ESTIMATING STRUCTURAL SHOCKS IN BULGARIAN HOUSE PRICES: A SVAR-BASED HISTORICAL DECOMPOSITION

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Abstract

This paper examines the structural drivers of housing prices in Bulgaria from 2002 to 2024 using a Structural VAR model based on the expectations-driven framework with inelastic housing supply and amplified financial sector. Historical decomposition reveals that speculative dynamics and expectation shocks became dominant recently. The findings highlight the increasing role of financial and behavioral channels, alongside fundamentals. The study contributes methodologically by offering the SVAR-based decomposition of housing prices in Bulgaria and emphasizes the need for expectation-sensitive macroprudential policy.

Keywords: housing prices, structural shocks, expectations, credit, financial stability

JEL: C32, R31, E44

Introduction

Theoretical concerns over speculation as a destabilizing force in asset markets have deep roots in economic thought. Wicksell (1898) notes that speculative activity becomes prominent when agents anticipate substantial price increases, rendering the cost of credit secondary. "True speculative purchases… seldom occur unless the buyer expects a price rise of at least ten percent", he writes, highlighting that such behavior intensifies in cyclical peaks and crisis episodes (Wicksell, 1898, p. 140). Decades later, Keynes (1936) distinguished between *speculation*, defined as "forecasting the psychology of the market", and *enterprise*, or the prediction of the asset's long-term yield. His warning is unambiguous: "When the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done" (Keynes, 1936, p. 159). Together, these views underscore the critical role of expectations and momentum in fueling non-fundamental price dynamics – a conceptual foundation that informs the present analysis of Bulgaria's housing market.

In the past two decades housing prices in Bulgaria have experienced pronounced cyclical movements, reflecting both structural developments and

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the accumulation of speculative dynamics. Following the initial post-transition stabilization and EU accession, housing prices surged rapidly before the global financial crisis of 2008, underwent a correction in its aftermath, and reaccelerated significantly in the post-COVID recovery phase. Most notably, in the 2021 –2024 period, annual growth rates of residential property prices exceeded 15%, raising concerns about sustainability, affordability, and the role of expectations and financial transmission mechanisms in the real estate market. Recent survey among professional forecasters reveals a broad consensus that housing prices in Bulgaria are currently overvalued relative to fundamentals (CRDET, 2025). A total of 76% of respondents consider prices to be overvalued – a third rate them as significantly overvalued, and 43% as slightly overvalued. Only 5% believe that prices are close to their fundamental value, while undervaluation was not reported by anyone. Almost a fifth of participants express additional reservations through comments or alternative assessments, suggesting a nuanced perception of the market situation. This comes amid macroeconomic volatility, persistent inflationary pressures, rising nominal incomes, constrained housing supply in urban centers, and declining real interest rates. In such an environment, housing increasingly acts not only as a consumption good but also as a store of value and speculative asset – a pattern long observed in emerging European economies.

The subject of this study is the housing price dynamics in Bulgaria, and the research object is the structural composition and transmission of macroeconomic shocks that affect residential real estate prices. The core research thesis is that house price dynamics in Bulgaria are not fully explained by fundamental (deterministic) drivers, but instead display significant cumulative behavior influenced by expectation-driven feedback loops and financial market imperfections.

The main objective of this study is to reveal the underlying macro-financial logic that governs the housing price dynamics in Bulgaria, by tracing how various structural shocks – both domestic and external – interact over time to generate cumulative or destabilizing patterns in a seemingly fundamental-driven market. Through this lens, the study seeks to explain not only how prices have moved, but why they have moved the way they did, and what this implies for future sustainability, policy response, and affordability.

It looks like the Bulgarian literature (discussed below) is evolving, but remains fragmented across descriptive, forecasting, and equilibrium-based approaches. An integrated, shock-based dynamic framework such as the one presented here offers a novel lens to understand price booms, affordability shifts, and policy challenges in Bulgaria's housing market. Against this background, the current study focuses on identifying and quantifying the structural shocks that have driven the housing price dynamics in Bulgaria over the period 2002 – 2024. In doing so, the article aims to contribute to the academic and policy debate on

the drivers of house price dynamics and their implications for financial stability, affordability, and macroprudential regulation.

