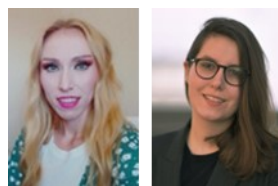


Easier said than done: Predicting downside risks to house prices in Croatia*



By Tihana Škrinjarić (Bank of England) and Maja Sabol (European Parliament)

Keywords: financial stability, macroprudential policy, quantile regression, growth at risk, house price dynamics, downside risks.

JEL codes: E32, E44, E58, G01, G28, C22.

This research examines the dynamics and associated risks of real house price growth in the context of macroprudential policymaking for the case of Croatia. The research, a first of its kind in the Croatian housing market, aims to identify the main factors influencing house price-at-risk (HaR) and predict the downside risks of future real house price growth. Results suggest that, even though the downside risks in the housing market have increased in recent years, they are less pronounced compared to the period before the global financial crisis. Results also show the challenging feature of the empirical approach used for assessing forecasted real house price growth and understanding key drivers of house price dynamics. Thus, this research should be seen as a starting point for enhancing the methodology that will enable informed decision-making based on expert judgment and provide assistance in communicating risks related to housing markets.

*This policy draws its foundation from the paper: Škrinjarić, T. and Sabol M. (2023), [Easier said than done: Predicting downside risks to house prices in Croatia](#), CNB Working Papers, W-73, Croatian National Bank. The views expressed in this study reflect the views/opinions of the authors and are not necessarily those of the Croatian National Bank, Bank of England or European Parliament. The paper was written at a time when the authors were affiliated with the Croatian National Bank.

Introduction

The last global financial crisis demonstrated the profound impact of shocks originated on housing markets on the overall economy, especially when property investments are highly leveraged, leading to longer-lasting recessions. Even more, economic slowdowns resulting from housing market downturns are three times more likely than those caused by other factors. In response to that, the growing recognition of the importance of employing macroprudential policies to ensure financial sector resilience and reduce systemic risks has been evolving, as traditional monetary policy tools proved ineffective in addressing financial stability concerns, particularly in housing markets. Therefore, monitoring housing market developments has become crucial for macroprudential policy decision makers.

Recent years have witnessed significant rise in house prices globally, including in Croatia, raising concerns about potential short-term price corrections. Coupled with persistently high inflation and rising mortgage rates, the likelihood of adverse macroeconomic outcomes has increased - some housing markets have already begun to cool off.

To deepen our understanding and quantify future downside risks to house prices we develop a house price-at-risk (HaR) model for the case of Croatia and its regions for period 2002Q1-2022Q3¹. This approach, aligned with the growth-at-risk measure (GaR) proposed by Adrian et al. (2019)², uses quantile regressions to forecast the entire distribution of future real house price growth, with a particular emphasis on the left-tail (in our case 10th percentile) of the distribution representing sudden downturns in house prices which may pose significant financial stability risks.

Stylised facts on the Croatian housing market

Croatia's high homeownership rate, standing at 91% in 2021 alongside Slovakia, Romania, and Hungary, sets it apart in the European Union (EU) (Eurostat, 2023). The Croatian housing market displays distinct features, including consistently strong foreign demand, particularly in coastal areas, and a government subsidy program initiated in 2017 that supports demand in inland regions. In addition, favourable tax treatment of real estate property and tourist accommodation rentals attracts both local and foreign demand and a substantial proportion of housing market transactions in Croatia is not financed through credit, according to the Croatian National Bank (CNB, 2022).

In the last couple of years, there is an upward pressure on house prices in Croatia, driven by a combination of factors such as increasing housing demand and disruptions in housing supply. Low borrowing costs, post-GFC, made mortgages more accessible, and at the same time made housing purchases an attractive investment. On the supply side, rising construction costs and a sluggish housing supply, which struggled to meet growing demand after the GFC, further exerted upward pressure (ESRB (2022), CNB (2022)).

¹ For more information on the results for regions refer to the paper.

