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16 October 2023

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Macroeconomic Variables and Volatility Regimes as Determinants of the House Price Index: A Case for the UK

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Overview

What constitutes the complex relationship between macroeconomic factors and the UK housing market? Is the dynamic nature of these relationships regime-dependent? Our research aims to assess how fluctuations in macroeconomic variables influence both house prices and the broader economic landscape. Additionally, we employ a two-state Markov switching model to reveal how economic regimes impact variable dynamics. The study provides forecasts for key variables, shedding light on potential trends in house prices and write-off rates in the UK.

We have uncovered compelling evidence indicating that house price growth significantly influences other variables within the system, suggesting its role as a leading indicator. Our Granger causality tests further illuminate the predictive power of lagged house price growth, corroborating previous research in this field.

Furthermore, our research reveals the presence of two distinct economic regimes: periods of high volatility and low volatility. During high volatility periods, all variables exhibit Granger causation, signifying predictive strength from their lagged values. Conversely, during low volatility periods, specific variables establish unique relationships, underscoring the influence of economic regimes. Notably, as of the first quarter of 2023, the UK is transitioning into a high volatility period.

In addition, our forecasts suggest an increased probability of write-off rate deterioration. This forecasting exercise calls for increased vigilance, particularly during high volatility periods when inflation can adversely impact the housing market and the broader economy. These projections offer a valuable glimpse into the future of the UK housing market.

Introduction

The report explores the dynamic relationship between macroeconomic factors and the UK housing market, employing econometric techniques. Its primary objectives are to assess how macroeconomic fluctuations influence house prices and the broader economy, investigate how these relationships vary across different economic regimes, and provide forecasts for write-off rates and house price index growth rates.

Methodology and Models

i. Statistical Models

The research employs a Vector Autoregressive (VAR) model to investigate the dynamic relationship between macroeconomic factors and the UK housing market. This multivariate model includes all variables as endogenous, capturing feedback effects between them.

For regime analysis, a two-state Markov switching model is used. This model includes a Markov chain based on a constant transition probability matrix and an autoregressive (AR(1)) model on the house price index growth rate series. In a two-state Markov switching model, there are two regimes, and the transition probability matrix determines the likelihood of moving from one regime to another.

ii. Data

The study includes 90 observations across 7 variables, spanning from Q1 2001 to Q2 2023. These variables are:

1. HPIgr: Year-on-year growth in a house price index
2. RGDPgr: Year-on-year growth in real gross domestic product
3. CPIgr: Year-on-year growth in a consumer price index (inflation rate)
4. un_rate: Unemployment rate
5. MortgageRate: Fixed Mortgage Rate (5-year 75% LTV) in the UK
6. WriteOffRate: Annualised percentage of UK-wide loan balance written off in the residential loan sector
7. SecuredAnnex: Availability of secured credit provided to households according to the credit conditions survey

iii. Defining and Choosing the Models

The appropriate number of lags for the VAR model was determined using information criteria. Four models were considered, each exploring different lag configurations and transformations of non-stationary variables:

1. Standard Model 1 lag: No variable transformation, 1 lag.
2. Standard Model 2 lags: No variable transformation, 2 lags.
3. Transformed Model 1 lag: Growth rate in un_rate and MortgageRate and first differences in CPIgr, 1 lag.
4. Transformed Model 2 lags: Growth rate in un_rate and MortgageRate and first differences in CPIgr, 2 lags.

Statistical checks, including stationarity and structural breaks of residuals, as well as heteroscedasticity tests, were conducted. The Standard Model with 2 lags emerged as the best choice, providing stable and accurate re-

sults. As well, the Standard Model with 2 lags consistently outperformed others in various forecasting accuracy metrics.

Results

i. Dynamics among Macroeconomic Variables

The VAR model results suggest that HPIgr influences other variables in the system more than the reverse, aligning with previous research. As well Granger causality tests were conducted. Below can be seen the results of the Granger causality test for HPIgr:

> **Granger causality** H_0: House price growth rate does not Granger-cause unemployment rate, inflation, real GDP growth rate, mortgage rate, and the write-off rate.
>
> data: VAR object model_lag2
>
> F-Test = 1.7304, df1 = 10, df2 = 444, p-value = 0.0716

For HPIgr, the null hypothesis was nearly rejected, indicating that lags of HPIgr predict contemporaneous values of other variables. No other variables showed conclusive evidence of Granger-causing others.

