

Should monetary policy pay attention to house prices? The Czech National Bank's approach

Mojmír Hampl and Tomáš Havránek¹

Abstract

Monetary and macroprudential policies are interconnected parts of the twin mandate of many central banks. We describe the Czech National Bank's approach to one aspect of integrating these two policies, namely the use of a broader inflation measure that includes house prices and enters monetary policy considerations along with headline consumer price index (CPI) inflation. We further argue that, in terms of theory, the broader inflation gauge is at least as suitable as headline CPI for measuring the value of money, but we also acknowledge the practical problems that arise from the use of the broader index.

Keywords: macroprudential policy, monetary policy, financial stability, consumer price index, house prices, owner-occupied housing

JEL classification: E31, E44, E50, R30

¹ We would like to thank the participants of the BIS Emerging Market Deputy Governors Meeting in Basel, 20–21 February 2017, for their useful comments on a previous version of this note.

Introduction

The Czech Republic is among the few countries where headline consumer price index (CPI) inflation directly includes house prices. This inclusiveness is, however, mostly symbolic because house prices account for just 16% of the CPI's owner-occupied housing component, which in turn represents only 9% of the CPI. This approach gives house prices a 1.4% weight in headline inflation (for comparison, tobacco has a 5% weight). Moreover, the data on house prices only cover purchases of dwellings that are new to the household sector. As a result, all transactions between households are excluded from the CPI, even though 90% of real estate deals occur on the secondary market. There are practical reasons for such treatment, and the Czech Statistical Office – the agency responsible for computing the CPI – is at the forefront of efforts to measure owner-occupied housing (its current approach is very close to the one Eurostat will probably incorporate into the harmonised index of consumer prices, HICP, in 2019). Nevertheless, house prices not only play a prominent role for macroprudential policy, but also reflect an important item expenditure that a typical household must make at least once and that influences its consumption behaviour vis-à-vis other CPI segments.

We argue that it is important to integrate the macroprudential and monetary policy views and not set the tools for each policy independently. That said, this does not diminish the importance of purely macroprudential tools, which have also been implemented by the Czech National Bank (such as a non-zero countercyclical capital buffer, a capital buffer for systemically important banks, and a limit on the loan-to-value ratio for mortgages). But these fairly new tools have their limits; for example, while they seem to work well in tightening the financial cycle, we have scarce evidence on the functioning of purely macroprudential tools when it comes to the need to ease financial market conditions. Paying more attention to house prices when conducting monetary policy allows us to utilise the interest rate, the main and well tested tool of the central bank, which also has a strong effect on house prices (Williams, 2015). Thus, we call for a syncretic approach: leaning against the wind not solely by using the interest rate, but in tandem with macroprudential measures and keeping in mind the symmetry inherent in the inflation target.

The remainder of the paper is structured as follows. In Section 2, we discuss why it makes sense, from a macroprudential point of view, to consider a broader measure of inflation that also includes house prices. In Section 3, we argue that there are strong reasons to pay attention to house prices purely from a monetary policy perspective, too. In Section 4, we outline how statistical bureaus measure inflation related to owner-occupied housing. In Section 5, we describe the experience of the Czech National Bank in this field. Section 6 concludes.

Macroprudential reasons for incorporating house prices into the CPI

In the aftermath of the late 2000s' financial crisis, many economists have constructed early warning systems in which house prices play a prominent role (see, among others, Babecký et al (2011), Reimers (2012), Babecký et al (2013), Antunes et al (2014), Laina et al (2015) and Tölö (2015)). The importance of house prices is also

emphasized in the classical books on financial crises by Kindleberger and Aliber (2015) and Reinhart and Rogoff (2009). Especially in developed countries and during recent decades, house prices have tended to increase fast before a crisis, slump markedly during the crisis, and rise only gradually when the first signs of recovery kick in. The prominence of house prices among the large number of potential early warning indicators has led many commentators to stress the interaction between this variable and the monetary policy stance. As with many other issues in the recent discussion on macroprudential policy, however, it is perhaps not surprising that no clear consensus on the matter has yet been reached.