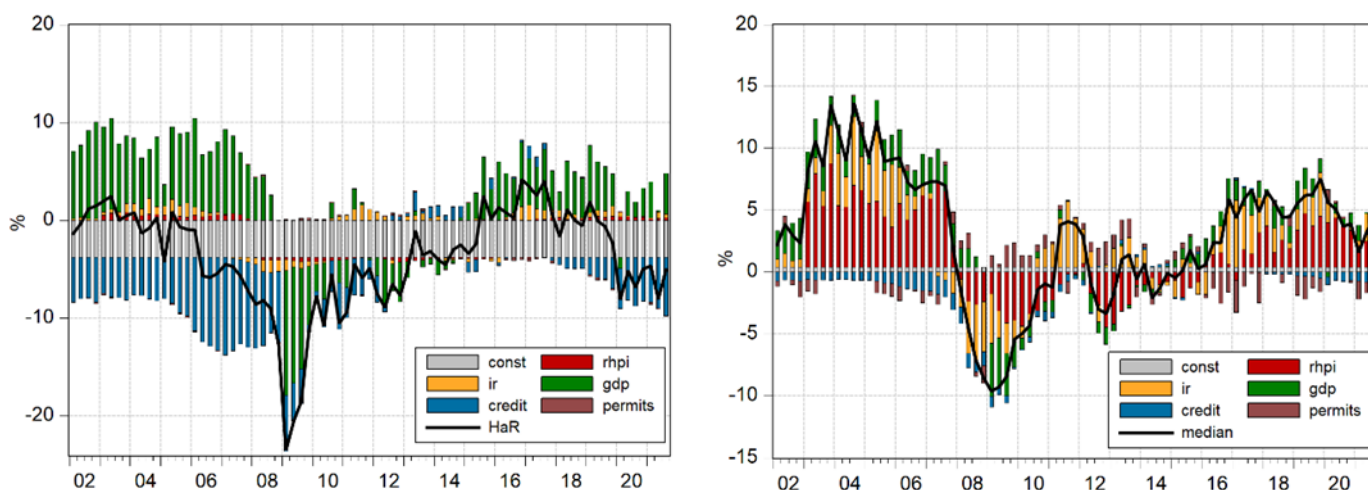
² Most of the related HaR literature aligns with GaR approach proposed by Adrian et al. (2019), Aikman et al. (2019) and others. Some central banks, like the Central Bank of Ireland (O'Brien and Wosser (2018), O'Brien et al. 2022)) and the ECB (Lang et al. 2020) regularly use HaR approach in their macroprudential policy analyses. Both the ECB and IMF (2019) regularly report HaR for euro-area countries and emerging economies respectively as part of their financial stability reports/reviews.

Main results

For the empirical part of the paper, quarterly data for the period 2002 Q1 to 2022 Q3³ has been collected from different sources such as Croatian National Bank, Croatian Bureau of Statistics and Eurostat (2023) for the following variables. House price index is an official quarterly based index calculated by the Croatian National Bank and the Croatian Bureau of Statistics. Following variables are: real house prices (*rhpi*); calculated by deflating using the harmonised index of consumer prices (*HICP*) (2015 = 100), real GDP (*gdp*), stock of mortgage credit (*credit*), mortgage interest rates (*ir*) and building permits index (residential buildings; square meters of useful floor area, 2015 = 100) (*permits*). All of the variables are transformed into year-on-year growth rates or differences (e.g., we calculate differences for interest rates, whereas other variables are transformed into growth rates). In order to obtain estimates over the entire distribution of the house price growth, we employ the quantile regression approach. As the time series for *rhpi* indicator is relatively short, the lowest percentile in the estimation is the 10th percentile. Alongside tail, we estimate the effects at the median value of future real house price growth.

Figure 1 shows different factors affecting HaR and median house price growth in Croatia. Overall, the figure suggests that downside risks to house prices in Croatia have increased in recent years (left panel) - there was a gradual deterioration in the early 2000s, leading up to the period before last global financial crisis. Over time, factors such as previous house price movements and credit began to negatively affect HaR, although this was partially mitigated by the positive influence of GDP growth. Following the last global financial crisis, economic downturn and tighter financial conditions had an adverse effect on HaR. However, recently after years of sustained house price growth and reduced downside risks, the period since 2017 has seen a gradual worsening of HaR, which is attributed to high credit growth and the indirect impact of low interest rate environment. These effects also coincide with the introduction of government subsidy programme from 2017 onwards. However, downside risks are smaller compared to the GFC period, indicating a healthier macro-financial environment in the Croatian economy.