Orthogonal impulse response functions reveal that there are intricate feedback loops in the system. Positive housing market shocks affect unemployment, inflation, and potentially economic strain. HPIgr and un_rate are key shock initiators, highlighting crucial pathways of influence.

Lastly, figure 1 shows HPIgr significantly influences most variables' variance, underscoring its substantial role in the economy.

ii. Regime Switching Model Analysis

The regime-switching analysis introduces a nuanced perspective into the dynamics of the UK housing market.

We present transition probabilities for the regime-switching model, which identifies two distinct regimes: high volatility and low volatility. The transition probabilities offer insights into the likelihood of shifts between these regimes. Notably, as of the first quarter of 2023, we are entering a high volatility period. Figure 2 illustrates the regime probabilities.

VAR models are run for both regimes, shedding light on how house price sensitivity to macroeconomic changes differs under varying levels of volatility. Results indicate heightened sensitivity of HPIgr to variable changes during high volatility scenarios. We also observe that changes in mortgage rates and WriteOffRates become more significant during high volatility periods.

Granger causality tests are conducted separately for each regime. In high volatility regimes, all variables Granger cause the system, indicating predictive power from their lagged values. In contrast, during low volatility periods, only certain variables lack Granger causation with others, highlighting regime-based differences in variable relationships. Results of the Granger causality tests can be found in Table 1.

An intriguing aspect of the regime-switching analysis is the ability to investigate the impulse response functions for the current high volatility regime. Results show that a positive shock to CPIgr negatively impacts HPIgr, mirroring the ongoing UK scenario of high inflation and a slowing housing market. This underscores the regime-dependent nature of real estate dynamics and their macroeconomic drivers.