One stream of thought, represented, for example, by Assenmacher-Wesche and Gerlach (2010) and Svensson (2014), puts forward the notion that using monetary policy as a tool to stem an increase in house prices is too costly and detrimental to the welfare of the country. Williams (2015) conducts a meta-analysis of the empirical estimates reported in this literature and finds that a typical result implies a 1% loss in GDP associated with a 4% reduction in house prices delivered by monetary policy contraction. Often missing from the discussion, however, are the positive effects of such a policy on GDP and employment during the downturn, when traditional CPI targeting implies less easing than what would otherwise be optimal if house prices were also taken into account. In other words, it is important to highlight the symmetrical nature of inflation targeting, even if the definition of the targeted inflation series changes.

Several studies have demonstrated the usefulness of incorporating financial stability considerations (including, most prominently, house prices) into monetary policy rules under inflation targeting. Because our focus is on the Czech Republic, we are mostly interested in evidence for small open economies. Aydin and Volkan (2011) provide such evidence using a structural model calibrated for the case of Korea; they find that paying attention to house prices pays off for monetary policy in terms of smoother business cycle fluctuations, as compared with conventional inflation targeting. Tentative evidence for the Czech Republic is presented by Žáček (2016), who uses a similar structural model and finds that incorporating financial variables (including house prices) into the monetary policy rule helps macroeconomic stability in terms of the implied volatility of inflation and output. Therefore, we cannot discard the merit of Czech monetary policy potentially leaning against the wind of change in house prices.

Conceptual reasons for incorporating house prices into the CPI

As Goodhart (2001, p. F335) eloquently puts it: “My dictionary (Longman) defines inflation as a fall in the value of money, not as a rise in the consumer price index. If I spend my money now on obtaining a claim on future housing services by buying a house, or on future dividends by buying an equity, and the price of that claim on housing services or on dividends goes up, why is that not just as much inflation as when the price of current goods and services rises?”

Why indeed? House prices are typically excluded from official inflation measures, although other goods that also provide a flow of future services (durables such as motor vehicles and washing machines) are included. There is no clear

theoretical reason for such treatment; rather, it is a convention that arises from intuition and convenience, as we will discuss in the next section. The argument supporting the conventional exclusion of house prices goes as follows: for houses, the investment component relative to the consumption component is larger than for other durables such as cars. Moreover, a portion of the house value does not depreciate (such as land) and is therefore often considered a good store of value. In spite of that, anecdotal evidence suggests that many households treat at least their first home purchase more as consumption than investment. Furthermore, it can be shown on theoretical grounds that the prices of all assets, including houses, stocks and bonds, should in principle be included in inflation if we are to measure the current cost of the expected lifetime consumption (in the Fisherian tradition of a proper definition of intertemporal substitution) instead of merely the current consumption (see Alchian and Klein (1973)).

Put simply, every investment translates into future consumption. Just as we pay for the insurance of our property (such insurance is typically included in inflation measures), we pay for life insurance to protect our family against tragedies (life insurance is typically not included in CPI inflation). We invest in houses, stocks and bonds to ensure a good standard of living after we retire and provide for the education of our children and, potentially, their own housing needs. Across the developed world, the importance of private allowances for retirement has increased in the wake of great demographic changes, which unfortunately ensures that less money will be available for retirees from the government under pay-as-you-go pension systems. In the Czech Republic, the stock market is relatively small and houses represent the main investment item for the majority of the population. Thus, for our purposes, there is little reason to consider indices of asset price inflation other than house prices.

Aside from Alchian and Klein (1973) and Goodhart (2001), many other authors have argued for the inclusion of house prices in the consumer price index. For example, Bryan et al (2002) show that, for the case of the United States, the omission of house prices introduces an excluded goods bias and results in an underestimation of the CPI by about 0.25 percentage points annually. Diewert and Nakamura (2009) also point to the need for a more direct measure of house price inflation in the official CPI index. They suggest that the recent period of low official inflation may result from mismeasured underlying consumer prices.

Approaches to measuring owner-occupied housing

It is widely known that house prices were included with a substantial weight in the official measure of inflation in the United States prior to 1983. Other components of owner-occupied housing used in the computation of the CPI at that time were mortgage interest rates, property taxes, insurance rates and maintenance costs. It is less widely known, however, that the intention to separate the investment from the consumption part of home purchases was not the main reason for the change in the treatment of owner-occupied housing.