Literature Review: Approaches to Housing Price Determinants in Bulgaria

The literature on housing price dynamics in Bulgaria has grown in recent years, reflecting both domestic structural changes and broader European trends. This review aims to provide a comprehensive, methodologically informed overview of the main contributions, limitations, and emerging gaps in the current research field. We organize the discussion around three main axes: (1) structural and macroeconomic modeling approaches, (2) empirical econometric studies, and (3) institutional and diagnostic assessments. We conclude with a discussion of research gaps and how the present study contributes to the field.

The most analytically advanced contribution comes from Kotseva and Yanchev (2017) in a Bulgarian National Bank discussion paper. They develop a vector error correction model (VECM) to capture the long-run relationship between housing prices and fundamental macroeconomic variables: GDP, interest rates, credit to households, and foreign direct investment. A noteworthy innovation is their inclusion of a "hypothetical borrowing value" index, which approximates affordability using annuity-based present value estimates of mortgage payments, thereby linking interest rate dynamics directly to effective demand. Their model identifies a significant overvaluation of house prices in the period 2006 – 2008, in the range of 15-20%, and demonstrates that the housing market corrected to a level consistent with fundamentals following the global financial crisis. Importantly, the study acknowledges the role of subjective dynamics – sentiment, expectations, and speculation – but does not formally model them. While robust in the treatment of cointegration and mean-reverting properties, the study does not explore structural shocks or feedback loops through SVAR-type modeling.

Ivanov (2024) also applies a VECM framework to estimate deviations from equilibrium housing prices in Bulgaria. His study focuses on whether current prices reflect overheating. While methodologically sound, the results suggest no strong evidence of bubble-like behavior in 2022 – 2023. However this work omits behavioral and financial frictions that may drive short- to medium-term deviations. Research on house price dynamics in Bulgaria and closely related Central and Eastern Europe (CEE) area reveals complex interactions between economic fundamentals and transition-specific factors. Conventional determinants like disposable income, population, and interest rates play significant roles, alongside transition-specific elements such as remittances and credit growth (Égert and Mihaljek, 2007; European Central Bank, 2010; Iliev et al., 2013). Nonlinear analysis

indicates asymmetric house price adjustments in transition countries, potentially contributing to price booms (Posedel & Vizek, 2009). Although these factors explain much of the price movements, pre-crisis overshoots occurred in some CEE countries, followed by sharp corrections post-crisis (Huynh-Olesen et al., 2013).

A significant cluster of research has explored statistical modeling of prices through time series methods. Iliychovski et al. (2022) apply ARIMA and multivariate regression models, testing income per capita and credit per capita as predictors of housing price per square meter. Their models demonstrate high correlation and reveal that both variables strongly co-move with housing prices in the short run. However, the models are limited to point forecasting and lack systemic macro-financial context. There is no structural interpretation of causality, nor do the models account for expectations or policy feedback.

Other Bulgarian studies in the literature apply panel regressions and comparative frameworks, often with data covering 2000 – 2020. Mavrov (2018) finds that unemployment had the highest inverse correlation with prices during the 2002 – 2014 period, while inflation's correlation grew in the post-pandemic period. However, these models are not embedded within dynamic simulation frameworks that allow for feedback effects or propagation. The BNB discussion paper (2017) offers a historically contextualized view of the Bulgarian housing market, arguing that supply-side constraints stem from legacy issues dating back to the socialist era and the incomplete restructuring during transition. The authors note that Bulgaria's construction sector failed to match economic growth after 2000, and that long-term supply rigidity exacerbates price movements driven by external or demand-side shocks.