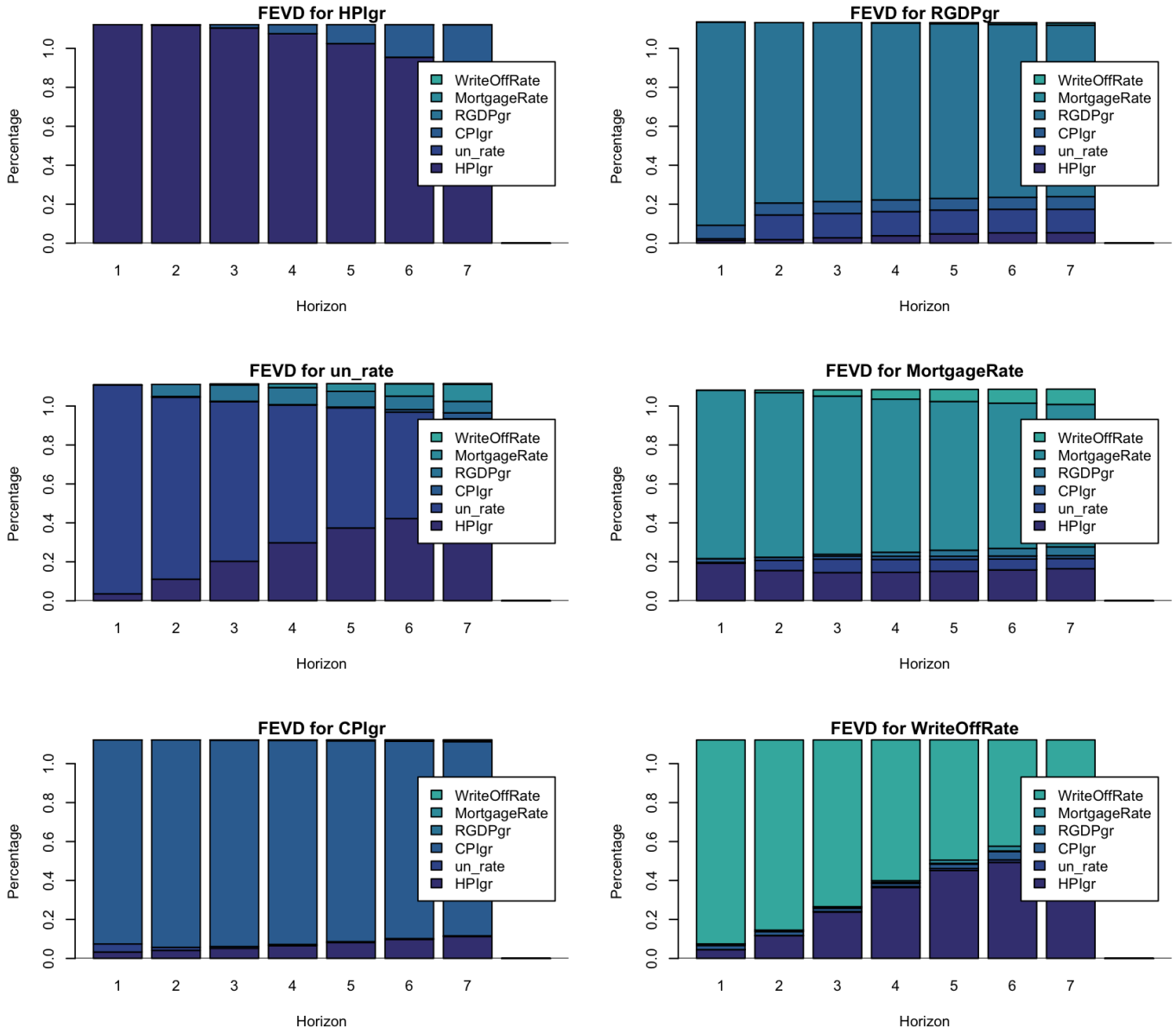

Figure 1: Variance decomposition is an analytical approach that dissects the overall variance in an outcome variable into distinct meaningful components. This visual representation aids in understanding how variables contribute to their own shocks or fluctuations.