The paper accompanying the change and published by the Bureau of Labor Statistics (the agency responsible for computing the CPI in the United States), Gillingham and Lane (1982), features a section entitled: "Why the CPI must be changed". In that section, the need to focus on shelter services instead of

investment in housing is mentioned only in passing; instead, the following problems are stressed: (i) serious difficulties in obtaining data on house purchases not financed by mortgages insured by the Federal Housing Administration; (ii) financial innovations that make it harder to collect reliable data on mortgage rates; (iii) changes in tax laws that complicate the use of house prices in inflation measures; and (iv) public distrust in the current measure of the CPI, given, among other things, the substantial volatility of house prices.

That is, the principal reason why house prices are typically excluded from the main inflation measure is empirical rather than theoretical: it is difficult to collect reliable data on house prices, especially at monthly frequency and without a significant delay, and the series tends to be more volatile than the other components of the CPI. Still, it is hard to entirely ignore home ownership and the associated costs in inflation measures (owner-occupied housing is missing entirely from the HICP gauge published by Eurostat, although it is planned to be included in the future). In most countries, a large proportion of households live in their own homes, which means that the costs associated with housing are not directly observable in terms of market rents. There are four main approaches to measuring owner-occupied housing: the acquisitions, rental equivalence, user cost, and payments methods. We outline these approaches in Table 1, while Table 2 provides a few examples of countries that use different approaches.

The acquisitions approach, formulated almost exclusively in “net” form, covers all expenses of households connected with home purchases, but only household purchases from other sectors are considered (therefore, only the prices of new houses are typically captured by this approach; prices on the secondary market are irrelevant). Other aspects taken into account are costs associated with reconstruction, repairs and maintenance, as well as insurance and property charges. More details about this method are available, for example, in Eurostat (2012) and Eurostat (2013). The method is currently employed by Australia and New Zealand for their quarterly measures of inflation, which means that the headline CPI inflation numbers of these countries directly include the prices of (new) houses, although commonly with a negligible weight.

Components of owner-occupied housing

Table 1

Component	Acquisitions	Rental equivalence	User cost	Payments
House purchase	x			
Property rates and charges	x		x	x
Owner-occupied rents		x		
Owner-occupied user costs			x	
Mortgage interest charges				x

Note: Adapted from Woolford (2010).

The rental equivalence approach uses the concept of imputed rent, in which the statistical bureau in charge of computing the CPI constructs the hypothetical rent paid by home owners to themselves, typically by using the market rents observed for homes with similar characteristics. This method is problematic for countries where the rental market is not well developed. In any case, to the best of our

knowledge, it is the most widespread approach used by countries including the United States, Germany, Switzerland and Norway. More details about the method, and especially its US incarnation, are provided by McCarthy et al (2015).

The user cost approach is probably the most technically sophisticated one and is computed as the costs of acquiring the house at the start of the period, plus all fees, taxes, mortgage payments, and repairs during the period, minus the price of the house at the end of the period (the price for which the house could be sold, thus reducing the user cost). Because of the complexity of the method, many variants exist, some of them used by Canada, Ireland and Sweden. In the case of Sweden, the inclusion of mortgage rates in the official CPI measure delivers the price puzzle: an increase in the monetary policy rate leads to inflation in the short run by definition (see Rusnák et al (2013) for a survey). In consequence, Sveriges Riksbank has to use an alternative measure of inflation with fixed mortgage rates and is not pleased with it (Jansson (2015); Johansson (2015)).

Finally, the rarely used payments approach (also called the cash-flow approach) focuses on actual expenses associated with home ownership, such as property taxes, reconstruction and repairs, insurance and mortgage payments, which, among other things, means that the price puzzle problem occurs here as well. The payments approach is used, for example, in Austria. Many other countries, such as Belgium, France, Italy, Spain and the United Kingdom, do not account for owner-occupied housing in their headline CPI inflation figures at all.

Examples of the treatment of owner-occupied housing

Table 2

Approach	Countries
Net acquisitions	Australia, New Zealand
Rental equivalence	Denmark, Germany, Netherlands, Norway, Switzerland; Japan, Mexico, South Africa, the United States
User costs	Iceland, Ireland, Finland, Sweden; Canada
Payments	Austria
Headline CPI inflation measure excludes owner-occupied housing	Belgium, Estonia, euro area, France, Greece, Italy, Luxembourg, Poland, Portugal, Spain, the United Kingdom; Argentina, Brazil, China, India, Indonesia, Korea, Russia, Saudi Arabia, Turkey

Sources: Boldsen (2011); Eurostat (2012); OECD (2015a, 2015b); national statistical bureaus.

