borrowers' ability to repay, growth in non-performing loans and large losses in the banking sector, which together can limit banks' ability to lend to the sound part of the real economy and hamper economic growth. Against this backdrop, correctly determining the current phase of the financial cycle is vital for successfully identifying emerging risks, taking timely preventive action and implementing stabilisation policies. In practice, however, this objective may pose some practical challenges, as the financial cycle is mainly a theoretical quantity lacking a generally accepted empirical counterpart.

[1] This article is based on Plašil et al. (2015).

Although some favour quite a parsimonious description of the financial cycle defined only in terms of one or very few variables (see, for example, Borio, 2012), relevant features of the cycle are echoed in far more indicators. These can be analysed one by one, but for communication purposes as well as for easier risk assessment it might be useful to summarise the existing information with a single representative measure. With this objective in mind, we propose a new composite indicator useful for monitoring developments over the financial cycle (the abbreviation FCI is used for future reference). The primary motivation was to come up with a very simple indicator, one that would be very simple to construct, easy to interpret and well understood by the widest possible audience. The indicator should mainly capture those cyclical risks which can be effectively handled by the countercyclical capital buffer (CCyB), and closer attention is paid to the identification of those phases of the cycle where the need for macroprudential actions is the most urgent (i.e. mainly the build-up phase of the cycle).

Conceptually, we follow papers aiming to extract information on cyclical comovements from a variety of financial variables. However, our empirical approach is quite different. The proposed method uses a set of indicators measuring swings in risk perceptions and aggregates them into a composite indicator using the CISS methodology (Composite Indicator of Systemic Stress; Holló et al., 2012). Although the CISS was designed for a quite different purpose, we argue that its underlying logic has practical appeal for the measurement of the financial cycle if proper variables (subindicators) are used as inputs.

There is hardly a consensus on the definition of the financial cycle, so it might be useful to explain what exactly the FCI should capture. We interpret the financial cycle from the perspective of the build-up rather than the materialisation of risks and select the subindicators accordingly. This approach is necessary if the FCI is to be used for timely macroprudential action. We do not include any risk materialisation indicators, as they usually lag behind the cycle, as outlined above, or even attain their most optimistic levels in the risk accumulation phase. We covered the widest possible area of the economy that might be affected by changes in risk perceptions, i.e. the credit demand and supply sides, property prices, debt sustainability, general financial market sentiment and external imbalances. A list of the input variables together with the adjustments made to them can be found in Table 1. The list is arguably subjective but quite in line with the existing literature (see, for example, Babecký et al., 2013). It also takes into account the quality of the data, as some relevant indicators could not be employed due to limited availability of long time series and/or erratic dynamics.

Table 1. Definition of input indicators

	Indicator	Original units and adjustments made
1	New bank loans to households	CZK bn, annual moving sum of monthly new loans
2	New bank loans to non-financial corporations	CZK bn, annual moving sum of monthly new loans
3	Property prices (inflation)	y-o-y change in price index
4	Household debt/gross disposable income	bank loans/moving annual total, y-o-y change, %
5	Non-financial corporations' debt/gross operating surplus	bank loans/moving annual total, y-o-y change, %
6	Spread between rate on new loans to households and 3M PRIBOR	% p.a., computed from quarterly average rates
7	Spread between rate on new loans to NFCs and 3M PRIBOR	% p.a., computed from quarterly average rates
8	PX stock index	three-month average
9	Adjusted current account deficit/GDP	% p.a., adjusted for reinvestment and transfers

Source: CNB and CZSO, authors' calculations

The input variables were transformed into the unit interval prior to aggregation to ensure their mutual comparability. The CISS-like aggregation is then given by the following formula (see Holló et al., 2012)

$$FCI_t = (w \circ s_t)' C_t (w \circ s_t), \tag{1}$$

where a vector of weights,[2] $w = (w_1, w_2, \ldots, w_9)$, indicates the relative importance of the individual variables (subindicators), $s_t = (s_{1,t}, s_{2,t}, \ldots, s_{9,t})$ is the vector of the subindicators' values at time t and $(w \circ s_t)$ represents the element-by-element multiplication of these vectors. Matrix C_t contains the values of the pairwise correlation coefficients $\rho_{t,ij}$ determining how strong the relationship between subindicator i and j is at time t.

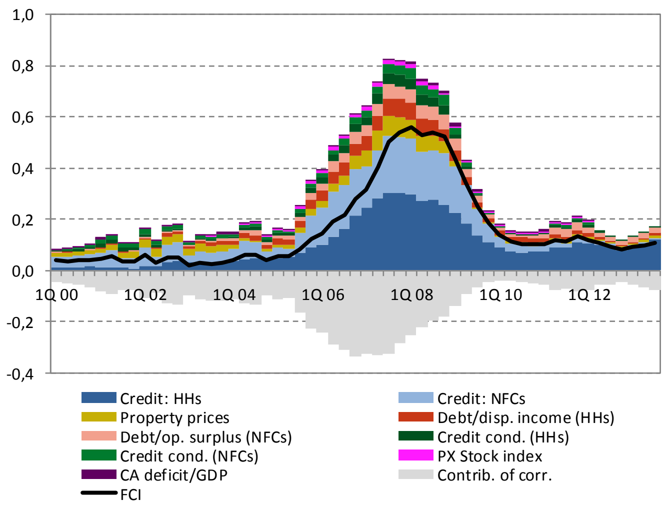
The strength of the comovement between the variables can be inferred from the time-varying cross-correlation structure given by matrix C_t. It can be shown that variables exhibiting strong comovement will (other things being constant) contribute most to the value of the FCI. In general, the FCI will take the highest values when risks are rising across all monitored segments. The stronger are the correlations between all subindicators, the stronger is the signal sent out by the FCI about overall changes in sentiment over the cycle. In other words, a lack of comovement and mixed developments among subindicators in a given period are penalised with a negative contribution to the value of the FCI. This property of the aggregation method may help differentiate between good and bad credit expansions. If growth in credit is accompanied by a rise in property prices, deteriorating debt-service capacity and ever looser credit standards, it is

