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Risk-Sensitive Capital Regulation

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EDITORIAL

The current regulatory framework allows banks to use the standardised (STA) approach and the internal ratings based (IRB) approach for the purposes of determining capital requirements for credit risk. While the STA approach takes into account the type of exposure, its external rating and the quality of collateral, the IRB approach is based on the internal ratings set by banks and takes into account the perceived risk of various asset classes in a given economic environment.

The main advantage of the IRB approach is the higher sensitivity of the capital requirement to the risk structure of the bank's assets. However, a number of international studies and regulatory authorities point to some drawbacks of risk-sensitive capital regulation leading potentially to inadequate risk assessment and coverage.

Given the complexity of the IRB approach, concerns have been expressed about the risk of insufficiently conservative models. In particular, there is significant heterogeneity in risk weight estimates across countries and banks, which means that each bank may assess the same risk to some extent differently. Another potential weakness of risk-sensitive capital regulation is its inherent procyclicality, which stems from the fact that credit risk is lowest at the peak and highest at the trough of the financial cycle. This may not be fully addressed by the approaches applied.

In response to these concerns, the Czech National Bank's economists have devoted time and effort to analysing the possible weaknesses of the IRB approach in the context of the Czech banking sector. The authors of the first article identify a significant impact of monetary policy conditions on banks' implicit risk weights under the IRB approach. This supports the existence of the risk-taking channel of monetary policy. In the second article, the authors show that the implicit risk weights under the IRB approach behave procyclically with respect to the financial cycle. The third article presents empirical research on the impact of additional capital requirements on banks' regulatory capital ratios. The author concludes that banks respond to requirements for a higher capital ratio not only by changing their overall capitalisation, but also by changing their average risk weights.

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IN THIS ISSUE

Does Monetary Policy Influence Banks' Perception of Risks?[1]

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In recent years, economists have been devoting considerable attention to the risk-taking channel of monetary policy, which postulates that a prolonged period of very accommodative monetary conditions can significantly influence the risk perceptions and risk tolerance of financial institutions (see, for example, Rajan, 2005; Gambacorta, 2009; Adrian and Shin, 2009; Borio and Zhu, 2012; Adrian and Liang, 2014; Dell'Ariccia et al., 2017). In the short run, a monetary policy easing may enhance the stability of banks, as low interest rates improve the overall quality of their loan portfolios. In the long run, on the other hand, low interest rates may encourage banks to raise both the size and the riskiness of their balance sheets in order to attain their original interest margins (the search-for-yield hypothesis; Rajan, 2005; Borio and Zhu, 2012; Adrian and Shin, 2009).

Another way in which accommodative monetary policy can induce financial institutions to take on more risk is through its impact on risk parameter estimates. These parameters enter the calculation of banks' capital requirements for credit risk, which is then reflected in banks' implicit risk weights[2] under the internal ratings-based (IRB) approach.[3] Low interest rates may facilitate a decline in the values of these parameters either directly or indirectly through their impact on collateral value and firms' valuation, income and cash flow (Gambacorta, 2009). For instance, low interest rates and increasing asset prices tend to reduce asset price volatility and increase collateral value, which, in turn, reduces risk perceptions and risk parameter estimates. Further, higher asset prices increase the value of a firm's equity relative to its debt and thus reduce its leverage. Such a firm looks safer and the risk of holding its shares seems lower. Consequently, a decline in risk parameter estimates translates into lower implicit risk weights,

[1] This article is based on Malovaná et al. (2017).

[2] For simplicity, we refer here to risk weights even though under the internal ratings-based approach the capital requirement is set for a given asset and the resulting risk weight is thus implicit (calculated as risk-weighted exposures divided by total assets).

[3] The current CRD IV/CRR regulatory framework allows the standardised approach (STA) and the internal ratings based (IRB) approach to be used for the purposes of determining capital requirements for credit risk. The STA approach takes into account the type of exposure, its external rating and the quality of collateral. The IRB approach is based on the internal rating set by banks and takes into account the perceived risk of various asset classes in a given economic environment.

leading, ceteris paribus, to a higher capital ratio. All in all, assuming an unchanged asset structure and constant risk, the bank can look safer and healthier without its level of capital actually increasing.

In this article, we analyse the extent to which monetary policy may affect banks' perception of credit risk and the way banks measure risk under the IRB approach. In other words, we look at the impact of monetary policy on banks' implicit risk weights while controlling for different bank-specific and macroeconomic factors. We draw on a panel data set covering quarterly data for 20 banks in the Czech Republic for the period 2003–2016.[4] We estimate a dynamic panel data model across different model specifications and monetary policy proxies, which provide a robust overview of the effect of monetary policy changes.[5]

In the Czech Republic, the IRB approach was adopted in the five largest universal banks and the majority of their subsidiaries in four waves starting in 2007 Q3. Their combined market share was approximately 80% as of 2016 Q4. All IRB banks also use the STA approach for a certain (usually very small) portion of their exposures. Figure 1 documents the evolution of the implicit risk weights of IRB and STA banks; it shows that the implicit risk weights for IRB banks started to fall simultaneously with the switch to the IRB approach, while those for STA banks began to decrease slowly a few quarters later. In the case of STA banks, the decline can be explained by a fall in the ratio of loans to total assets and a rise in the ratio of less risky exposures to the central bank. The fall in the implicit risk weights of IRB banks cannot be explained solely by the change in asset structure, so migration to the IRB approach also played a role.

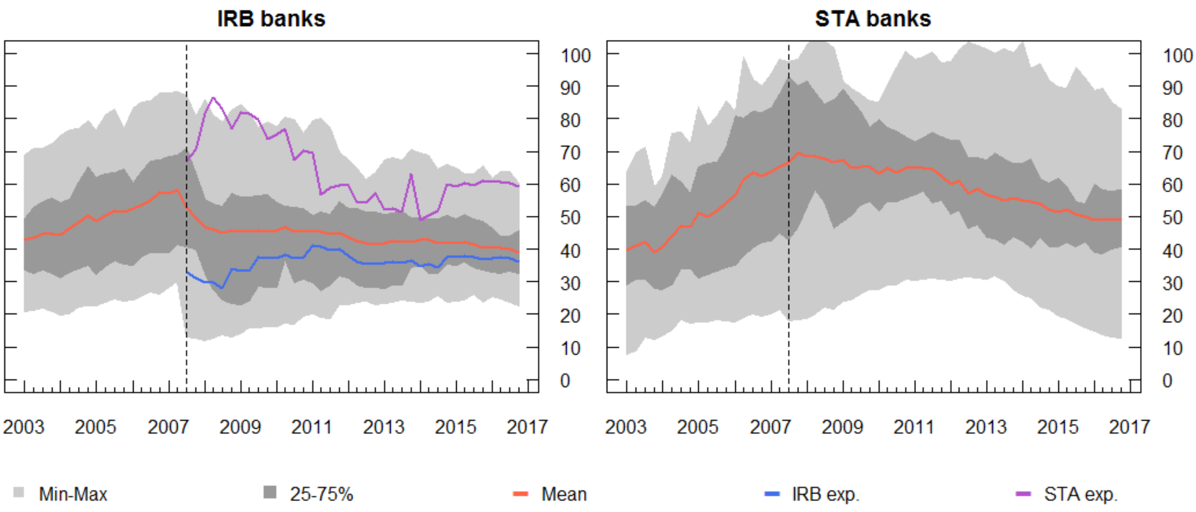
Regarding the monetary policy variable, we chose four indicators representing some of the most common measures used in the literature to account for the effect of both conventional and unconventional monetary policy and to overcome the problem of the zero lower bound on interest rates (see Figure 2).[6] We use a short-term interbank rate (specifically the 3-month Pribor), the shadow rate (SR) as suggested by Krippner (2012), the monetary conditions index (MCI) as estimated by Malovaná and Frait (2017) and the real monetary conditions index (RMCI) as proposed by CNB (2015). All the monetary policy indicators capture to some extent and on various scales the effect of the prolonged period of monetary policy easing in recent years.