The Czech experience

According to the latest available Eurostat statistics, close to 80% of Czechs live in their own houses and apartments, which is substantially above the EU average. Moreover, Czechs typically spend 26% of their disposable income on expenses associated with housing, the highest percentage among all the OECD countries. These two facts underline the importance of accounting in the CPI for costs associated with owner-occupied housing. The Czech Statistical Office has been attempting to do so for two decades. The changes in the definition of owner-occupied housing in the Czech CPI are described in Table 3.

The method of the Czech Statistical Office has traditionally been based on rental equivalence, though not on the typical hedonic approach that approximates housing costs by using the market rent of a dwelling with similar characteristics. Prior to 2007, owner-occupied housing was defined as payments in dwellings of housing cooperatives. Since 2007, the Czech Statistical Office has assigned non-zero weights to construction work including materials and inputs in residential buildings. A major change in the philosophy of Czech owner-occupied housing came in 2015, when the figure started to cover purchases of new dwellings as well, albeit with a small weight (8%). The weight of the latter item doubled in 2017 (and more than tripled for inflation measured in the capital city of Prague). Because house prices are only available at quarterly frequency, monthly figures need to be interpolated.

The treatment of owner-occupied housing by the Czech Statistical Office

Table 3

Period	Component of owner-occupied housing	Weight
until 2006	Payments in dwellings of housing cooperatives	100%
2007–11	Construction work, including materials	77%
	Payments in dwellings of housing cooperatives	23%
2012–14	Price of construction work, including materials	41.5%
	Inputs in residential buildings	41.5%
	Payments in dwellings of housing cooperatives	17%
2015–16	Construction work, including materials	38.2%
	Inputs in residential buildings	38.2%
	Payments in dwellings of housing cooperatives	15.6%
	Purchases of new dwellings	8%
since 2017	Self-repair and overhaul	25%
	Maintenance, reconstruction, and renovation	52.7%
	Real estate brokerage	6%
	Purchases of new dwellings	16.3%

Note: In the future the Czech Statistical Office intends to further reduce the difference between its definition of owner-occupied housing and the definition used by Eurostat.

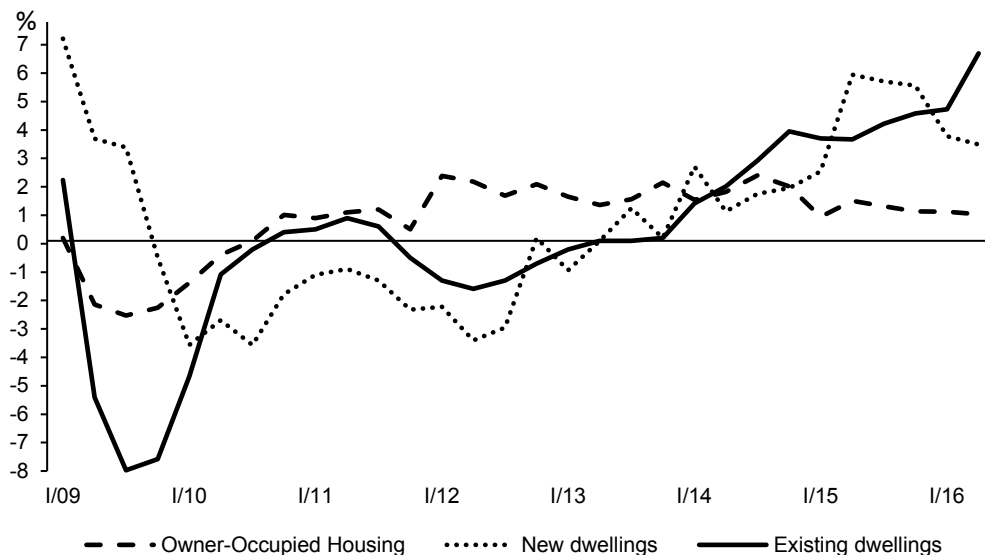
Although the owner-occupied housing item in the Czech CPI is still described as being computed by the rental equivalence approach (Czech Statistical Office 2016), in the terminology introduced in the previous section, we perceive it as being closer to the definition of the net acquisitions approach. The intention of the Czech Statistical Office is to gradually converge with the definition of owner-occupied housing as prepared by Eurostat, which also employs the net acquisitions approach. A side effect of this definition is the relatively small weight of the entire item in the Czech CPI: owner-occupied housing accounts for about 9% of the index, compared with 24% in the United States, 15.6% in Japan and 12.2% in the United Kingdom (an alternative index with owner-occupied housing; headline CPI inflation in the United Kingdom excludes home ownership costs). As discussed in ECB (2016), the weight of housing indices based on net acquisitions is typically much smaller than the weight of imputed rentals, because the latter cover not only new but all owner-occupied dwellings.