[2] These weights were calibrated by simulation techniques so as to obtain best in-sample predictions of loan loss impairments six quarters ahead. The chosen number of quarters reflects the fact that when a non-zero CCyB is announced, banks need at least one year to implement it. To this period one also needs to add the data publication lag and the time needed to make the decision to set the capital buffer.

potentially more dangerous (the FCI would attain high values) than under more favourable scenarios.

The performance of the FCI was tested on Czech data for the period 2000Q1–2013Q3. Figure 1 shows the evolution of the FCI (the black line) along with its decomposition into individual components (the bar chart). The results show that the period of 2005–2008 can be described as an expansionary phase of the financial cycle, with an economic recovery accompanied by gradually rising risk tolerance. In this period, bank clients showed a greater willingness to borrow despite the risks associated with future debt service. As time went on, this willingness was also fostered by banks themselves through ever weaker lending conditions. Late 2008/early 2009 can be identified as the peak of the cycle. This was followed by a rapid switch to a downward phase of the cycle as a result of the financial crisis impacting on the Czech economy. Unlike for the credit-to-GDP gap, which is tainted by structural breaks in the time series of credit as well as by the catching-up process, these developments closely correspond to economic intuition and are in line with current expert judgement. In this light, our measure may better serve macroprudential purposes than the traditionally used credit-to-GDP gap and may provide policy makers with a useful framework for assessing the financial cycle.

Figure 1. The FCI and its decomposition



Note: Minimum FCI = 0, maximum = 1. The negative contribution of the cross-correlation structure to the FCI (the loss due to imperfect correlation of the subindicators) is due to the difference between the current FCI value and the potential upper bound. Highly negative contributions indicate a generally weak correlation between the subindicators, whereas near-zero contributions indicate growing interconnectedness in individual areas of financial risk.

In our research, we also investigated the predictive content of the FCI with respect to credit risk and economic activity using both static and dynamic Bayesian averaging techniques (see Hoeting et al., 1999, and Raftery et al., 2010). An initial analysis suggests that this may contribute to a more precise assessment of future credit risk materialisation in both the expansionary and recessionary phase, and to some extent it may also help predict developments in the real economy, notably around a tipping point of the financial cycle. This seems to confirm earlier literature on the non-linearities observed in the relation between macroeconomic and financial developments.

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Confidence Cycles and Liquidity Hoarding[3]

Volha Audzei[a,b]

[a] Czech National Bank

[b] CERGE-EI, Charles University

The expectations of financial agents affect the functioning of the financial market. They can propagate shocks to the real economy or become a source of shocks themselves. These expectations are not necessarily perfect. Agents can have limited information or a limited ability to process it. Studies[4] have shown that the expectations of professional forecasters demonstrate inertia and it takes time for them to learn when changes occur. Therefore, after crisis episodes, agents can have pessimistic forecasts. Imperfect information and/or overly pessimistic expectations influence the efficiency of policy actions aimed at mitigating the recession and can undermine their effect or lead to unintended consequences.[5]

As regards the recent financial crisis with the subsequent recession and unconventional policy responses by leading central banks, there are papers that show how banks' liquidity constraints affect interbank market allocations. Policies aimed at relaxing these constraints are found to be efficient in restoring the markets. At the time of the credit crunch in 2008–2009, however, banks demonstrated a reluctance to lend and hoarded some of the liquidity they obtained from central banks. Hoarding was observed in the form of banks being reluctant to lend while keeping funds in excessive reserves or investing in short-term assets.

This paper contributes to the literature by addressing how imperfect information among financial agents, i.e. banks, influences the functioning of the interbank market and the supply of credit to the real economy. We start with a simple model where the supply of interbank market credit depends on banks' expectations about economic activity. There are two types of assets in our model economy – a safe storage asset, which we interpret as holding reserves at the central bank, and a risky asset – credit to the real economy. The return on the risky asset is uncertain, as it is subject to a capital quality shock (in the spirit of Gertler and Karadi, 2011[6]). Banks have

[3] This article is based on Audzei (2016).
[4] Examples being Coibion and Gorodnichenko (2012) and Andrade and Bihan (2013).
[5] For evidence on liquidity hoarding see Gale and Yorulmazer (2013), Heider et al. (2009) and Allen et al. (2009).
[6] The model of Gertler and Karadi (2011) serves as a baseline model without imperfect information. Note that if there is no imperfect information, banks have homogeneous beliefs, the interbank market does not exist and everyone invests everything in the risky asset unless it pays less than the safe one.

imperfect information about risky asset returns and form heterogeneous expectations about them. Depending on their beliefs about returns, banks are endogenously divided into lenders and borrowers. The lenders assess counterparty risk as borrowers' ability to meet their obligations given their portfolio returns. After periods with low returns, lenders anticipate higher risk on the interbank market and demand a higher interbank rate. Given the banks' beliefs distribution, lower market sentiment results in less lending and can even lead to an interbank market crunch. As banks are creditors to the real sector, the functioning of the interbank market then affects the real economy, generating or amplifying business cycle fluctuations. Within this framework we study possible central bank policy actions for stimulating credit or restoring the interbank market. We show that when lending is impaired because of low market sentiment, policy actions have a rather limited effect.