[4] Additionally, Malovaná et al. (2017) present an extended analysis covering the Visegrad Four countries (the Czech Republic, Slovakia, Hungary and Poland).

[5] We estimate the dynamic panel data model using the bootstrap-based bias corrected LSDV estimator proposed by De Vos et al. (2015). Bias corrected estimators are more suitable for panels with a relatively high number of time periods and a relatively small number of individuals than the Generalised Method of Moments (GMM), which is usually used in similar types of analyses. Bias corrected estimators are shown to have superior small sample properties compared to GMM estimators; they maintain relatively small coefficient uncertainty while removing most of the bias.

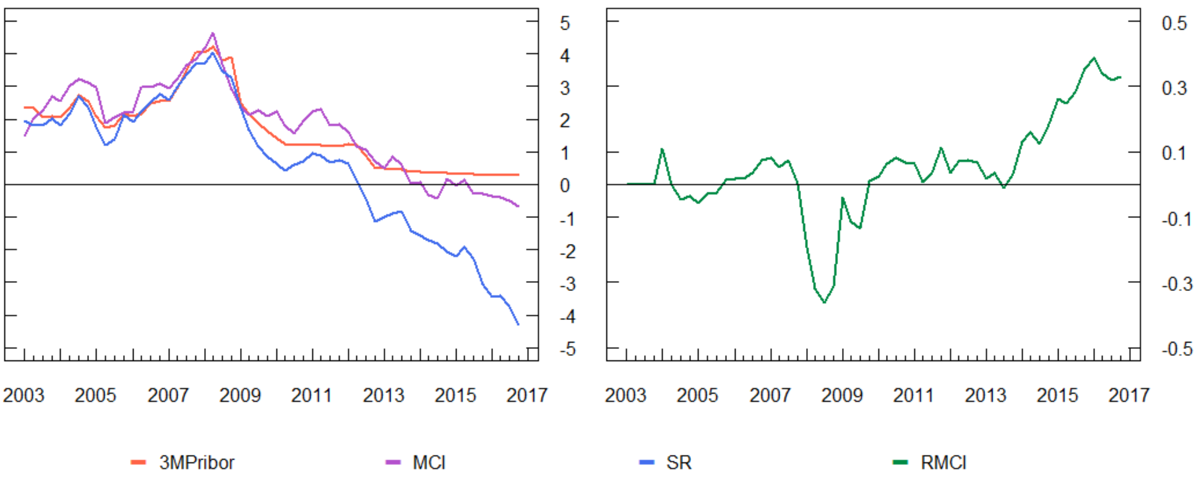
[6] The CNB operated with its monetary policy rates at the zero lower bound from November 2012 to the end of our data sample. It started to use the exchange rate as an unconventional monetary policy instrument within its inflation targeting regime in the form of a publicly declared, one-sided exchange rate commitment in November 2013 and decided to discontinue that commitment in April 2017. Given this, we provide some alternative measures that are informative of the monetary policy stance in such a situation.

Figure 1. Implicit risk weights – IRB and STA banks (%)



Note: Implicit risk weights are calculated as risk-weighted exposures divided by total assets; vertical line = 2007 Q3 (when five large or medium-sized banks started to use the IRB approach; three others followed a few quarters later; the last one started to use the IRB approach in 2011 Q1); IRB banks – banks using the IRB approach for at least some portion of their exposures as of 2016 Q4; STA banks – banks using solely the STA approach as of 2016 Q4. All IRB banks also use the STA approach for a certain portion of their exposures; therefore, we additionally distinguish between implicit risk weights calculated using the STA exposures of IRB banks (STA exp.) and the IRB exposures of IRB banks (IRB exp.).

Figure 2. Monetary policy indicators



Note: MCI – the monetary conditions index as estimated by Malovaná and Frait (2017); SR – the shadow rate as estimated by Krippner (2012); RMCI – the real monetary conditions index as estimated by CNB (2015); positive values of the RMCI refer to easy monetary conditions and negative values to tight monetary conditions.

We present robust evidence of the risk-taking channel in the Czech Republic for banks using the IRB approach. Specifically, we find a strong, statistically significant relationship between monetary policy easing and lower implicit risk weights of IRB banks, after controlling for banks' asset composition, a wide range of other bank-specific variables, the business cycle, and regulatory pressures (see columns 2 and 3 of Table 1). The effect is even stronger for banks mainly using the Advanced IRB approach, i.e. banks that are permitted to estimate not only their own value of probability of default, but also loss given default and exposure at default.

Interesting patterns emerge if we exclude the prolonged period of monetary easing and repeat the estimation exercise for IRB banks. We obtain evidence of the existence of the risk-taking channel once we include the period 2013–2016. Specifically, the relationship between monetary policy variables and implicit risk weights is statistically significant if we include these years and statistically insignificant if we exclude them (see Table 2).[7] We interpret this finding as meaning that the prolonged period of accommodative monetary conditions has been instrumental in establishing the risk-taking channel of monetary policy in the Czech Republic.[8]

The presented findings add to the stream of literature stressing that the effect of monetary policy on financial stability is not neutral. A great advantage of the IRB approach is that it allows for higher sensitivity of the capital requirements to the risk structure of banks' assets. Nevertheless, the IRB approach may also have significant weaknesses, including its dependence on historical data and its complexity. Such dependence may allow monetary policy to manifest itself through the estimated risk parameters and, consequently, banks' risk weights. Therefore, it is important to regularly assess whether the evolution and current level of risk weights give rise to any risk of underestimating (and potentially also overestimating) the necessary level of capital. The prudential authority should pay special attention to prolonged periods of low interest rates accompanied by signs of increased risk-taking, including a combination of excessive credit growth and asset price growth and a decline in risk weights.

Table 1. Baseline estimation results

	(1)		(2)		(3)	
Banks:	All		IRB		A-IRB	
Dependent variable:	RW		RW		RW IRB	
3-month Pribor	-0.047	(0.152)	0.696**	(0.269)	0.885***	(0.300)
Shadow rate	0.074	(0.085)	0.307**	(0.127)	0.382***	(0.135)
MCI	0.084	(0.126)	0.583***	(0.189)	0.721***	(0.190)
RMCI	-0.287	(0.968)	-3.469***	(1.189)	-2.451**	(1.223)
Observations	963/899		310		204	

Note: For the sake of brevity, only the coefficients on the monetary policy indicators, the standard errors and the significance levels are reported; the complete estimation results can be found in Malovaná et al. (2017). Bootstrapped standard errors are reported in parentheses; ***, ** and * denote the 1%, 5% and 10% significance levels. In the regression with the 3-month Pribor we additionally control for the slope of the yield curve. The lower number of observations in column 1 refers to the regression with the RMCI, which is available only from 2004 Q1.