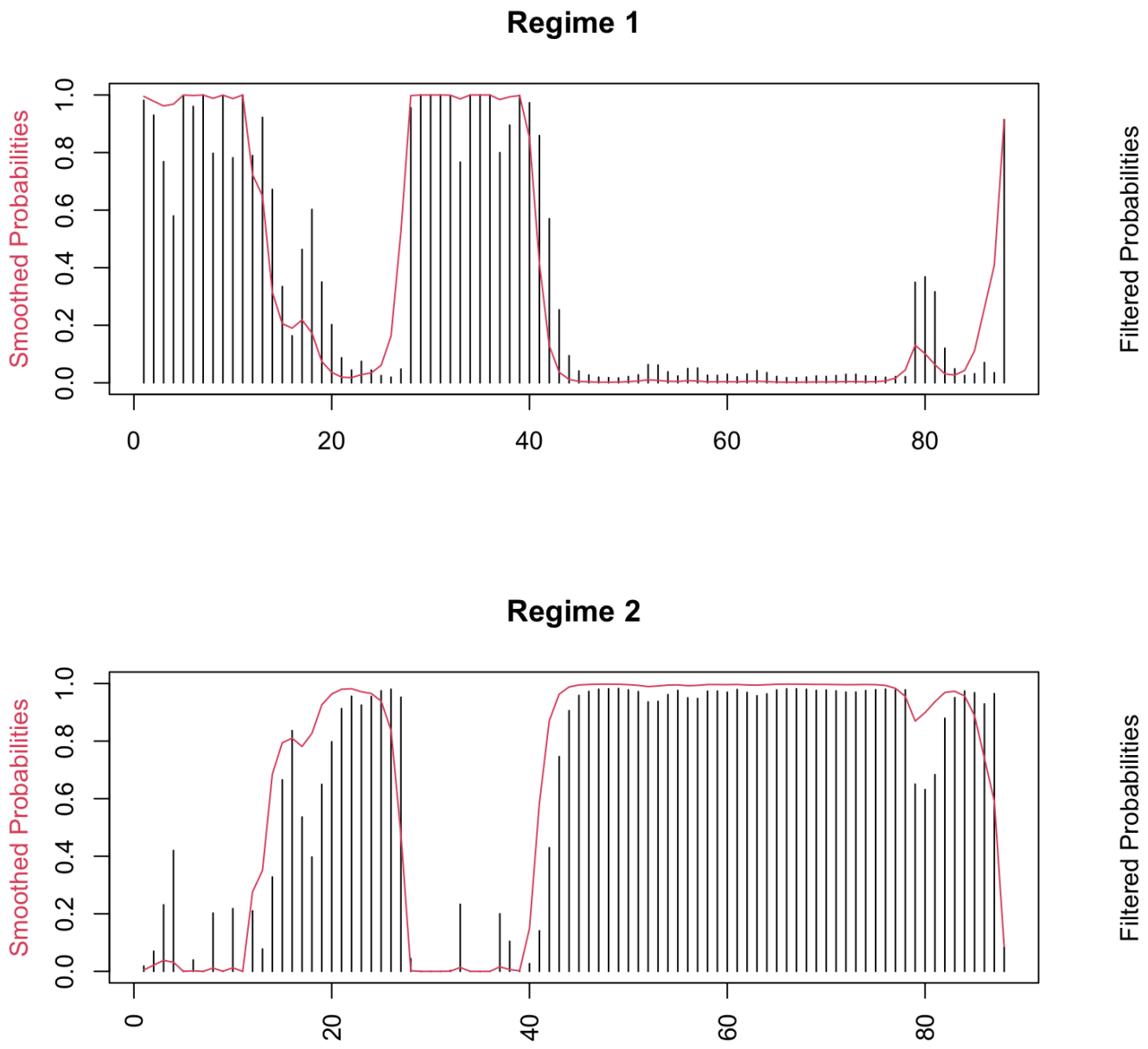

Figure 2: Filtered probabilities reflect the evolving regime estimates as new data becomes available, while smoothed probabilities provide a more complete and accurate representation of the historical regime probabilities by considering all available data, making it have a smoother behavior.

Table 1: Granger Causality Test for Low and High Volatility Regimes

Variable	P-value	Granger causes the system?
Low Volatility Regime		
HPIgr	0.14	No
Un_rate	0.00	Yes
CPIgr	0.01	Yes
RGDPgr	0.10	Yes (significant at the .1 level)
Mortgage Rate	0.06	Yes (significant at the .1 level)
WriteOffRate	0.30	No
High Volatility Regime		
HPIgr	0.00	Yes
Un_rate	0.00	Yes
CPIgr	0.00	Yes
RGDPgr	0.00	Yes
Mortgage Rate	0.04	Yes
WriteOffRate	0.02	Yes

iii. Forecasting

The forecasting exercise provides a glimpse into the future of the UK housing market.

We present forecasts for both HPIgr and WriteOffRate for the upcoming quarters in plots 3 and 4. These projections suggest a slight increase in HPIgr and a rise in WriteOffRate, indicating a potential economic downturn if the WriteOffRate's projections materialise. To gain a deeper understanding, we compare our forecasts with baseline and adverse scenarios. The scenarios for HPIgr align with the Bank of England's projections, while WriteOffRate projections incorporate NPL Markets' assessments based on the Bank of England's 2022 bank stress test scenarios. Notably, our projections for the Write-Off Rate are more pessimistic than the baseline but more optimistic than the adverse scenario. As for our HPIgr projections they seem to closely align with the Bank of England's baseline scenario.

Table 2: Forecasting *HPIgr* and *WriteOffRate* up to 4 Periods

	Q3 2023	Q4 2023	Q1 2023	Q2 2024
HPIgr	1.21	1.35	1.77	2.07
WriteOffRate	0.0065	0.0097	0.0111	0.0116