Graph 1 shows that the index of owner-occupied housing for the Czech Republic (computed according to the Eurostat definition, which is nevertheless very close to the 2017 definition of the Czech Statistical Office) does not display much cyclical variation and is only mildly correlated with house prices. The index includes prices of dwellings new to the household sector, but only with a small weight; moreover, it excludes prices of dwellings sold from one household to another, which is how most transactions in the housing market take place (in the Czech Republic it is 90% according to the Eurostat). We can also see that prices of new dwellings show considerably less variation than prices of existing dwellings. The index of new dwellings did not capture, for example, the large fall in house prices on the secondary market in 2009. Prices of existing dwellings provide a better early warning signal (see Section 2), because individual households are more sensitive to changes in sentiment than developers, who are more likely to be able to wait and see before selling.

Owner-occupied housing does not capture the cyclical variation of house prices

In per cent

Graph 1



Source: Czech Statistical Office.

For these reasons we believe there is merit in giving a non-zero weight to the prices of existing dwellings. In the first half of 2016, the Czech National Bank started to compute for its internal purposes an experimental index of broader inflation, including house prices along with the traditionally defined owner-occupied housing (CPIH). The weight of existing dwellings was set to 14%, which is a significant share (especially in comparison with owner-occupied housing based on the net acquisitions approach), but still smaller than the weight used in the US CPI prior to 1983. The weight is determined by the share of consumer expenditure on existing dwellings and is consistent with the way the weights for the other components of CPI are computed. Weights for individual categories in Czech CPI and CPIH are shown in Table 4. An important issue that we do not tackle is the regional

differences in the development of house prices, which may have important macroprudential implications. Nevertheless, regional heterogeneity is not a problem specific to house prices, as the development of individual components of CPI differs across regions too.

Components of Czech CPI and CPIH

Table 4

COICOP	Title	Weight in CPI	Weight in CPIH
01.	Food and non-alcoholic beverages	18.1%	15.5%
02.	Alcoholic beverages and tobacco	9.3%	8.0%
03.	Clothing and footwear	3.9%	3.4%
04.1	Actual rentals for housing	3.5%	3.0%
04.2	Owner-occupied housing (including new dwellings)	8.7%	7.5%
04.x	Existing dwellings	0.0%	14.0%
04.y	Other expenses on housing, water, electricity, gas and other fuels	12.9%	11.1%
05.	Furnishings, household equipment and routine maintenance	5.8%	5.0%
06.	Health	2.3%	2.0%
07.	Transport	10.1%	8.7%
08.	Communication	3.1%	2.6%
09.	Recreation and culture	9.0%	7.7%
10.	Education	0.6%	0.5%
11.	Restaurants and hotels	5.8%	5.0%
12.	Miscellaneous goods and services	6.9%	6.0%

Note: CPIH = CPI including the prices of existing dwellings.

Sources: Czech National Bank; Czech Statistical Office.