We further proceed with a workhorse DSGE model where banks' return expectations depend on their backward-looking economic model and heterogeneous expert assessments. When a negative shock occurs, banks are uncertain whether it is persistent or temporary. If it is temporary, their economic model leaves some probability for the shock to be persistent and predicts a lower future return. Agents combine these predictions with expert assessment (noisy signals about shock realisation). In addition to a shock to returns, we consider a sentiment shock – when expert beliefs about shock realisation are overly pessimistic. In this environment we simulate three types of crises: (i) a negative shock to banks' returns with no additional change in investor sentiment; (ii) a negative shock to returns together with an additional shock to investor sentiment; (iii) just a sentiment shock.

After a large negative shock to returns, banks tend to underestimate future revenues, reduce interbank lending and increase hoarding, which results in lower credit to the economy and amplifies the recession. The expectational shock alone can generate some need for a policy response by the central bank. Combined with the occurrence of an actual crisis, it leads to a more severe recession and a larger policy response. That is, investor sentiment can be an important factor for policy design and evaluation. Comparing our model with the literature, without the expectational shock our model predicts a milder recession than Gertler and Karadi (2011), as banks in our model have an opportunity to diversify their assets and are thus less impacted by the crisis. With the expectational shock, our model has similar predictions to the baseline regarding the dynamics of output, capital, labour and consumption.

Within this framework, we consider the following central bank policy responses to crisis shocks with and without sentiment shocks: (i) liquidity provision, targeted and untargeted, (ii) a policy rate cut, and (iii) relaxation of the collateral constraint on the interbank market. Under the first two policies, the central bank funds asset purchases by intermediaries. The untargeted liquidity provision is modelled as the funding of a share of banks' asset purchases – be they reserves or real sector credit. There are, however, operational costs of conducting the policy. As in Gertler and Karadi (2011), we model them as proportional to the funds provided to banks. The central bank selects the size of the policy response as a proportion of the rise in the risk premium, as when there are disturbances in the economy, the risk premium rises above the steady-state level. Similarly, for targeted credit support, the central bank funds a fraction of the asset purchases, but limits the set of assets to risky assets. We assume this policy is as costly as unlimited liquidity provision.

We further consider relaxing the collateral constraint on the interbank market and lowering the reserve rate, both of which policies involve no operational costs. Relaxing the collateral constraint takes the form of increasing the fraction of borrowers' net worth up to which borrowing is restricted. An increase in this fraction and a reduction in the reserve rate follow the same decision rule as the two previous policies considered – the policy responds to a rise in the risk premium.

Some of our findings are illustrated in Figure 1, where we show the impulse responses of our model to the crisis with the shock to the return and the sentiment shock.[7] Each line illustrates the impulse responses under different central bank policies. On the vertical axis are the percentage deviations from the steady state level (negative values mean a relative decline and positive values a relative rise).[8] On the horizontal axis are quarters of the year. The central bank conducts policy in every period proportionally to the deviation of the risk premium above the steady state. The targeted and untargeted liquidity provision policies are marked with a black and red line respectively, and the simulation without any policy response is shown as a green line with dots. The results suggest that liquidity provision can help restore credit to the real sector (which is capital in our model) and output, but its effect is limited by banks' pessimism, with a significant share of the central bank's funds ending in central bank reserves (which is hoarding in our model).

The policy of relaxing collateral constraints is marked with a purple line. The policy allows borrowers to borrow a larger fraction of their net wealth. The larger demand for interbank credit

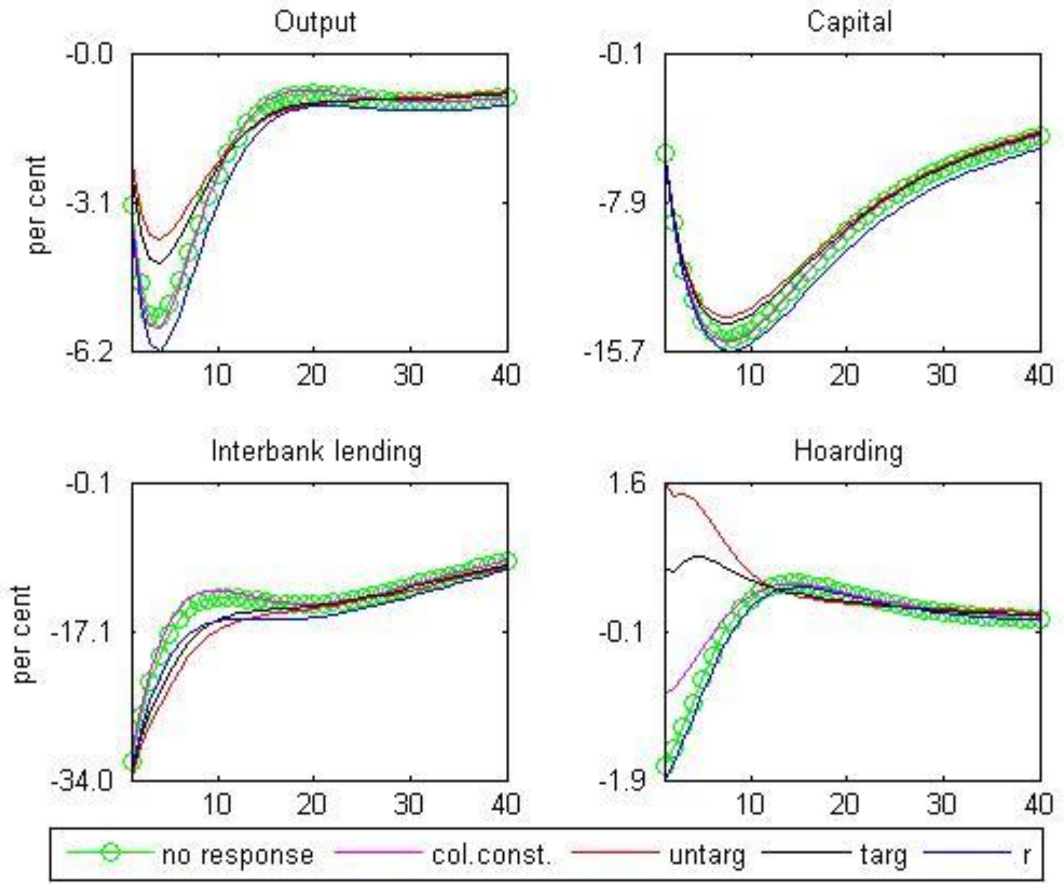
[7] In the paper we also consider the responses to the crisis without a sentiment shock. The results do not differ qualitatively.