Separately, Nenov (2024) presents a labor market-focused analysis, showing that housing affordability in Sofia limits geographical mobility of lower-income workers. While not focused on price modeling, this approach underlines the macroeconomic externalities of house price misalignments. The relationship between housing prices and macroeconomic factors varies across different markets and economic cycles, highlighting the importance of local economic specifics in shaping housing markets (Iliev, 2024). From a policy and planning perspective, Ilijchovski et al. (2022) argue that the Bulgarian housing market lacks adequate forecasting infrastructure and propose using short-horizon ARIMA models and regression-based assessments. While their effort is notable for introducing prediction tools, it falls short of identifying structural imbalances or testing hypotheses about speculative dynamics.

Despite the diversity of methodologies and the increasing interest in the topic, several key gaps persist in the Bulgarian academic and institutional literature on housing prices. First, most models fail to incorporate forward-looking

expectations, even though international studies and behavioral finance literature highlight expectations as a central driver of housing price dynamics. This omission limits the ability of existing models to explain self-reinforcing trends or speculative behavior. Second, the role of credit conditions, financial leverage, and macroprudential policy remains insufficiently developed. Although some studies mention credit-to-income metrics or mortgage volumes, these variables are typically treated in a descriptive manner and not within an integrated macro-financial framework. Third, while housing supply constraints are acknowledged in narrative discussions, they are rarely incorporated into quantitative models. Fourth (and maybe the most important gap), structural shocks and historical decomposition techniques, are virtually absent from the literature. This creates a major gap in our understanding of the timing and persistence of key turning points in Bulgaria's housing market, particularly during crisis episodes or boom periods.

This paper addresses several of these gaps. It applies a structural VAR (SVAR) model to the Bulgarian housing market using quarterly data for the period 2002 – 2024. The model incorporates a rich set of variables: expectations (using ESI indicators), capital inflows (FDI), leverage (banking sector risk), and price dynamics. Both recursive short-term identification (explicit) and long-run structural (implicit) restrictions are applied. Historical decomposition is used to detect the relative contribution of shocks – expectations, policy, credit – to house price changes over time. By bridging econometric rigor and macro-financial insight (in the next section below), this study aims to contribute not only to national literature but to the broader debate on housing markets in small open economies with financial constraints. It is the first known study for Bulgaria to empirically estimate the speculative component of housing prices using structural decomposition methods.

Methodological Framework

Analytical Rationale and Core Mechanism
The analytical framework of this study builds upon the expectations-driven housing model presented by Carlin and Soskice (2024), which is designed to capture the self-reinforcing feedback loop between house price expectations, credit, and actual price dynamics. This approach combines demand-side financial frictions with psychological (forward-looking) mechanisms, making it particularly suited for the Bulgarian case, where supply rigidities and financial transmission matter. In this version house price changes are driven by two central components: (i) demand for housing, which is credit-sensitive, and (ii) expected future house prices, which are partially adaptive. Prices respond to these factors according to:

$$\Delta P_{H,1} = \alpha \Delta H^D_1 + \beta \Delta P^e_{H,1} \qquad (1)$$

Where: $\Delta P_{H,1}$ is current period housing price change; $\Delta P^e_{H,1}$ is expected next period housing price change; $\Delta H_{D,1}$ is generated housing demand, $\alpha, \beta > 0$ are sensitivity parameters.

Expectations are formed adaptively:

$$\Delta P^e_{H,1} = \gamma \Delta P_{H,1} \qquad (2)$$

With $\gamma \in (0,1)$, reflecting backward-looking (extrapolative) expectations.

Housing demand is a function of credit availability:

$$\Delta H^D_1 = \delta \Delta L_1 \qquad (3)$$

The volume of new loans ($\Delta L_{,1}$) is constrained by the perceived value of collateral and perceived risk:

$$\Delta L_1 = \eta \lambda \Delta P_{H,0} H_0 - \alpha \Delta z_{,1} \qquad (4)$$

Where: λ reflects LTV – loan-to-value, $P_{H0} H_0$ is collateral, $a \Delta z$ are changes in risk perceived.