[7] An additional estimation exercise excluding the year 2012 confirms this pattern; the coefficients on monetary policy proxies remain insignificant in all cases. However, this specification is based on only 130 observations and therefore needs to be taken with caution.

[8] For additional results and robustness analyses, see Malovaná et al. (2017).

Table 2. Estimation results – different time periods

	(1)	(2)	(3)	(4)	(5)
End of the sample:	2012 Q4	2013 Q4	2014 Q4	2015 Q4	2016 Q4
3-month Pribor	0.448	1.137***	1.177***	1.026***	0.696**
	(0.415)	(0.409)	(0.354)	(0.311)	(0.269)
Shadow rate	-0.027	0.558**	0.634***	0.531***	0.307**
	(0.298)	(0.278)	(0.208)	(0.166)	(0.127)
MCI	0.589	1.064***	0.890***	0.799***	0.583***
	(0.372)	(0.308)	(0.237)	(0.217)	(0.189)
RMCI	1.002	-1.072	-3.991**	-4.674***	-3.469***
	(1.735)	(1.819)	(1.789)	(1.464)	(1.189)
Observations	166	202	238	274	310

Note: See the note to Table 1.

References

Adrian, T. and N. Liang (2014): Monetary Policy, Financial Conditions, and Financial Stability. Staff Report 690, Federal Reserve Bank of New York.

Adrian, T. and H. Shin (2009): Financial Intermediaries and Monetary Economics. Staff Report 398, Federal Reserve Bank of New York.

Borio, C. and H. Zhu (2012): Capital Regulation, Risk-taking and Monetary Policy: A Missing Link in the Transmission Mechanism? *Journal of Financial Stability*, 8(4), 236–51.

CNB (2015): Inflation Report II/2015. Czech National Bank. ISSN 1804-2457.

De Vos, I., G. Everaert and I. Ruyssen (2015): Bootstrap-based Bias Correction and Inference for Dynamic Panels with Fixed Effects. *Stata Journal*, 15(4), 986–1018.

Dell’Ariccia, G., L. Laeven and A. A. Suarez (2017): Bank Leverage and Monetary Policy’s Risk-Taking Channel: Evidence from the United States. *Journal of Finance*, 72(2), 613–654.

Gambacorta, L. (2009): Monetary Policy and the Risk-taking Channel. BIS Quarterly Review, Bank for International Settlements.

Krippner, L. (2012): Modifying Gaussian Term Structure Models When Interest Rates Are Near the Zero Lower Bound. Reserve Bank of New Zealand Discussion Paper Series DP 2012/02, Reserve Bank of New Zealand.

Malovaná, S. and J. Frait (2017): Monetary Policy and Macroprudential Policy: Rivals or Teammates? *Journal of Financial Stability*, (32), 1–16.

Malovaná, S., Kolcunová, D. and V. Brož (2017): Does Monetary Policy Influence Banks’ Perception of Risks? CNB Working Paper No. 9/2017, Czech National Bank.

Rajan, R. (2005): Has Financial Development Made the World Riskier? Working Paper Series No. 11728, National Bureau of Economic Research.

Are Risk Weights of Banks in the Czech Republic Procyclical? Evidence from Wavelet Analysis[9]

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In this article, we analyse the cyclical behaviour of risk weights for credit exposures of banks in the Czech Republic.[10] Analyses of the behaviour of risk weights are essential for financial stability due to their direct interconnection with the calculation of banks' capital requirements (EBA, 2013; CNB, 2015). If risk weights behave procyclically, the effect of the cycle on the balance sheets of lending institutions may be amplified and the resilience of the financial system may be negatively influenced once the cycle turns.

The topic of procyclicality of risk weights is also connected to the fact that banks can use two approaches to measure credit risk – the standardised (STA) approach and the internal ratings-based (IRB) approach.[11] Under the IRB approach, the implicit risk weight of a given exposure should represent an unbiased measure of risk. However, there are two reasons why the IRB approach might imply procyclical behaviour of risk-weighted exposures and regulatory capital requirements. First, the changing quality of the bank's assets might affect the probability of default (PD)[12] and thus also the level of risk weights. As asset quality typically increases during an expansionary phase of the economic/financial cycle, PD might decrease and so might risk weights. The opposite occurs during a downturn in the economic/financial cycle.

[9] This article is based on Brož et al. (2017).

[10] A risk weight is calculated as the ratio of risk-weighted exposures to total exposures and can be understood as a measure of the risk relevant to a particular exposure/exposure category.

[11] Under the STA approach, risk weights are derived directly based on regulatory rules; the bank simply applies the relevant regulatory standards. In contrast, banks using the IRB approach determine risk weights on the basis of their own internal models, which are subject to the regulator's approval.

[12] PD – the probability of default – is a risk parameter that conveys the probability that the counterparty will be unable to meet its contractual obligations.

Second, procyclicality of risk weights under the IRB approach may be accentuated by too short a measurement of the actual financial cycle in banks' internal credit risk models. While the CRR[13] assumes that the cycle lasts for around 8 years, Borio (2014) shows it can be up to 20 years. During the expansion phase of the financial cycle, PD gradually decreases in line with the decline in the ratio of non-performing loans to total loans (NPL ratio), so banks' internal models might estimate the lowest PD value at the peak of the financial cycle, especially in the case of a long-running boom. At the same time, however, systemic risks accumulate, based on the paradox of financial instability (Borio and Drehmann, 2011). Banks using the IRB approach may thus demonstrate the lowest risk weights and the lowest absolute capital requirement when real risks are at their highest.

The goal of our analysis is to check for potential differences between the cyclical behaviour of the risk weights under the IRB and STA approaches with respect to the financial cycle.[14] From this point onwards, we consider risk weights to be procyclical if the time series comoves with the financial cycle in such a way that this relationship magnifies both booms and busts. Thus, we will interpret a negative correlation between the series of risk weights and the measure of the financial cycle as evidence of procyclicality of risk weights.