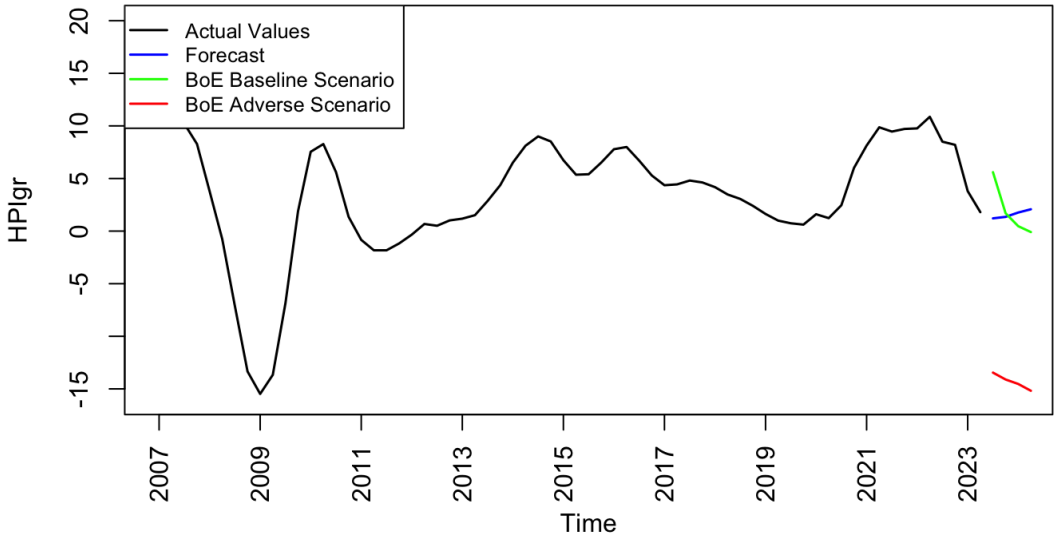

Figure 3: Forecasting for the HPIgr series for up to four quarters. These projections encompass three distinct categories: the research's developed VAR model, along with the Bank of England's adverse and baseline scenarios.

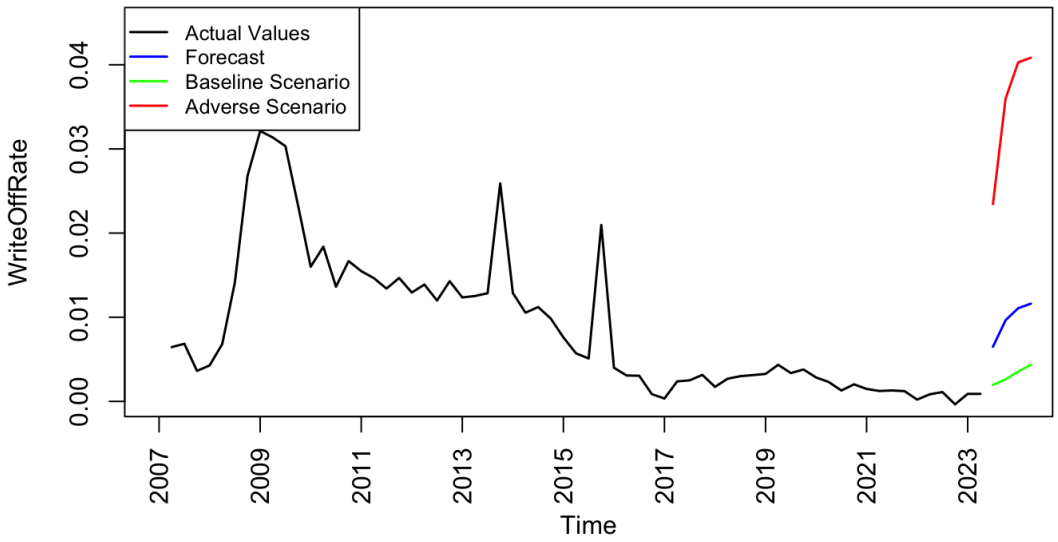

Figure 4: Forecasting for the WriteOffRate series for up to four quarters. These projections encompass the research's developed VAR model, along with the NPL Markets' projections based on scenarios of the Bank of England 2022 stress test.

Conclusion

In conclusion, this analysis unravels the complex web of relationships between macroeconomic variables and the UK housing market. The research highlights the role of HPIgr as a leading indicator and underscores the regime-dependent nature of these relationships. Our forecasting exercise calls for vigilance, particularly in high volatility periods, where inflation can adversely affect both the housing market and the broader economy.

Recommendations for Future Research

Future research avenues may explore more advanced models that explicitly capture regime shifts for enhanced forecasting accuracy. Additionally, integrating granular data and considering regional variations within the UK housing market could provide a more comprehensive understanding of dynamics.

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