[8] The variables do not fully return to the steady state level in 20 quarters. After 40 quarters (10 years), output is still 0.8% below the steady state, but converging to it slowly. Here, we choose a length of 20 quarters to better illustrate the model dynamics on the graph.

drives up the interbank market rate, reducing the number of banks willing to borrow. Thus, there are fewer borrowers on the market, but they borrow more. As a result, interbank market lending increases relative to the no response scenario. The high interbank market rate makes interbank lending more attractive relative to investment in risky assets, so some potential investors become lenders on the interbank market and the share of those investing in the risky asset falls. As a result, despite the larger volume on the interbank market, credit supply to the real economy is almost unchanged, as are safe asset positions and hoarding.

Interestingly, reducing the policy rate (the blue line) results in a worse outcome in terms of output and capital accumulation than the scenario with no policy response. In our model, the policy rate is the reserve rate, with reserves being the only safe asset. The low return on reserves thus erodes banks' returns, resulting in a smaller supply of credit and a subsequent fall in capital accumulation.

Figure 1. Policy effects



In the paper, we also compare the policy results from our model with those from the baseline model by Gertler and Karadi (2011). This allows us to show how hoarding and imperfect information influence policy efficiency. The imperfect information in our model results in a more dramatic fall in deposits and an increase in labour supply relative to the baseline model. As expected, a policy response of initially similar size has a delayed effect in our model, as banks are less optimistic about future returns and store some part of central bank funds in the safe asset.

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Limited Liability, Asset Price Bubbles and the Credit Cycle: The Role of Monetary Policy[9]

Jakub Matějů[a] and Michal Kejak[b]

[a] Czech National Bank

[b] CERGE-EI, Charles University

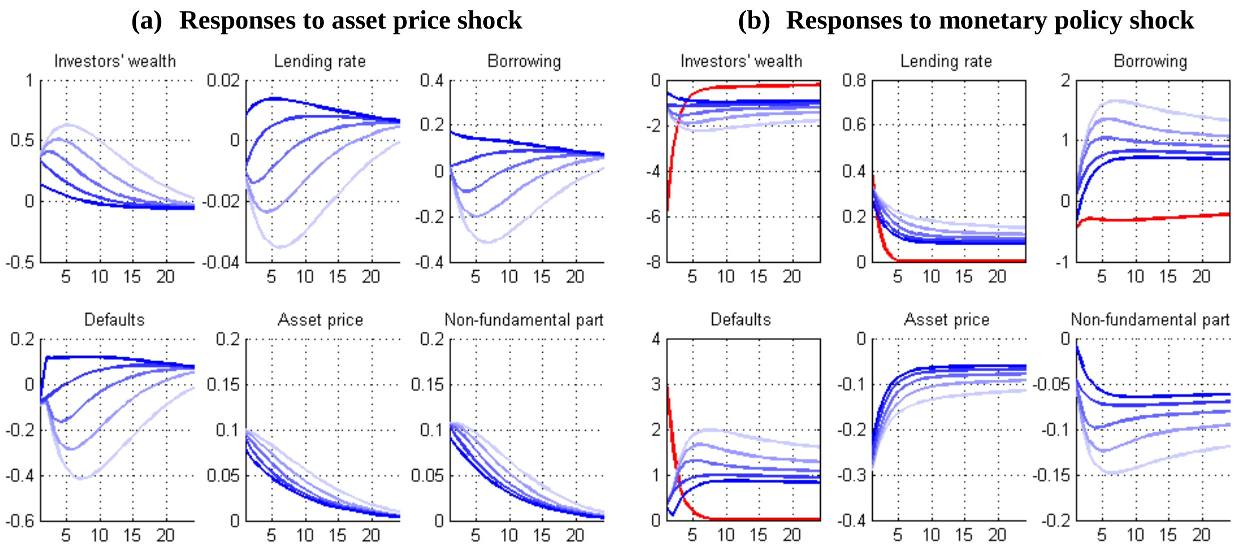
The financial crisis, its aftermath and the recent renewed upturn in selected asset prices has intensified the questions about the interconnectedness between asset prices, their non-fundamental components and financial sector conditions, and their implications for the real sector. In particular, monetary policy makers need to know how their actions affect asset prices and what implications this may have. This paper aims to address these questions.