Figure 1: Factors affecting house price-at-risk (HaR) (left) and median house price growth (right) in Croatia



Note: *const* = constant, *rhpi* = yoy growth real house prices, *ir* = yoy change of mortgage interest rates, *gdp* = yoy real GDP growth, *credit* = yoy mortgage credit growth, *permits* = yoy growth building permits, *HaR* = house-price-at-risk (10th percentile).

Source: Croatian National Bank, Croatian Bureau of Statistics and Eurostat; authors' calculations.

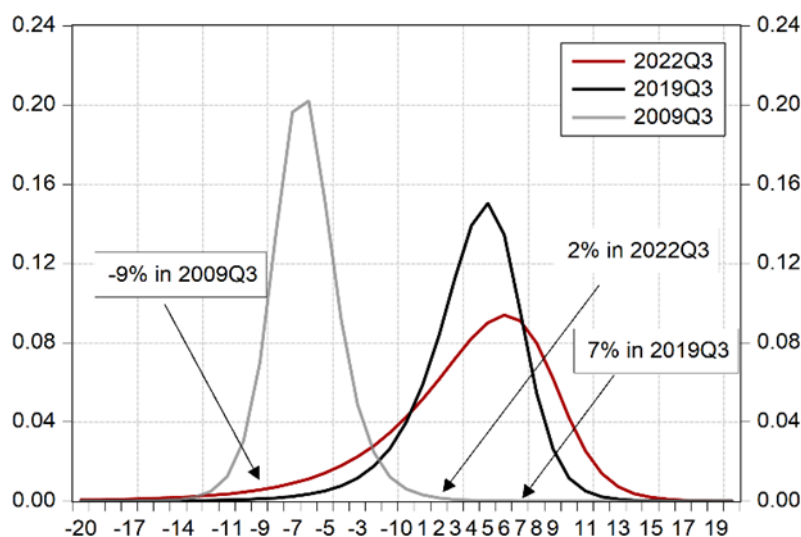
³ 2002 Q1 is the earliest date for which the data on house prices is available.

In more detail, autoregressive component for the total house price index is generally positive and larger for median house price growth, which is aligned with existing literature on HaR. Interest rate changes, while affecting median house price growth more significantly, also have smaller effects on HaR dynamics. This is consistent with previous studies that highlight the influence of mortgage interest rates on house prices, particularly in low-interest rate environments. Real GDP growth is found to have a positive effect on both HaR and median growth dynamics, with a more pronounced impact on the 10th percentile. This relationship corresponds with similar research in CEE countries (Cevik and Naik, 2022).

Credit dynamics show a stronger impact on HaR values, reflecting the significance of credit growth in the period up to global financial crisis, especially during housing market booms. However, one should have in mind the limitations such as the use of change in credit stock instead of new mortgage lending due to data availability constraints. The feedback loop from house prices to credit growth is not as strong in Croatia as in countries with more widespread variable-rate mortgages. Additionally, the impact of building permits on downside risks to house prices is statistically insignificant in the 10th percentile, and only moderately affects median price growth, which is aligned with prior research emphasizing the limited influence of the supply side on house price dynamics.

An alternative method for monitoring changes in house price growth dynamics over time is also proposed. Distributions in Figure 2 are based on forecasts made with data available from the previous year, comparing them to specific points in time as shown in the Figure. This approach considers actual realizations of real house price growth within the distribution and highlights three key observations. First, actual real price growth closely aligns with the distribution centres, indicating that the most likely forecasts and those in close proximity are valuable for forecasting purposes. Second, the shift in the distribution over time is significant when comparing to previous points in time, and third the width of the distribution is a crucial aspect since during housing market downturns (e.g. GFC) the distribution narrows, and its tail shrinks. In contrast, if distributions before COVID-19 are compared to the last point (2022Q3), the latter is wider, likely due to increased uncertainty.