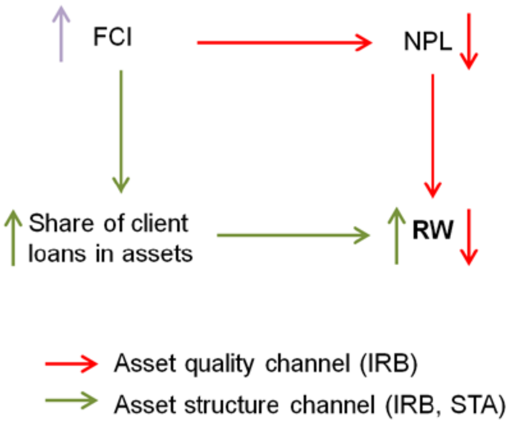
In line with the discussion above, we introduce two channels through which the financial cycle might influence risk weights – the asset structure channel and the asset quality channel (see Figure 1). In the case of the *asset structure channel*, a financial boom is generally reflected in an increasing share of client loans in total assets, i.e. we assume the asset structure changes relatively toward riskier exposures and this translates into an increase of risk weights under both the IRB and STA approaches. Contrary to that, we suppose that the *asset quality channel* should not matter equally for the two approaches. For the IRB approach, defaulted exposures enter the internal models and affect the PD of the entire loan portfolio. By contrast, in the case of the STA approach, only the PD of defaulted exposures is impacted. During a financial boom, the NPL ratio – which captures the quality of the assets banks hold – typically falls, and so do PD and IRB risk weights.

In the empirical analysis, we use quarterly data on banks in the Czech Republic in the period from 2008 to 2016. We primarily focus on the aggregate implicit risk weights for the entire banking sector and we explicitly distinguish between risk weights under the IRB approach and those under the STA approach. The financial cycle is represented by the Financial Cycle Indicator (FCI) constructed by Plašil et al. (2017) and used by the Czech National Bank. The asset quality channel is then represented by the NPL ratio and the asset structure channel by the share of client loans in total assets.

[13] CRR – the Capital Requirements Regulation – refers to Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms.

[14] In the full version of the article, we also study the behaviour of risk weights with respect to the business cycle and separately for different credit exposure classes. For more details, see Brož et al. (2017).

Figure 1. The effect of the financial cycle on risk weights through the asset quality and asset structure channels under the IRB and STA approaches

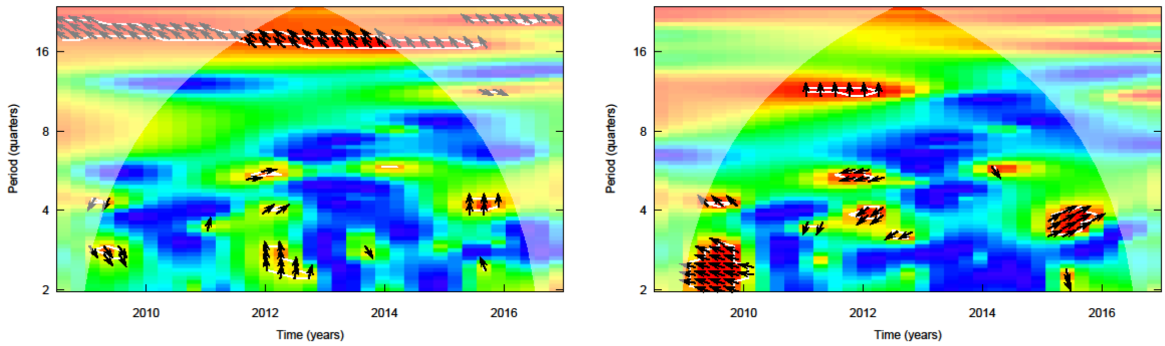


On the methodological level, we employ the wavelet coherence technique, which allows us to draw conclusions about the cyclicality of risk weights over the entire sample period, including potential changes in the nature of the correlation relationship. In other words, this tool reveals whether two time series are positively or negatively correlated in a certain time span and across several frequencies – which can be interpreted as procyclical or countercyclical behaviour. Wavelet analysis decomposes a time series into several components which tell us which cycles (short or long) are essential to the behaviour of the time series analysed. Moreover, thanks to the frequency dimension, we can determine the phase difference between the two time series at various frequencies, and phase differences can be understood as correlations. While simple correlation produces a single number only, the output of the wavelet coherence technique is a figure capturing the evolution of the correlation relationship between two series over time, across different frequencies and at a certain level of confidence.

Before the results are presented, we comment on the interpretation of the graphical outputs of wavelet analysis. Each figure contains two axes: the horizontal axis is the time axis, measured in years, while the vertical axis is the frequency axis, measured in quarters. The bottom part of the frequency axis measures the dependencies at high frequencies, i.e. it points to short cycles, while the upper part measures the dependencies at low frequencies, i.e. it points to longer cycles. Red colour shows the statistical significance of the dependencies at the 10% level of confidence. As for the arrows, those pointing to the right show that the time series are positively correlated at the particular time and frequency, while those pointing to the left show that they are negatively correlated. The shaded area at the edges indicates results that should be interpreted with caution, as they are less reliable given the fact that the time series is artificially extended at the edges.

As for the comovement of risk weights with the FCI indicator, we obtain a notable contrast between the IRB and STA approaches (see Figure 2). The aggregate risk weights for total exposures under the STA approach are insensitive to the financial cycle, which is in line with EBA (2013, 2016). However, the risk weights for the IRB approach exhibit a negative dependence on the FCI measure at a frequency of around 16 quarters (4 years) over almost the entire sample period, i.e. they are procyclical with respect to the financial cycle. The duration of the dependence reveals that the relationship between the two time series is longer-lasting, as it holds both for the period when the financial cycle was subsiding (until 2010) and for its expansionary phase (since 2011).[15] We find the same results of procyclicality with respect to the financial cycle for risk weights of retail exposures under the IRB approach and the FCI measure (for more details, see Brož et al., 2017). From the point of view of financial stability, this result is relevant, as retail exposures also include exposures secured by real estate collateral and this category of exposures deserves increased scrutiny because of its recent evolution in the Czech Republic (CNB, 2017).

Figure 2. Wavelet coherence plots for the aggregate risk weights of total exposures and the Financial Cycle Indicator

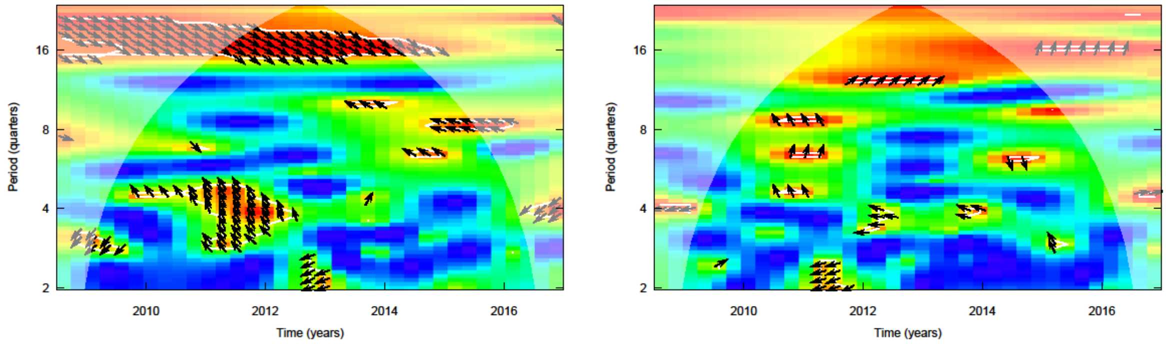


(a) IRB approach (b) STA approach

Regarding the two asset channels introduced in Figure 1, we obtain results that are consistent with our expectations. The asset quality channel is relevant only for the IRB approach (a strong, predominantly positive correlation between the implicit risk weights under the IRB approach and the NPL ratio; see Figure 3). The asset structure channel is stronger for the STA approach (a positive correlation between the implicit risk weights under the STA approach and the share of client loans in total assets; see Figure 4). At the same time, risk weights under the STA approach are ultimately almost insensitive to the financial cycle. Based on that, we can claim that the asset quality channel seems to be the one fostering the procyclicality of risk weights under the IRB approach with respect to the financial cycle.