In this framework, supply is either assumed fixed or weakly elastic in the short run. This condition amplifies the feedback effects described above, as new supply does not offset demand-side pressures, leading to stronger price responses to expectations and credit shocks. We follow core mechanism logic and adopt the restrictive assumption of inelastic supply, justified empirically by structural constraints in Bulgarian construction capacity, land-use regulation, and administrative bottlenecks. This theoretical model implies that house price increases can become self-fulfilling if expectations are sufficiently extrapolative and credit conditions loose. It also predicts that stabilization policy must address both expectations and financial accelerators to avoid boom-bust cycles. The above equations inform the structure of the SVAR model in two important ways: Expectations enter as a forward-looking variable with endogenous propagation; Credit and capital inflows affect demand directly but are mediated through risk-sensitive lending and perceived wealth effects. By including leverage as a financial friction indicator, the model also captures the banking sector's role in amplifying or dampening price responses.

To empirically identify the macro-financial mechanisms influencing housing prices in Bulgaria, this study employs a Structural Vector Autoregression (SVAR) model. The SVAR approach is particularly suitable for this context as it allows for

the identification and quantification of structural shocks that may be unobserved but are economically interpretable – such as shocks to capital inflows, inflation expectations, credit conditions, and financial sector risk. Unlike reduced-form VAR models, SVAR incorporates economically meaningful restrictions, enabling both causal inference and historical decomposition.

The choice of SVAR is motivated by the need to go beyond long-run cointe-gration or short-term forecasting (as in previous VECM and ARIMA models) and instead examine the dynamic propagation and relative contribution of structural innovations to housing price variation over time.

Variable Selection and Data Description

The system includes five variables on a quarterly basis, selected to capture the relevant channels identified in the literature:

1. **PH_YoY** – Year-over-year percentage change in housing prices (source: NSI).

2. **Pexp** – Expected housing prices three months ahead, based on the construc-tion sector's expectations from the ESI (source: European Commission).

3. **FDI_Gap** – Cyclical component of foreign direct investment inflows as a share of GDP, obtained through HP filter smoothing (source: BNB, own calcula-tions).

4. **Credit_YoY** – Year-over-year growth rate of household credit (source: BNB).

5. **Leverage** – System-wide banking sector leverage ratio, approximated by Tier 1 capital to total exposures (source: BNB and supervisory reports).

All variables are tested for stationarity using ADF and KPSS tests. Where necessary, first-differencing or HP filtering is applied to ensure that the SVAR op-erates in a stable environment. Lag selection is based on the Akaike and Schwarz information criteria, with LM residual tests ensuring no serial correlation. The baseline model includes two lags.

Identification, Historical Decomposition and Scenario Analysis

The SVAR model is identified using a recursive short-run Cholesky decomposition (A matrix), combined with a set of long-run restrictions (L matrix) motivated by theoretical and empirical priors. The ordering of variables reflects a recursive causality assumption, where capital inflows are treated as exogenous in the short run, followed by expectations, credit, banking leverage, and finally house prices. The central empirical tool is historical decomposition, through which each variable's contribution to housing price variation is isolated over time. This allows for a backward-looking assessment of:

• The magnitude and direction of expectation-driven shocks;
• The impact of foreign capital surges and credit booms;

- The role of banking sector leverage as a constraint or amplifier;
- The residual own-price dynamics, interpreted as self-sustained or speculative movements.

To deepen the interpretive value of the results, the paper further develops counterfactual scenarios, estimating what house price trajectories would have looked like in the absence of one or more dominant shocks. This technique strengthens the causal argument of the model and informs policy implications.