We investigate the role of asset prices and their non-fundamental component in the credit cycle. The proposed model features a financial sector consisting of households depositing savings in banks, which in turn lend to investors to finance purchases of risky assets consisting of claims on the returns on capital of firms. Analogously to Allen and Gale (2000), risky assets (such as corporate shares) are shown to be overvalued if the investors in these assets possess limited liability and can thus default whenever returns on their investment are low. Limited liability shifts their preferred portfolio allocation towards overweighting of risky assets relative to the case of investing their own funds with full liability. This also causes leveraged investors to prefer idiosyncratic risk over diversification. The elevated risk-taking induces overpricing of risky assets, which in turn drives away any non-leveraged investors with asset valuations closer to fundamentals (provided that they are not able to short-sell) from the risky asset market. This risky asset market is embedded in a New Keynesian general equilibrium model with financial frictions inspired by Bernanke, Gertler and Gilchrist (1999), which enables monetary policy simulations. The core principle of the general equilibrium effects of overpriced assets (a bubble channel) follows the principle illustrated by Adrian and Shin (2010): if the overpriced assets appear on investors' balance sheets and can be used as collateral for further loans, the non-fundamental pricing has real effects on credit supply, investment and output. To this end, we analytically derive results for the model with risky assets with longer maturities, which affect investors'

[9] This article is based on Matějů and Kejak (2015).

balance sheets. We show that whenever the growth of the market for the risky asset maintains sufficient momentum, real variables, including investment and output, stay above the benchmark model of Bernanke, Gertler and Gilchrist (1999), but whenever the asset market slows down below a certain threshold, the real variables fall short of the benchmark.

Figure 1. Impulse responses of financial variables



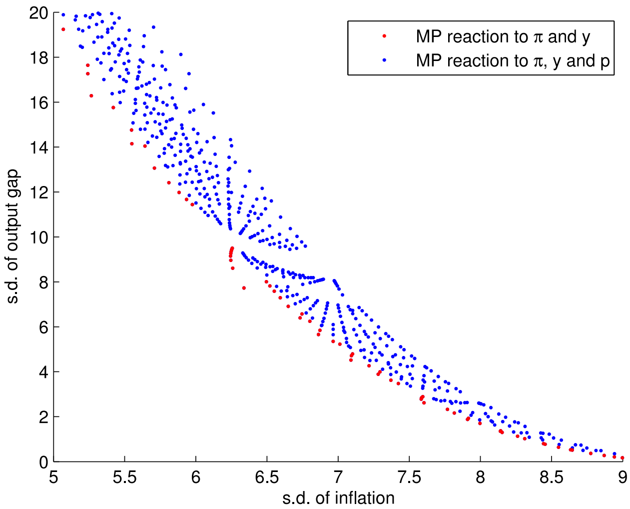
Note: Impulse responses to a monetary policy shock (to the nominal interest rate) of size 0.1, all in log-deviations from the respective steady-state values. The red line represents the responses from the Bernanke, Gertler and Gilchrist (1999) benchmark model (BGG); note that there are no counterparts to some of the financial variables in BGG, so the red line is missing from some of the subfigures. The darkest blue line represents the present model with single-period assets; lighter colours represent models with longer asset maturities (2 to 5 periods).

The simulations show that a positive shock to the non-fundamental component of asset prices triggers an upward phase of the credit cycle (Figure 1a). A positive asset price shock causes investors' wealth to expand, which temporarily pushes down lending rates and the amount of credit investors need to borrow against uncertain returns. However, the credit boom lasts only while stock market growth maintains sufficient momentum. After several periods, when the immediate expansionary impact of stock market growth fades out, the lending rates, the amount of necessary risky loans and the fraction of defaulting investors rise above their steady-state values. Output and investment respond to a positive asset price shock by increasing, while consumption picks up after an initial decline.

In response to a restrictive monetary policy shock, both the fundamental and non-fundamental components of asset prices rise, as does the lending rate and the amount investors need to borrow (Figure 1b). On the real side, consumption, output and inflation fall similarly to the benchmark model. However, the response of capital returns and investment is much weaker, and investors' wealth responds in a different manner – the response is less pronounced at the start, but more persistent and hump-shaped when risky assets are used as collateral. This suggests that non-fundamental prices work as a shock absorber in the short run: the price of risky assets has a counter-cyclical effect on the wedge between capital returns and the risk-free rate, thereby cushioning the impact of exogenous shocks, including monetary policy. At first glance, this observation may appear to be at odds with common perceptions. However, the effect is based on the fact that leveraged investors are residual claimants of the profits generated by financial intermediation in the model. As a result, they have a cushion of profits to adjust when a negative shock hits, contributing to financial fragility (an increased default rate) afterwards.

Finally, the simulations (Figure 2) show that incorporating asset prices or their non-fundamental component into various definitions of the monetary policy reaction function does not lead to lower volatilities of inflation and the output gap, a result consistent with the findings in previous literature using different methods. This suggests that monetary policy should not react to asset prices beyond their impact on the inflation and output forecast.

Figure 2. Monetary policy efficiency and reaction to asset prices



Note: The vertical and horizontal lines show the standard deviation (s.d.) of the output gap (y) and inflation (π) respectively, both in percentage deviations from the steady state, when monetary policy reacts to π and y compared to when it also adds asset prices (p) to the reaction function. The reaction parameters are in the range (0,1), except for the low values of the inflation reaction parameter, which do not ensure determinacy. Based on 1,000 simulations.