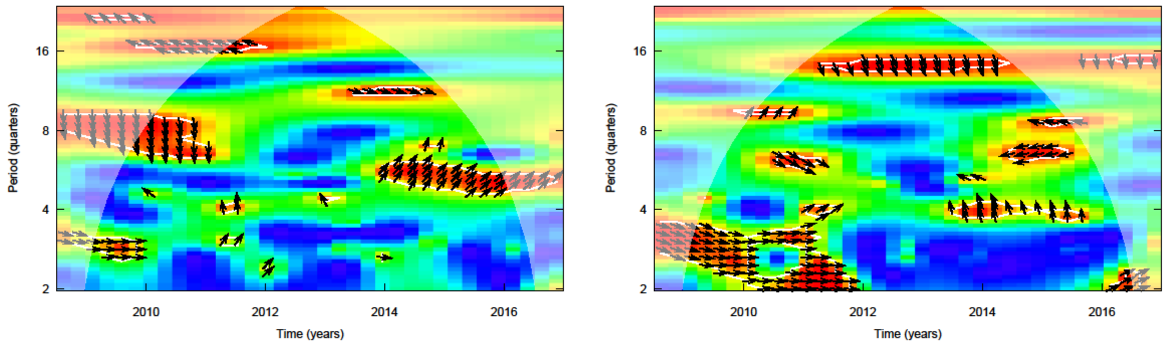
[15] We do not find procyclicality of implicit risk weights with respect to the business cycle under either the IRB approach or the STA approach (for more details, see Brož et al., 2017). We thus obtain some differences in the cyclical behaviour of risk weights under the two regulatory approaches, in line with the academic literature.

Figure 3. Wavelet coherence plots for the aggregate risk weights of total exposures and the NPL ratio



(a) IRB approach (b) STA approach

Figure 4. Wavelet coherence plots for the aggregate risk weights of total exposures and the share of client loans in total assets



(a) IRB approach (b) STA approach

References

Behn, M., R. Haselmann and P. Wachtel (2016): Procyclical Capital Regulation and Lending. *Journal of Finance*, 71(2), 919–956.

Borio, C. (2014): The Financial Cycle and Macroeconomics: What Have We Learnt? *Journal of Banking & Finance*, 45, 182–198.

Borio, C. and M. Drehmann (2011): Toward an Operational Framework for Financial Stability: Fuzzy Measurement and its Consequences. *Central Banking, Analysis, and Economic Policies Book Series*, 15, 63–123.

Brož, V., Pfeifer, L. and D. Kolcunová (2017): Are the Risk Weights of Banks in the Czech Republic Procyclical? Evidence from Wavelet Analysis. CNB Working Paper No. 15/2017.

Cizel, J., H. A. Rijken, E. I. Altman and P. Wierts (2017): Assessing Basel III Capital Ratios: Do Risk Weights Matter? http://pages.stern.nyu.edu/~ealtman/Assessing%20Basel%20III%20Capital%20Ratios.pdf (retrieved 20 March 2018).

CNB (2015): Financial Stability Report 2014/2015. Czech National Bank.

CNB (2017): Financial Stability Report 2016/2017. Czech National Bank.

EBA (2013): Summary Report on the Comparability and Pro-cyclicality of Capital Requirements under the Internal Ratings Based Approach in Accordance with Article 502 of the Capital Requirements Regulation. December 2013, European Banking Authority.

EBA (2016): Cyclicality of Capital Requirements. European Banking Authority.

Mariathasan, M. and O. Merrouche (2014): The Manipulation of Basel Risk-weights. *Journal of Financial Intermediation*, 23(3), 300–321.

Plašil, M., Seidler, J., Hlaváč, P. and T. Konečný (2014): An Indicator of the Financial Cycle in the Czech Economy. CNB Financial Stability Report 2013/2014, Czech National Bank.

Banks' Capital Surplus and the Impact of Additional Capital Requirements[16]

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For almost three decades, the Czech banking sector has been subject to prudential regulation. This has included formal capital requirements designed to maintain the resilience of the banking sector and its capacity to absorb financial and economic shocks.[17] Banks frequently argue that extra capital requirements reduce their ability to expand their business because equity is more expensive than debt. It would therefore be natural to expect banks to operate with their regulatory capital close to the minimum requirements. Nevertheless, banks in the Czech Republic have maintained their total regulatory capital ratios well in excess of the regulatory minima. The aggregated capital surplus of the domestic banking sector relative to the overall capital requirements[18] was CZK 80 billion (3.3% of risk-weighted exposures) as of 2016 Q4.[19] Most banks are compliant with these requirements by a sufficient margin on an individual basis as well (see Figure 1).[20]

Banks may experience a capital surplus for various reasons. They can build up an intentional capital surplus to hedge against having to raise new equity at short notice, which might entail significant transaction costs or share price reductions (Ayuso et al., 2004; Peura and Keppo, 2006). Banks might be willing to hold more capital in order to match planned future asset

[16] This article is based on Malovaná (2017).

[17] The current rules can be found in the act implementing Basel III in Europe: the CRD IV/CRR regulatory framework.

[18] The overall capital requirements consist of the Pillar 1 capital requirement, additional Pillar 2 capital requirements and capital buffers. The Czech National Bank currently applies three capital buffers – a conservation buffer (2.5% since July 2014), a systemic risk buffer (1%–3% for some banks since October 2014) and a countercyclical capital buffer (0.5% since January 2017, 1% since July 2018 and 1.25% since January 2019). It has also set an additional Pillar 2 requirement since 2014 Q1 (1.6% on aggregate as of 2016 Q4). Pillar 2 add-ons have been set for banks for which supervisory colleges have been established. The analysis draws on quarterly bank-level data for 14 banks and bank groups between 2002 Q4 and 2016 Q4.