Empirical Results and Structural Decomposition

Model Diagnostics and Stability

The baseline SVAR model was estimated with two lags, as determined by the Akaike and Schwarz information criteria. Residual diagnostics (LM test) confirm the absence of serial correlation, and all variables were confirmed to be stationary after appropriate differencing or filtering. The model satisfies stability conditions, and the eigenvalue decomposition places all roots within the unit circle. Variance decomposition shows that over a 10-quarter horizon, a large portion of the variance in housing prices is explained by own-price dynamics, followed by capital inflows, credit conditions, and to a lesser extent, expectations and leverage. This confirms the theoretical intuition that housing prices are subject to both demand-driven pressures and internally propagated cycles.
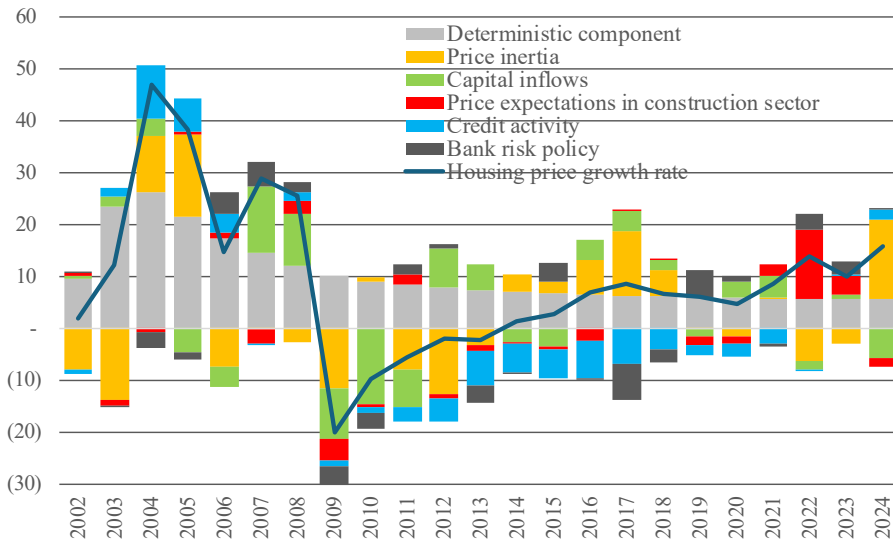
Source: Own calculations

Figure 1: Assessment of price dynamics factors – results from SVAR model

Using historical decomposition, we disentangle the contribution of each structural shock to the observed housing price trajectory. The results suggest four distinct subperiods with qualitatively different dynamics:

(a) 2002 – 2008: Credit and Capital-Driven Expansion

This period is characterized by a strong and positive contribution from capital inflows and credit growth. FDI as a share of GDP rose significantly, while household credit expanded by over 30% annually. These forces, combined with moderate expectations and rising income, generated a sustained increase in housing prices. The model attributes over 60% of the price appreciation in this period to exogenous capital and credit shocks, amplified by feedback from expectations.

(b) 2009 – 2013: Post-Crisis Contraction and Adjustment

Following the global financial crisis, capital inflows reversed sharply, and credit conditions tightened. Historical decomposition shows negative contributions from both capital and leverage shocks, while expectations turned downward. House prices stabilized in real terms, and the model identifies this period as a fundamental correction phase. The negative own-price shock component reflects the unwinding of prior speculative momentum.

(c) 2014 – 2019: Gradual Recovery with Decent Risk

In the post-crisis recovery phase, capital inflows resumed gradually, and bank leverage stabilized. Credit growth recovered at a moderate pace. Interestingly, the model attributes a growing share of price dynamics to own-price shocks, suggesting an increasingly autonomous momentum, likely reflecting renewed speculative sentiment. Expectations played a secondary role, remaining positive but modest.