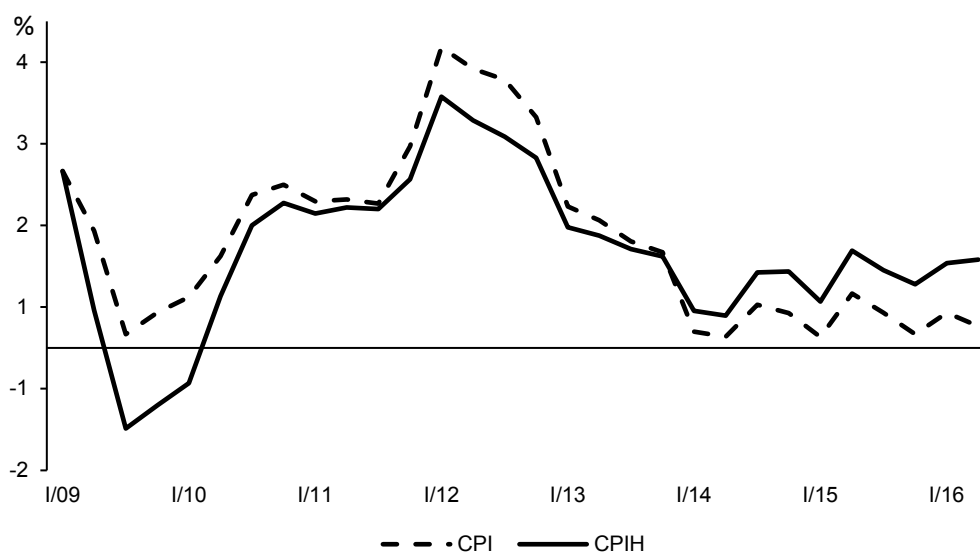
Graph 2 shows that the broader inflation measure would call for significantly more expansionary monetary policy in 2009, 2010 and 2012,² but somewhat tighter monetary conditions in 2015 and 2016 – although in the latter case even broader inflation was safely below the Czech National Bank’s target of 2%. While the difference between the CPI and the CPIH is substantial, it is not dramatic, and CPIH targeting would not radically redefine the conduct of Czech monetary policy. If anything, it would make it more aggressively countercyclical.

² In 2012, the Czech National Bank reached the zero lower bound on the policy rate, and in 2013, as a means of additional monetary easing, it made a commitment to keep the Czech koruna from appreciating beyond CZK 27 per euro. The exchange rate commitment has benefited the Czech economy significantly (Opatrný, 2016). Had the Czech National Bank targeted the CPIH instead of the CPI, the commitment would probably have been introduced earlier.

Accounting for house prices markedly changes the profile of inflation

In per cent

Graph 2



Note: CPIH = CPI including prices of existing dwellings.

Sources: Czech National Bank; Czech Statistical Office.

Conclusion

We do not argue that the time has come to replace the current inflation measures with broader indices that fully incorporate house prices. Rather, we consider such broader measures of inflation to be useful supplementary indicators, similar in this function to core inflation, which, in contrast, constitutes a narrower gauge than headline CPI inflation. The assessment of Goodhart (2001) resonates with our thoughts on the matter: "Continuity, certainty, and simplicity all argue against chopping and changing existing procedures. So in the conclusions, we do not argue for replacing the present measures, but of paying rather more attention to accompanying, alternative measures which *do* give a more appropriate weighting to asset prices." A major technical limitation of the broader index is that, at present, reliable data on house prices are available only at quarterly frequency and with a significant lag (although that will cease to be a problem when the Czech National Bank gains direct access to the land registry, where all price information is available within a few days after property changes hands).

Consequently, the Czech National Bank has not dropped its focus on headline CPI inflation in favour of a broader measure that includes house prices, and does not plan to do so in the near future. But the broader measure, the CPIH, has become one of the important indicators that the Czech National Bank's board considers when it decides on changes in the monetary policy stance. In a well-known and colourfully entitled paper, "Measuring inflation: the core is rotten," the President of the Federal Reserve Bank of St. Louis, James Bullard, criticises the Federal Reserve's focus on core inflation and argues for paying more attention to a broader gauge of inflation. To paraphrase Bullard's (2011) provocative statement,

we can say the following: one immediate benefit of dropping the sole emphasis on an inflation measure that excludes house purchases would be to reconnect central banks and statistical bureaus with households and businesses that know price changes when they see them.

References

Alchian, A and B Klein (1973): "On a correct measure of inflation", *Journal of Money, Credit and Banking*, vol 5, no 1, pp 173–91.

Antunes, A, D Bonfim, N Monteiro and P Rodrigues (2014): "Early warning indicators of banking crises: exploring new data and tools", *Economic Bulletin and Financial Stability Report Articles*, Bank of Portugal.

Assenmacher-Wesche, K and S Gerlach (2010): "Monetary policy and financial imbalances: facts and fiction", *Economic Policy*, vol 25, pp 437–82.

Aydin, B and E Volkan (2011): "Incorporating financial stability in inflation targeting frameworks", *IMF Working Papers*, no 11/224.