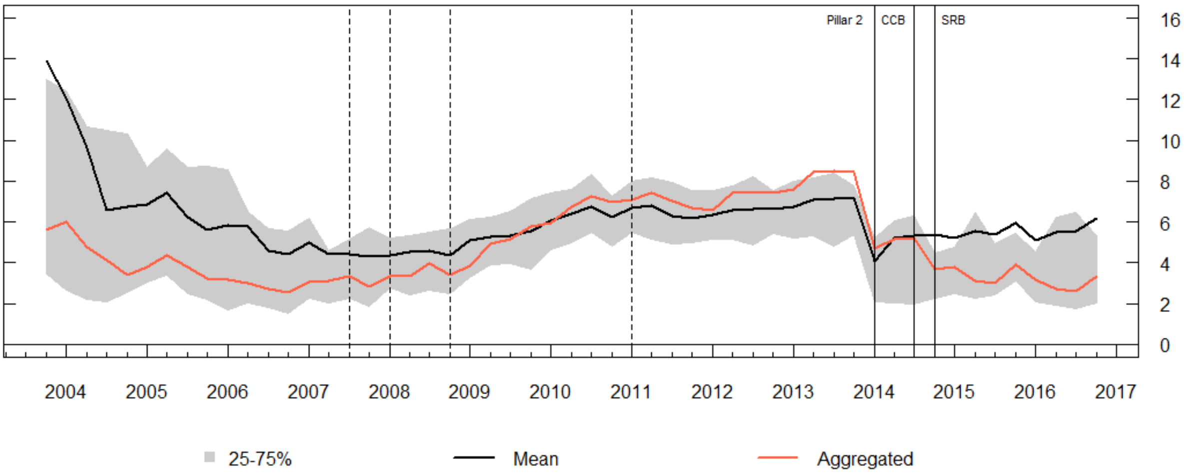
[19] Calculated on a consolidated basis.

[20] Maintaining capital in excess of the minimum regulatory requirements is not solely a phenomenon of the Czech banking sector, but has also been observed in other countries around the world (Berger et al., 2008; Brewer et al., 2008; Flannery and Rangan, 2008; Gropp and Heider, 2010; Berrospide and Edge, 2010).

expansions or changes in asset structure. They will tend to hold additional capital if they expect an increase in the additional capital requirements in the near future. More risk averse banks with volatile earnings are also more likely to build up additional surpluses than less risk averse banks with stable earnings streams (Gale and Ogur, 2005).

In all these cases, the higher capital ratio would be set as an explicit bank-specific target. However, it is also relatively easy to maintain or increase capital when earnings are high. Since dividend payments tend to be sticky, capital ratios may rise almost automatically in a situation of high earnings. According to this view, today's high bank capital ratios were not explicitly targeted, but simply reflect a long run of high profits (Myers and Majluf, 1984; Berger et al., 2008). Combining the two views, the difference between the target capital ratio and the overall capital requirement can be regarded as an intentional capital surplus and the difference between the total regulatory capital ratio and the target capital ratio as an unintentional capital surplus. The sum of the two would then form the total capital surplus.

Figure 1. Total capital surplus (% of risk-weighted exposures)

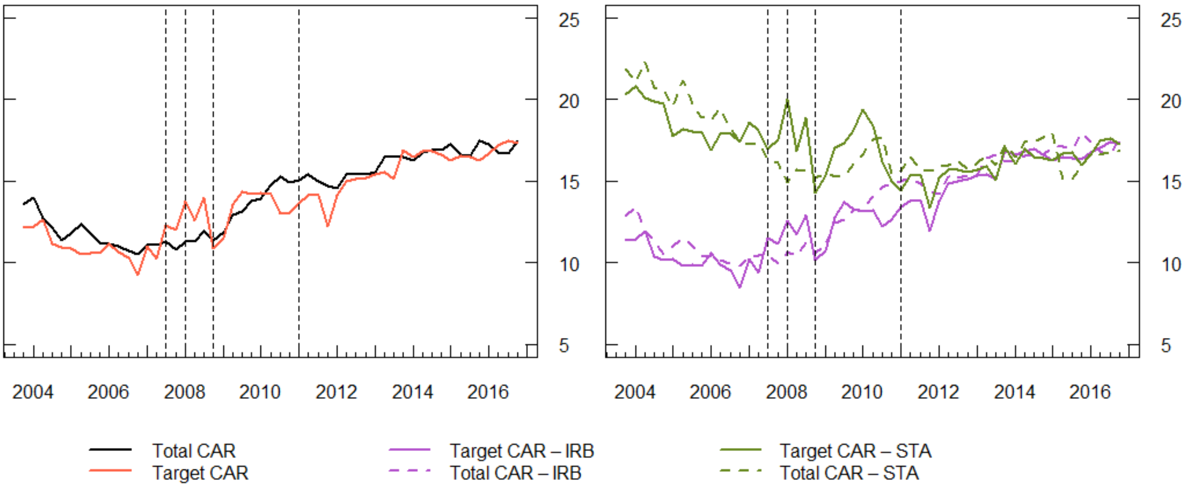


Note: The total capital surplus is calculated on a consolidated basis as total regulatory capital net of overall capital requirements (Pillar 1 capital requirement + additional Pillar 2 capital requirement + combined buffer requirement) over risk-weighted exposures. Dashed vertical lines – switches to the internal ratings-based approach (five banks/bank groups in four waves); solid vertical lines – additional capital requirements stemming from capital buffers (capital conservation buffer, CCB, and systemic risk buffer, SRB) and Pillar 2 add-ons.

Maintaining capital surpluses and the underlying motives for this behaviour have important policy implications. In particular, an increase in the additional capital requirements might be expected to have a limited effect on banks' capitalisation if banks have a high capital surplus, simply because they would use the extra capital and shrink the surplus. But if banks intentionally target higher capital ratios than the level required by their regulator and form an intentional capital surplus, additional capital requirements could actually lead them to increase their overall capitalisation in an effort to preserve the existing surplus. It is therefore important to distinguish between intentionally and unintentionally formed capital surpluses and to analyse the effect of capital regulation on each of them separately.

In the first part of the analysis, bank-specific target capital ratios are estimated using a standard partial adjustment model. The estimation results indicate that domestic banks cannot be regarded as either active or passive managers of their capital. While the overall speed of adjustment from the total capital ratio towards the target capital ratio seems to be rather high and above the average values reported in the literature, the contribution of the adjustment in the level of capital is one-half, which is a below-average value. In other words, a substantial portion of this adjustment can be attributed to changes in risk-weighted exposures (through a combination of changes in portfolio size, structure and risk). Figure 2 compares the estimated target capital ratio with the actual total capital ratio of banks in the Czech Republic. It reveals that the path of the target capital ratio is determined predominantly by IRB banks (approximately 80% of the total assets of the whole banking sector as of 2016 Q4). The estimated target ratio reflects the switch of some banks to the IRB approach between 2007 Q3 and 2008 Q4: the decline in risk weights following this switch pushed the target temporarily above the actual ratio, but it returned below it very quickly.

Figure 2. Total regulatory and target capital ratios (%)



Note: The target capital ratio is calculated using the coefficient estimates of model (2) from Table 2 in Malovaná (2017). Vertical lines – switches to the internal ratings-based approach (five banks/bank groups in four waves). IRB banks – banks using the IRB approach for at least some portion of their exposures as of 2016 Q4; STA banks – banks using solely the STA approach as of 2016 Q4.

In the second part of the analysis, the impact of additional capital requirements stemming from capital buffers and Pillar 2 add-ons is analysed using a dynamic panel data model. The evidence implies that banks shrink their capital surplus in response to an increase in the additional capital requirements (see column 2 of Table 1). Along with that, banks slightly revise both the target and the total regulatory capital ratio (compare columns 1 and 2).