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Monetary Policy and Macroprudential Policy: Rivals or Teammates?[10]

Simona Malovaná[a] and Jan Frait[a,b,c]

[a] Czech National Bank

[b] Institute of Economic Studies, Charles University in Prague

[c] University of Finance and Administration, Prague

Following the economic and financial crisis of 2008–2013, it has been accepted that price stability alone is not enough for maintaining financial stability. In this context, there has been renewed discussion about whether the central bank should take risks to financial stability into account in setting its monetary policy tools even when the current forecast does not indicate any risks to price stability over the monetary policy horizon (Woodford, 2012). A consensus on this issue has not been reached so far.

The incorporation of macroprudential policy into the framework for the functioning of central banks has given rise to new questions regarding the form of coordination between macroprudential and monetary policy. The need for such coordination stems from the observation that monetary and macroprudential policy tools are not independent, as they affect both the monetary and credit conditions via their effect on credit growth. At the same time, the best economic outcomes can be expected if the two policies are used in a complementary manner (Agénor et al., 2014). However, in some situations the desired complementarity can be achieved by the two policies working in opposite directions, while in other situations it may be desirable for them to act in the same direction. This makes it necessary to analyse their interactions at different stages of the financial and business cycle and to coordinate them where appropriate (Borio, 2014).

We study the extent to which monetary policy may contribute to a build-up of financial vulnerabilities and the effect of macroprudential capital regulation on the macroeconomy and the credit cycle. Methodologically, we use a time-varying coefficient panel VAR model capable of estimating dynamic interdependencies. Since the number of coefficients for estimation rapidly increases with the number of countries, variables and time periods, we reformulate the model into a parsimonious one using much lower-dimension common factors. The factors are intended to capture components in the coefficient vector which are common in some way, for example,

[10] This article is based on Malovaná and Frait (2016).

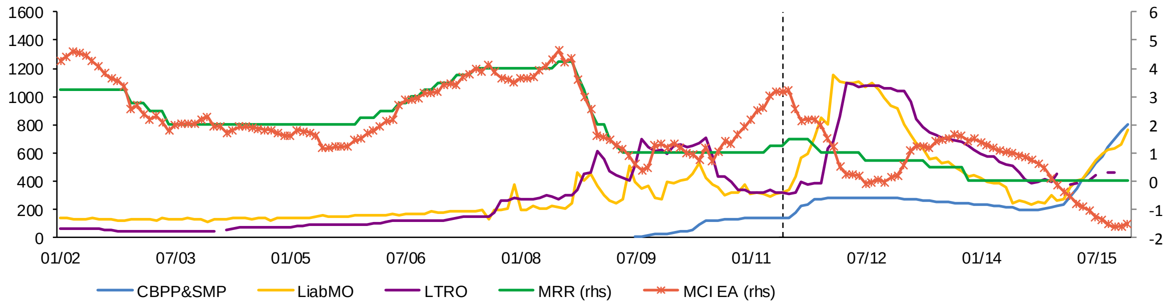
across units, variables, lags or groups thereof. We take a Bayesian approach to estimating the model, with an inverse Wishart prior distribution for covariance matrices. The posterior quantities are obtained using the Gibbs sampler.

Macroprudential capital regulation is proxied by the non-risk-weighted bank capital ratio. Such an analysis, however, is associated with a high degree of uncertainty, since macroprudential policy tools have only recently started to be used actively in many countries and we have very few observations for a proper estimation. The time-varying framework may help us partially overcome this problem, as we can focus on the more recent period. However, the estimation is still also based on the period when no or limited macroprudential tools were applied.[11] Another potential weakness of our analysis is the fact that changes in the aggregate measure of capital may reflect other things in addition to regulatory changes.

Monetary policy is proxied by a monetary conditions index (MCI) estimated using dynamic factor analysis and representing both conventional and unconventional monetary policy (see Figure 1). Therefore, it is more suitable for studying monetary policy changes than policy rates, which have reached their lower bounds in recent years. Before the global financial crisis and before the period of strong monetary easing, the MCI for both the euro area and the Czech Republic closely tracks interest rates, especially the main policy rates. Afterwards, it starts to deviate from them due to unconventional measures

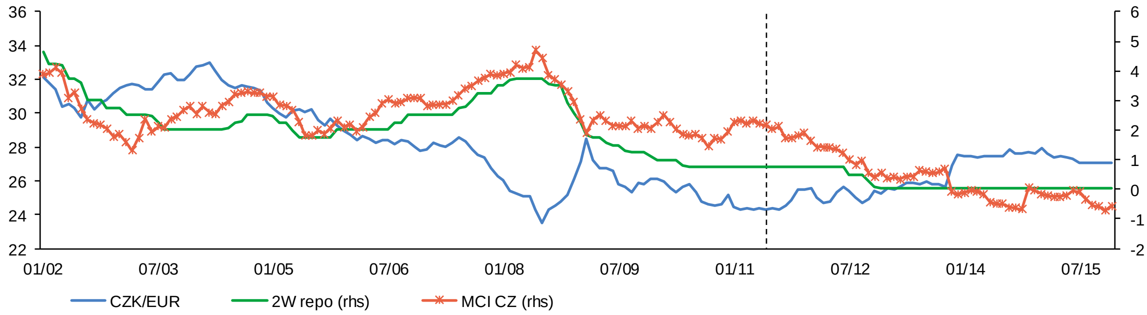
Figure 1. Monetary conditions index

(a) Euro area (EUR billions; right-hand scale in %)



[11] In this respect the analysis is subject to the Lucas critique.