Figure 2: Comparisons of selected probability distributions of forecasted (total) real house price growth



Note: X axis denotes growth values in %, y axis refers to the probability.

Source: Authors' calculations.

Final considerations

This paper is the first one attempting to predict downside risks in the Croatian housing market, emphasizing its significance for financial stability analysis and macroprudential policymaking. The paper also advocates for forward-looking approach when analysing risks on housing market, suggesting that forecasting the entire distribution of future house price growth can provide valuable insights into macroprudential policymaking.

While our results indicate that various factors influence house price dynamics and that downside risks to real house price growth have increased in the recent period, one should have in mind that variable choice and empirical section of the paper underscores the challenges in modelling HaR dynamics, as suggested by the title of the paper, emphasizing the need for cautious interpretation of the findings.

The framework proposed in this paper can serve as a first step indicator for financial stability risks captured by HaR model. Future research could extend these findings to forecast risks in a broader context of GaR and assess the impact of macroprudential measures, especially borrower-based measures and on safeguarding the household sector against housing market shocks. The study also acknowledges that macroprudential policies alone may not be sufficient in addressing these risks, opening the floor for other housing market policies and effective and timely communication with the wider public when risks are on the rise. ■

References

- Adrian T., Boyarchenko N, Giannone D (2019): Vulnerable growth, *American Economic Review*, 109(4): 1263-1289.
- Aikman D, Bridges J, Hoke SH, O'Neill C, Raja A (2019): *Credit, capital and crisis: a GDP-at-risk approach*, Staff Working Paper No. 824, Bank of England.
- Cevik S, Naik S (2022): *Don't Look Up: House Prices in Emerging Europe*. IMF Working Paper, WP/22/236. International Monetary Fund.
- Croatian Bureau of Statistics (2023): Database.
- Croatian National Bank (2023): Internal database.
- Croatian National Bank (2017): Financial Stability Report, No 18.
- Croatian National Bank (2014): Financial Stability Report, No 12.
- ESRB (2022): Vulnerabilities in the residential real estate sectors of the EEA countries. European Systemic Risk Board.
- Eurostat (2023): Database, available at: <https://ec.europa.eu/eurostat/data/database>
- IMF (2019): Global Financial Stability Report. Downside Risks to House Prices, International Monetary Fund.
- O'Brien M., Wosser M. (2018): *An Early Warning System for Systemic Banking Crises – A Model-Robust Approach*, Research Technical Paper Series No. 9, Central Bank of Ireland.
- Lang J.H., Pirovano M., Rusnak M., Schwarz C. (2020): *Trends in residential real estate lending standards and implications for financial stability*, Financial Stability Review. European Central Bank.
- O'Brien M, Staunton D, Wosser M (2022): *Recurrent Property Taxes and house price risks*. Economic Letter No.4. Central Bank of Ireland.

About the authors

Tihana Škrinjarić is a Research Economist at the Bank of England. Previously, she was an Advisor at the Macroeprudential Policy and Financial Stability Department at the Croatian National Bank (2021-2023). She holds a Ph.D. in Economics, and her interests include stress testing topics and methodology, econometrics applications within macroprudential policy, cyclical risk evaluation, and general macroprudential stance assessment. Before working in central banking, Tihana was an Assistant Professor at the University of Zagreb, where her interests included financial econometrics and time series.

Maja Sabol is an Administrator at the Economic Governance and EMU Scrutiny Unit at the European Parliament. Previously, she was an analyst at the Croatian National Bank at the Monetary Policy Department and Macroeprudential Policy and Financial Stability Department (2021-2023). Prior to joining the CNB, Maja did traineeships at the European Central Bank and European Parliament. Maja holds a master's degree in Economics from University of Zagreb. Her main field of interests concern monetary policy, macroprudential policy and central bank communications.

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SUERF Secretariat
c/o OeNB
Otto-Wagner-Platz 3
A-1090 Vienna, Austria
Phone: +43-1-40420-7206
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