To give some guide to the contribution of changes in risk weights and capital, the model is re-estimated separately with the numerator and the denominator of the dependent variables, each of them as a share of total assets. It is apparent that higher additional capital requirements have a strong negative and significant effect on banks' risk weights: a 1 pp increase translates on average to a 0.55 pp short-run decrease and a 1.38 pp long-run[21] decrease in risk weights (see column 5). The impact on the *non-risk-weighted* capital surplus is of the same direction as the impact on its risk-weighted peer, but the strength shrinks to roughly 50% (see columns 3 and 4).

[21] The long-run effect is calculated as $\beta/(1-\alpha)$, where β is the coefficient on the overall capital requirements (the short-term response) and α is the autoregressive coefficient.

Table 1. Estimation results – impact of additional higher capital requirements

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	CAR	ICS	CA	ICSnrw	RW
Dependent variable (t-1)	0.839***	0.061	0.682***	0.044	0.603***
	(0.035)	(0.057)	(0.066)	(0.062)	(0.088)
Overall capital requirements (t-1)	0.096***	-0.762***	0.079***	-0.394***	-0.550**
	(0.025)	(0.063)	(0.022)	(0.065)	(0.219)
ROA (t-1)	0.132	1.052***	-0.0751	1.170***	-0.277
	(0.188)	(0.264)	(0.116)	(0.209)	(0.600)
Log(assets) (t-1)	0.154	-0.997**	-0.102	-0.614	-2.005
	(0.343)	(0.412)	(0.197)	(0.423)	(2.958)
Loan loss provisions/assets (t-1)	0.104	-0.152	0.336**	-0.052	-3.249**
	(0.187)	(0.313)	(0.136)	(0.212)	(1.349)
Mortgage loans/assets (t-1)	0.017	0.168***	0.014	0.062	0.064
	(0.031)	(0.044)	(0.029)	(0.045)	(0.157)
Other retail loans/assets (t-1)	-0.078**	-0.256***	-0.119*	-0.107	0.685**
	(0.038)	(0.082)	(0.067)	(0.065)	(0.285)
Corporate loans (t-1)	0.016	-0.029	-0.028	-0.005	0.126
	(0.024)	(0.024)	(0.030)	(0.023)	(0.108)
IRB	0.370	3.453***	0.489	2.130***	-2.657*
	(0.253)	(0.34)	(0.376)	(0.432)	(1.53)
VIX	0.000	-0.071***	-0.005	-0.047***	0.000
	(0.009)	(0.007)	(0.005)	(0.009)	(0.040)
Crisis	0.175	-1.185***	0.180	-0.782***	-1.587
	(0.259)	(0.191)	(0.256)	(0.193)	(1.845)
Real GDP growth	-0.014	-0.214***	-0.011	-0.140***	0.036
	(0.024)	(0.024)	(0.030)	(0.027)	(0.165)
CA					1.737***
					(0.541)
RW			0.071***	0.037*	
			-0.021	(0.019)	
Observations	363	363	363	363	363

Note: This table presents the bootstrap corrected dynamic fixed-effect regression (De Vos et al., 2015) estimates. For each model, 300 iterations are produced and 250 are used for the final inference. The sample period is from 2002 Q4 to 2016 Q4 and covers seven banks, with some variation in the overall capital requirements stemming from Pillar 2 add-ons and capital buffers. Bootstrapped standard errors are reported in parentheses; ***, ** and * denote the 1%, 5% and 10% significance levels. Fixed effects are not reported. CAR – total regulatory capital ratio, i.e. regulatory capital over risk-weighted exposures; ICS – intentional capital surplus/shortfall calculated as difference between target capital ratio and overall capital requirement; CA – regulatory capital over total assets; ICSnrw – non-risk-weighted intentional capital surplus/shortfall, i.e. intentional capital surplus/shortfall over total assets; CA – regulatory capital over total assets; RW – implicit risk weights calculated as risk-weighted exposures over total assets. For more details see Malovaná (2017).

The presented findings have important policy implications. In particular, the pass-through from an increase in the additional capital requirements to the total regulatory and target capital ratios is incomplete. A substantial portion of the change seems to be delivered through changes in average risk weights. Banks may adjust risk weights through a combination of changes in asset structure and risk estimates (under the internal ratings-based approach). Each of the two options has a totally different interpretation and different implications for the prudential authority. The former would imply that the bank actually shifts the portfolio to less risky assets, i.e. it optimises the portfolio risk with respect to its capital (Flannery and Rangan, 2008). The latter would imply that the bank starts to see the same asset as less risky immediately after the increase in the additional capital requirements. This could be attributed to strategic risk-modelling by banks (i.e. risk-weight manipulation; see Mariathasan and Merrouche, 2014). It is beyond the scope of this article to distinguish between these two effects, but it is important to bear in mind these different possible transmission channels and to regularly assess whether the evolution and current level of risk weights give rise to any risk of underestimating the necessary level of capital.

References

Ayuso, J., D. Pérez and J. Saurina (2004): Are Capital Buffers Pro-cyclical? Evidence from Spanish Panel Data. *Journal of Financial Intermediation*, 13(2), 249–264.

Berger, A., R. Deyoung, M. Flannery, D. Lee and O. Oztekin (2008): How Do Large Banking Organizations Manage their Capital Ratios? *Journal of Financial Services Research*, 34, 123–149.

Berrospide, J. M. and R. M. Edge (2010): The Effects of Bank Capital on Lending: What Do We Know and, What Does It Mean? Finance and Economics Discussion Series 2010-44, Board of Governors of the Federal Reserve System (U.S.).

Brewer, E., G. Kaufman and L. Wall (2008): Bank Capital Ratios across Countries: Why Do They Vary? *Journal of Financial Services Research*, 34(2), 177–201.

De Vos, I., G. Everaert and I. Ruyssen (2015): Bootstrap-based Bias Correction and Inference for Dynamic Panels with Fixed Effects. *Stata Journal*, 15(4), 986–1018.

Flannery, M. and K. Rangan (2008): What Caused the Bank Capital Build-up of the 1990s. *Review of Finance*, 12, 391–429.

Gale, D. and O. Ogur (2005): Are Bank Capital Ratios Too High or Too Low? Incomplete Markets and Optimal Capital Structure. *Journal of the European Economic Association*, 3(2–3), 690–700.

Gropp, R. and F. Heider (2010): The Determinants of Bank Capital Structure. *Review of Finance*, 14(4), 587–622.

Malovaná, S. (2017): Banks' Capital Surplus and the Impact of Additional Capital Requirements. CNB Working Paper No. 8/2017, Czech National Bank.

Mariathasan, M. and O. Merrouche (2014): The Manipulation of Basel Risk-Weights. *Journal of Financial Intermediation*, 23(3), 300–321.

Myers, S. C. and N. S. Majluf (1984): Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have. *Journal of Financial Economics*, 13(2), 187–221.

Peura, S. and J. Keppo (2006): Optimal Bank Capital with Costly Recapitalization. *Journal of Business*, 79(4), 2162–2201.

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Adam, T., Benecká, S. and Matějů, J. (2018): Financial Stress and Its Non-Linear Impact on CEE Exchange Rates. Journal of Financial Stability, forthcoming.

Babecká Kucharčuková, O., Claeys, P. and Vasicek, B. (2016): Spillover of the ECB's Monetary Policy Outside the Euro Area: How Different is Conventional from Unconventional Policy? Journal of Policy Modeling, 37(1), 1–40.