(d) 2020 – 2024: Expectations and Financial Acceleration

In a more immediate perspective, the period 2022–2024 represents a particularly interesting stage in the dynamics of housing prices in Bulgaria, because it combines characteristics of fundamentally based growth with manifestations of cumulative and speculative effects. It follows the phase of recovery from COVID-19, but is also marked by serious macroeconomic shocks - a global inflation wave, geopolitical uncertainty and a continued increase in demand for relatively low-risk assets. During this period, price expectations are significantly strengthened, especially in the construction sector. This is probably related to an increase in the prices of construction materials and logistics (inflationary burden), the belief that investment in property is protected from depreciation of savings, speculative expectations for further price increases, especially in the context of the upcoming entry into the eurozone. A pronounced independent price dynamics is observed, this suggests the presence of market behavior in which prices are growing due to psychological expectations, which emphasizes the speculative element in recent years. Credit growth follows the growth of nominal incomes, but this does not

negate the fact of significant credit expansion and changed banking behavior, which suggests the need for increased attention to the long-term sustainability of the market.

Concluding Remarks and Scenario Analysis

The divergence between these scenarios highlights the sensitivity of the housing market to sentiment-driven dynamics and the absence of automatic stabilizers in a context of inelastic supply. This study offers a structural perspective on the drivers of housing price dynamics in Bulgaria from 2002 to 2024. By employing a SVAR model informed by the Carlin and Soskice feedback framework, it isolates the contributions of capital inflows, credit availability, financial risk, expectations, and self-reinforcing price shocks.

The empirical findings suggest that the Bulgarian housing market has alternated between externally driven expansions and domestically sustained momentum, especially in the 2021–2024 period, where expectations and speculative feedbacks played a dominant role. Structural shocks related to capital and credit explain much of the pre-crisis and recovery dynamics, but are increasingly complemented or overshadowed by extrapolative behavior. The results also confirm that affordability is not only a function of income and credit, but of expectations and institutional inertia. In the absence of elastic housing supply or active macroprudential policy, the market remains vulnerable to speculative cycles. The findings have broader implications: in small open economies with limited monetary independence and weak regulatory buffers, housing prices can become endogenous to beliefs and global liquidity.

To further test the implications of the model, two counterfactual scenarios are constructed based on the historical decomposition:

Scenario 1: Sustained Fundamental Growth. This scenario excludes the contribution of own-price and expectation shocks post-2020. It assumes housing prices are driven solely by capital flows, credit, and leverage. Under this specification, the estimated growth in housing prices is notably more moderate – suggesting a trend of 4-6% annually, consistent with wage growth, demographic stabilization, and inflation-adjusted fundamentals. Housing affordability would have remained relatively stable, with price-to-income ratios converging.

Scenario 2: Speculative Escalation. This scenario assumes further amplification of expectation and own-price shocks, with neutral or absent financial tightening. The resulting path shows housing prices growing at unsustainable double-digit rates, further decoupling from incomes. Affordability deteriorates sharply, while macroprudential risks accumulate, particularly through leverage channels. The model suggests that in this regime, expectations become self-

fulfilling and can only be reversed through policy interventions or external corrections.

This study offers a structural perspective on the drivers of housing price dynamics in Bulgaria from 2002 to 2024. By employing a SVAR model informed by the Carlin and Soskice feedback framework, it isolates the contributions of capital inflows, credit availability, financial risk, expectations, and self-reinforcing price shocks. The results confirm that housing prices in Bulgaria are not solely driven by fundamentals such as income or interest rates. Instead, expectations and credit-market feedbacks increasingly dominate, especially in the post-COVID period. The model validates the presence of speculative dynamics in recent years, where prices are partly sustained by sentiment and extrapolated beliefs. From a policy perspective, the findings suggest that affordability cannot be improved through income growth alone. Active macroprudential tools (e.g., LTV limits, countercyclical capital buffers), transparent communication about market fundamentals, and supply-side measures (e.g., permitting, incentives for rental housing, tax policy) are needed to mitigate speculative acceleration. Monitoring expectations – currently neglected in policy frameworks – should become a core element of risk assessments. Further research should focus on integrating regional heterogeneity, exploring the role of demographic dynamics, and applying non-linear or regime-switching models. It is also essential to explore more granular microdata and combine financial indicators with household-level behavior to refine policy diagnostics.

Sponsorship

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