(b) Czech Republic (right-hand scale in %)



Note: The monetary indexes are standardised; an increase means tightening of the monetary conditions. The vertical line indicates the beginning of the period of pronounced monetary easing. It refers to the point in the estimated impulse response functions (see below) where the monetary policy shock starts to have a stronger impact. CBPP – Covered Bond Purchase Programme, SMP – Securities Markets Programme, LiabMO – Liabilities Related to Monetary Policy Operations, LTRO – Long Term Refinancing Operations, MRR – Main Refinancing Rate, 2W repo – 2-week repo rate.

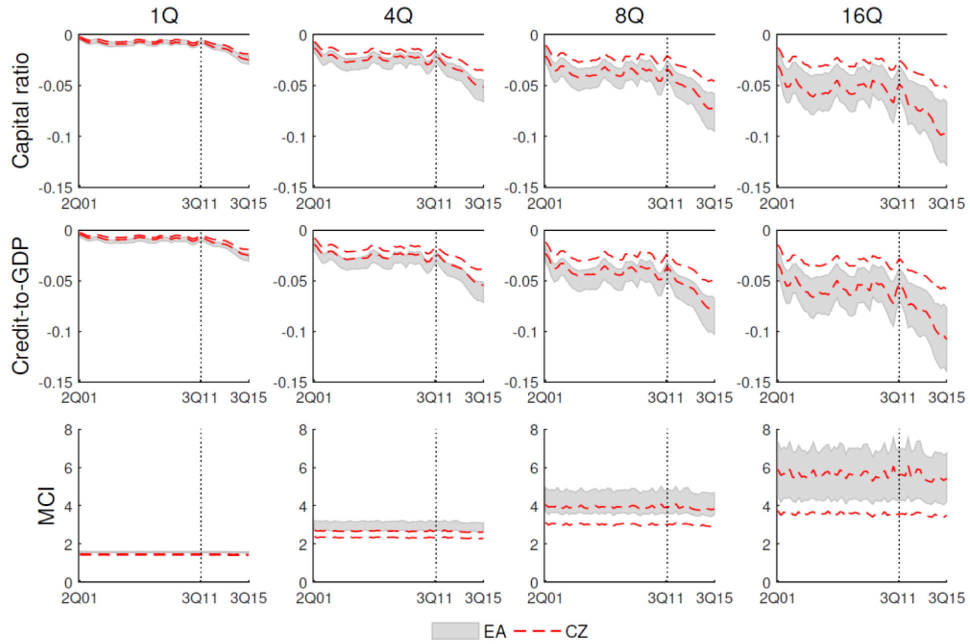
The sample covers the Czech Republic and five euro area countries – Germany, France, Italy, Belgium and Austria. This selection is purely pragmatic. Germany is the closest trading partner of the Czech Republic and the largest economy in Europe. Furthermore, the Czech banking system is mostly foreign owned, with parent companies mainly from France, Italy, Belgium and Austria. This set of euro area countries together account for about 70% of euro area banks' total assets and 72% of euro area GDP. This allows us to study possible spillover from abroad to the Czech economy, capture interdependencies and compare the dynamics of the Czech and closely related economies.

Using the proposed methodology, we identified a few patterns. First, monetary policy changes have a significantly larger effect on credit than GDP in the Czech Republic and the euro area countries. This supports the view that accommodative monetary policy contributes to a build-up of financial vulnerabilities, i.e. it boosts the credit cycle. Moreover, the effect has strengthened in recent years, indicating that a prolonged period of unusually low rates contributes to higher sensitivity of some financial variables to changes in monetary policy (see Figure 2).

The deepening of this effect may speed up the leveraging of the private sector, shift the economy to an expansionary phase of the credit cycle and compress the reaction time of macroprudential policy. While central banks' monetary policy independence enables them to deploy monetary tools quickly, it may take time for them to negotiate with other authorities, overcome political resistance or change the law before they can apply macroprudential policy tools. The delay in the final effect itself adds to the delay in implementation. If the macroprudential policy reaction time is significantly compressed, this policy may not have the capacity to act preventively and minimise potential losses.

From the conceptual perspective, the right response in such a situation is to tighten macroprudential policy, as there is an increasing risk of households and firms becoming overleveraged and the financial sector becoming more vulnerable. If this step is ineffective, the monetary policy authority may be faced with the dilemma of whether to support the achievement of the financial stability objective by preventively tightening the monetary conditions at the cost of missing the inflation target in the short run, i.e. whether to "lean against the wind"'.