Babecký, J., Galuščák, K. and Žigraiová, D. (2017): Mechanisms of the State Dependence of Wage Setting: Evidence from a Survey of Czech Firms. Eastern European Economics, 55, 342–356.

Baxa, J., Plašil, M. and Vašíček, B. (2016): Inflation and the Steeplechase between Economic Activity Variables: Evidence for G7 Countries. The B.E. Journal of Macroeconomics, 16 (3), published online.

Bulíř, A., Hurník, J. and Šmídková, K. (2016): What Do Central Banks Know about Inflation Factors? Open Economies Review, 27(4), 795–810.

Fiala, T. and Havranek, T. (2017): The Sources of Contagion Risk in a Banking Sector With Foreign Ownership. Economic Modelling, 60(C), 108–121.

Franta, M. (2017): Rare Shocks vs. Non-Linearities: What Drives Extreme Events in the Economy? Some Empirical Evidence. Journal of Economic Dynamics and Control, 75(C), 136–157.

Franta, M. (2016): The Effect of Non-Linearity Between Credit Conditions and Economic Activity on Density Forecasts. Journal of Forecasting, 35(2), 147–166.

Franta, M., Havrlant, D. and Rusnák, M. (2016): Forecasting Czech GDP Using Mixed-Frequency Data Models. Journal of Business Cycle Research, 12(2), 165–185.

Franta, M., Libich, J. and Stehlík, P. (2018): Tracking Monetary-Fiscal Interactions Across Time and Space. International Journal of Central Banking, 14(3), forthcoming.

Galuščák, K., Hlaváč, P. and Jakubík, P. (2016): Household Resilience to Adverse Macroeconomic Shocks: Evidence from Czech Microdata. International Review of Applied Economics, 30(3), 377–402.

Geršl, A., Komárková, Z. and Komárek, L. (2016): Liquidity Stress Testing with Second-Round Effects: Application to the Czech Banking Sector. Czech Journal of Economics and Finance, 66(1), 32–49.

Hájek, J. and Horváth, R. (2016): The Spillover Effect of Euro Area on Central and Southeastern European Economies: A Global VAR Approach. Open Economies Review, 27(2), 359–385.

Hampl, M. and Havránek, T. (2017): Should Monetary Policy Pay Attention to Hose Prices? The Czech National Bank's Experience. Central Banking Journal, 27(4), 28–37.

Havranek, T., Horvath, R. and Zeynalov, A. (2016): Natural Resources and Economic Growth: A Meta-Analysis. World Development, 88(C), 134–151.

Havránek, T. and Iršová, Z. (2016): Do Borders Really Slash Trade? A Meta-Analysis. IMF Economic Review, published online, 1–32.

Havránek, T., Iršová, Z. and Herman, D. (2018): Does Daylight Saving Save Energy? A Meta-Analysis. Energy Journal, 39(2), 35–61.

Havránek, T., Iršová, Z. and Zeynalova, O. (2018): Measuring the Income Elasticity of Water Demand: The Importance of Publication and Endogeneity Biases. Land Economics, 94(2), 259–283.

Havránek, T., Iršová, Z. and Lešanovská, J. (2016): Bank Efficiency and Interest Rate Pass-Through: Evidence from Czech Loan Products. Economic Modelling, 54(C), 153–169.

Havránek, T., Iršová, Z. and Schwarz, J. (2016): Dynamic Elasticities of Tax Revenue: Evidence from the Czech Republic. Applied Economics, 48(60), 5866–5881.

Havránek, T., Rusnák, M. and Sokolova, A. (2017): Habit Formation in Consumption: A Meta-Analysis. European Economic Review, 95(1), 142–167.

Hejlová, H., Hlaváček, M. and Komárek, L. (2017): A Comprehensive Method for House Price Sustainability Assessment in the Czech Republic. Prague Economic Papers, 26(3), 269–285.

Hlaváček, M., Novotný, O. and Rusnák, M. (2016): Analysis of the Commercial Property Prices in the Central European Countries. Politická ekonomie, 2016(1), 1–16.

Hlédik, T., Holub, T. and Král, P. (2016): The Czech National Bank's Role since the Global Crisis. Public Finance Quarterly (Hungary), Focus: New Central Bank Policies, 2016/1, 65–93.

Joy, M., Rusnák, M., Šmídková, K. and Vašíček, B. (2017): Banking and Currency Crises: Differential Diagnostics for Developed Countries. International Journal of Finance & Economics, 22(1), 44–67.

Kadlčáková, N., Komárek, L., Komárková, Z. and Hlaváček, M. (2016): Identification of Asset Price Misalignments on Financial Markets With Extreme Value Theory. Emerging Markets Finance and Trade, 52(11), 2595–2609.

Komárek, L. and Kadlčáková, N. (2017): Foreign Exchange Market Contagion in Central Europe from the Viewpoint of Extreme Value Theory. Prague Economic Papers, published online.

Konečný, T. and Babecká-Kucharčuková, O. (2016): Credit Spreads and the Links between the Financial and Real Sectors in a Small Open Economy: The Case of the Czech Republic. Czech Journal of Economics and Finance, 66(4), 302–321.

Malovaná, S. and Frait, J. (2017): Monetary Policy and Macroprudential Policy: Rivals or Teammates? Journal of Financial Stability, 32(C), 1–16.

Novotný, F. (2018): Profitability Life Cycle of Foreign Direct Investment: Application to the Czech Republic. Emerging Markets Finance and Trade, 54(7), 1623–1634.

Pfeifer, L., Holub, L., Pithart, Z. and Hodula, M. (2017): Interaction of Capital and Liquidity Regulation in the Banking Sector (in Czech). Politická ekonomie, 65(5), 525–545.

Pfeifer, L., Holub, L., Pithart, Z. and Hodula, M. (2017): Leverage Ratio and its Impact on the Resilience of the Banking Sector and Efficiency of Macroprudential Policy. Czech Journal of Economics and Finance, 67(4), 277–299.

Plašil, M., Seidler, J. and Hlaváč, P. (2016): A New Measure of the Financial Cycle: Application to the Czech Republic. Eastern European Economics, 54 (4), 296–318.

Polák, P. (2017): The productivity paradox: A meta-analysis. Information Economics and Policy, 38, 38–54.

Polák, P. (2018): The Euro's Trade Effect: A Meta-Analysis. Journal of Economic Surveys, forthcoming

Rusnák, M. (2016): Nowcasting Czech GDP in Real Time. Economic Modelling, 54(C), 26–39.

Schwarz, J. and Pospíšil, M. (2018): Bankruptcy, Investment, and Financial Constraints: Evidence from the Czech Republic. Eastern European Economics, 56(2), 99–121.

Skorepa, M. and Komarek, L. (2017): Real Exchange Rates: Are They Dominated by Fundamental Factors? Applied Economic Letters, 24(19), 1389–1392.

Žigraiová, D. and Havránek, T. (2016): Bank Competition And Financial Stability: Much Ado About Nothing? Journal of Economic Surveys, 30(5), 944–981.

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