Babecký, J, T Havránek, J Matějů, M Rusnák, K Šmídková, and B Vašíček (2011): "Early warning indicators of economic crises: evidence from a panel of 40 developed countries", *CNB Working Papers*, no 2011/08.

——— (2013): "Leading indicators of crisis incidence: evidence from developed countries", *Journal of International Money and Finance*, vol 35(C), pp 1–19.

Boldsen, C (2011): UNECE Workshop on Consumer Price Indices, Istanbul, Turkey, 10–13 October.

Bryan, M, S Cecchetti and R O'Sullivan (2002): "Asset prices in the measurement of inflation", *NBER Working Papers*, no 8700.

Bullard, J (2011): "Measuring inflation: the core is rotten", *Federal Reserve Bank of St. Louis Review*, pp 223–34, July.

Czech Statistical Office (2016): *Consumer price indices: user's methodological manual*, technical report.

Diewert, W and A Nakamura (2009): "Accounting for housing in a CPI", *Working Papers*, no 09-4, Federal Reserve Bank of Philadelphia.

ECB (2016): *ECB estimates of the impact of including owner-occupied housing price indices into the headline HICP*, technical report, 29 July.

Eurostat (2012): *Detailed technical manual on owner-occupied housing for harmonized index of consumer prices*, technical report, March.

——— (2013): *Methodological manual referred to in Commission Regulation (EU) No 93/2013*, technical report, February.

Gillingham, R and W Lane (1982): "Changing the treatment of shelter costs for homeowners in the CPI", *Monthly Labor Review*, pp 9–14, June.

Goodhart, C (2001): "What weight should be given to asset prices in the measurement of inflation?", Royal Economic Society, *Economic Journal*, vol 111, no 472, pp F335–56.

- Jansson, P (2015): "Time to improve the inflation target?", speech by Per Jansson, Deputy Governor of Sveriges Riksbank, Handelsbanken, Stockholm, 3 December.
- Johansson, J (2015): "How is inflation measured?", Sveriges Riksbank, *Economic Commentaries*, no 5/2015.
- Kindleberger, C and R Aliber (2015): *Manias, panics and crashes: a history of financial crises*, seventh edition, Palgrave Macmillan.
- Laina, P, J Nyholm and P Sarlin (2015): "Leading indicators of systemic banking crises: Finland in a panel of EU countries", European Central Bank, *Working Paper*, Series 1758.
- McCarthy, J, R Peach and M Ploenzke (2015): "The measurement of rent inflation", Federal Reserve Bank of New York, *Staff Reports*, no 425.
- OECD (2015a): *Methodological notes for OECD*, CPI news release, www.oecd.org/std/prices-ppp/47010757.pdf.
- (2015b): *Methodological notes for compilation of G20 Consumer Price Index*, www.oecd.org/std/prices-ppp/CPI-G20-methodology.pdf.
- Opatrný, M (2016): "Quantifying the effects of the CNB's exchange rate commitment: a synthetic control method", *IES Working Paper*, no 17/2016, Charles University, Prague.
- Reimers, H (2012): "Early warning indicator model of financial developments using an ordered logit", Macrothink Institute, *Business and Economic Research*, vol 2, no 2, pp 171–91.
- Reinhart, C and K Rogoff (2009): *This time is different: eight centuries of financial folly*, Princeton University Press.
- Rusnák, M, T Havránek and R Horváth (2013): "How to solve the price puzzle? A meta-analysis", *Journal of Money, Credit and Banking*, vol 45, no 1, pp 37–70.
- Svensson, L (2014): "Inflation targeting and leaning against the wind", *International Journal of Central Banking*, vol 10, no 2, pp 103–14.
- Tölö, E (2015): "Early warning indicators of banking crises", *Bank of Finland Bulletin*, no 2/2015.
- Williams, J (2015): "Measuring monetary policy's effect on house prices", Federal Reserve Bank of San Francisco, *FRBSF Economic Letter*, no 2015-28.
- Woolford, K (2010): *An exploration of alternative treatments of owner-occupied housing in a CPI*, Technical Advisory Group Meeting, International Comparison Program.
- Žáček, J (2016): *Should monetary policy pay attention to financial stability? A DSGE approach*, master's thesis, Institute of Economic Studies, Charles University, Prague.