Figure 2. Cumulative impulse responses – shock to the MCI

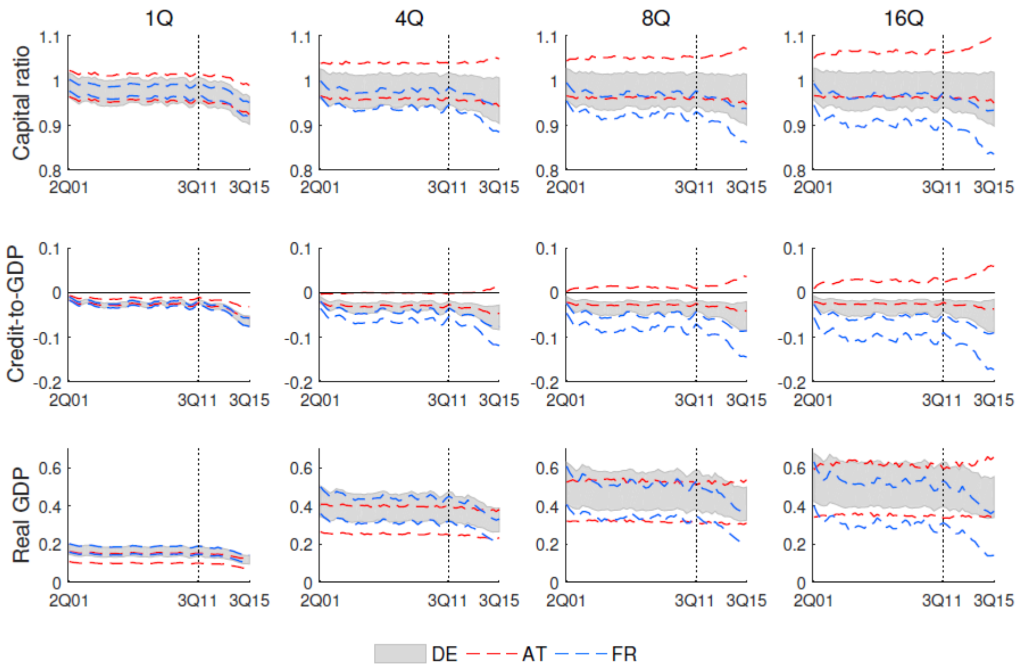


Note: Responses after 1, 4, 8 and 16 quarters to a 1 pp shock; 32th and 68th percentiles of the distribution reported. Except for the monetary policy proxies, the variables are in quarter-on-quarter changes, annualised.

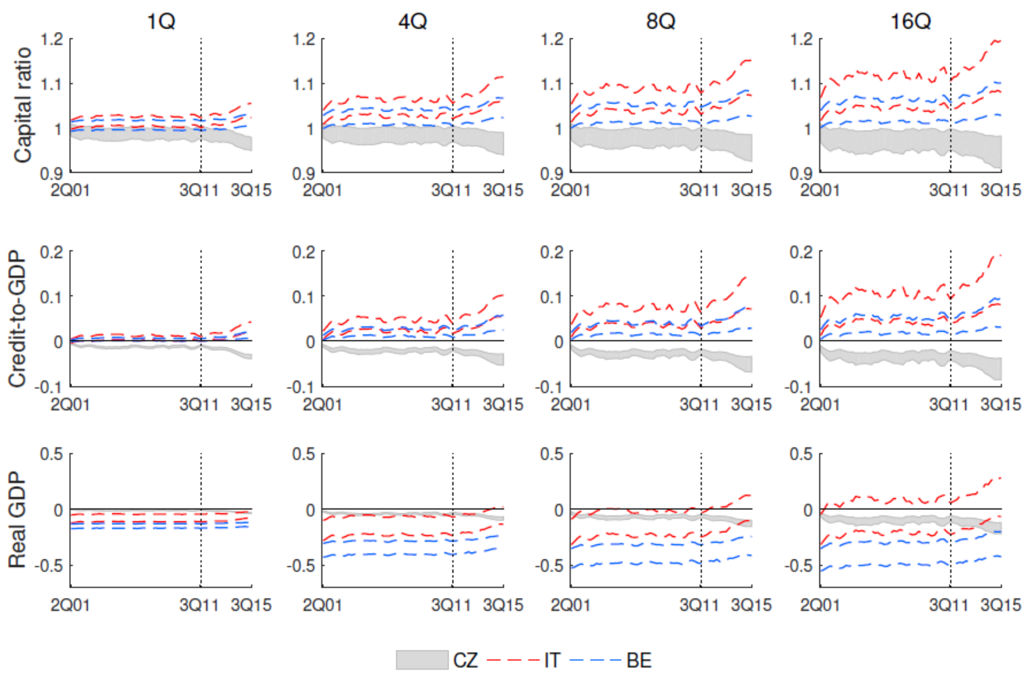
Third, the response to the higher bank capital ratio differs considerably across countries. We observe both a counter-cyclical and pro-cyclical impact with respect to credit-to-GDP and real GDP growth (see Figure 3). This may be a result, for example, of the omission of non-bank lenders or a lack of observations of when macroprudential capital regulation was actively used. All in all, the effect is associated with some degree of uncertainty.

Figure 3. Cumulative impulse responses – shock to the bank capital ratio

(a) Germany, Austria, France



(b) Czech Republic, Italy, Belgium



Note: Responses after 1, 8 and 16 quarters to a 1 pp shock at Q = 0; 32th and 68th percentiles of the distribution reported. Except for the monetary policy proxies, the variables are in quarter-on-quarter changes, annualised.

Given the presented findings, the conduct of monetary policy should not be completely separated from that of macroprudential policy. As suggested by the estimated impulse responses, a prolonged period of monetary easing increases the sensitivity of banks to a subsequent monetary tightening. On the other hand, the effect of macroprudential capital regulation is associated with uncertainty. Therefore, it is desirable to discuss and coordinate changes in monetary policy in both directions to avoid potential surprises and conflicts. Information sharing between the two policy areas in the central bank (or between the two authorities if the policies are conducted separately) and coordination of the two policies are necessary to avoid an inappropriate policy mix preventing effective achievement of the main objective of each authority.

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Czech National Bank
Economic Research Department
Na Příkopě 28, 115 03 Prague 1
Czech Republic
tel.: +420 2 2441 2321
fax: +420 2 2441 4278
http://www.cnb.cz
e-mail: research@cnb.cz