DOI: 10.55643/fcaptp.3.62.2025.4724

Iryna Lukianenko
D.Sc. in Economics, Professor of the Department of Finance, National University of Kyiv-Mohyla Academy, Kyiv, Ukraine;
ORCID: 0000-0002-4128-5909

Mariia Nasachenko
PhD in Economics, Department of Finance, National University of Kyiv-Mohyla Academy, Kyiv, Ukraine;
e-mail: m.nasachenko@ukma.edu.ua
ORCID: 0000-0002-5560-4640
(Corresponding author)

Taras Tokarchuk
Candidate of Economy Sciences, Department of Finance, National University of Kyiv-Mohyla Academy, Kyiv, Ukraine;
ORCID: 0009-0004-4370-489X

Received: 07/02/2025
Accepted: 19/05/2025
Published: 30/06/2025

ESTIMATING INFLATION AND INFLATION EXPECTATIONS BASED ON A MARKOV-SWITCHING VECTOR AUTOREGRESSION APPROACH: CASE OF UKRAINE

ABSTRACT

This article examines the behaviour of inflation and inflation expectations in Ukraine under conditions of macroeconomic instability caused by the full-scale Russian-Ukrainian war. Using a Markov Switching Vector Autoregressive (MS-VAR) model, the study investigates regime-switching dynamics between high and low volatility periods from 2021 to 2024. The findings reveal a significantly longer duration of high-volatility regimes (averaging 4 months) compared to low-volatility regimes (1.4 months), reflecting the prolonged instability in the macroeconomic environment.

The results highlight that inflation expectations and consumer price index (CPI) dynamics differ markedly between regimes. Under low volatility, changes in the key policy rate have a stronger and more predictable impact on domestic prices, aligning with theoretical expectations. Conversely, during high volatility, both inflation expectations and the CPI are predominantly driven by their own fluctuations, limiting the central bank's control. During periods of destabilization, the influence of monetary policy on the macroeconomy tends to weaken, as heightened volatility diminishes the effectiveness of policy transmission mechanisms.

The study also demonstrates the utility of the MS-VAR model in capturing regime-dependent dynamics and the influence of monetary policy during crises. The model successfully passed the Stability Condition Check, ensuring its reliability for analysis. Insights from Ukraine's experience in conducting monetary policy under conflict conditions offer valuable lessons for other nations facing similar economic challenges. The findings emphasize the critical role of adaptive monetary strategies in maintaining economic resilience amid crises.

This research provides valuable insights into the interplay between macroeconomic indicators during periods of instability, such as crises or wartime, and offers a framework for policymakers to navigate the complexities of managing inflation and expectations under volatile conditions. The findings are particularly relevant for countries facing similar economic challenges, as they underscore the importance of understanding regime shifts and the nonlinear dynamics of inflation and economic policies during times of crisis or conflict.

Keywords: inflation, inflation expectations, monetary policy, macroeconomic instability, monetary instruments, Markov-Switching VAR, econometric model

JEL Classification: C32, C34, E31, E37

INTRODUCTION

The start of the destabilization period in Ukraine due to the full-scale war against Russia also stipulated certain imbalances in the economies of other countries, in particular those, which helped in the financial sphere, gave weapons, accepted and provided minimal funding to Ukrainians fleeing the war. Macroeconomic destabilization caused by the ongoing war in Ukraine, lead to the tightening of monetary policies of countries with emerging markets and advanced economies. Starting of the deterioration of inflation expectations due to the risks of crisis in financial markets and in the economy overall became a driving factor for central banks in their decision to increase their key rates. Countries offering financial support or accommodating refugees have faced increased fiscal burdens. These challenges are amplified by energy price shocks and supply chain disruptions, requiring governments to adapt policies to balance domestic economic stability with international commitments. The war's disruption to global grain and energy markets has amplified inflation risks, creating challenges for countries dependent on imports from the region. Advanced economies, such as those in the EU, have also adjusted their fiscal priorities, including increased defence spending and energy diversification efforts.

To effectively analyze how economies, respond to crises and periods of instability, it is often inadequate to rely solely on models that describe relationships between multiple time series. Traditional models frequently lack the sophistication needed to address non-linear dynamics, structural breaks, or regime changes, which are common during economic disruptions. Advanced methodologies, such as Markov-switching models, offer a more robust approach. These models are capable of capturing transitions between economic regimes and account for the varying impacts of shocks across different phases of economic cycles, providing a more comprehensive and dynamic understanding of economic behaviour during instability.

LITERATURE REVIEW

Numerous econometric tools with varying levels of complexity are available for modelling monetary phenomena. However, in the context of current macroeconomic destabilization—driven by the pandemic, inflationary pressures, wars, and political uncertainty—it has become increasingly critical to employ advanced economic-mathematical instruments. These tools are essential for capturing the inherent nonlinearities of the present situation, enabling more accurate analysis and informed decision-making amidst complex and dynamic economic conditions. Markov-switching Vector Autoregressive (MSVAR) models are a powerful analytical tool, effectively capturing the combination of gradual changes in economic and financial variables with abrupt transitions between a limited number of regimes. These models are particularly useful in studying systems where structural shifts play a critical role, such as transitions between economic expansions and recessions (Hubrich & Tetlow, 2014). Similarly, in the context of fiscal and monetary policies, these models have been applied to assess the dynamic impacts of policy instruments, such as interest rate cuts and government investments, on macroeconomic indicators (Rivero, Ramirez & Mendivil, 2025).

The onset of the full-scale Russian-Ukrainian war in 2022 severely destabilized Ukraine's economic system, resulting in significant increases in inflation and inflation expectations, a devaluing exchange rate, and shortages of imported goods (Centre for Economic Policy Research, 2022). This period is characterized by high volatility and alternating phases of macroeconomic turbulence and short intervals of stabilization achieved through government intervention. By fixing the exchange rate and implementing currency restrictions, the National Bank of Ukraine helped avert panic in the foreign exchange market. Despite these measures, however, pressure on the exchange rate and international reserves continued to build. Additionally, the imbalance between inflationary and exchange rate expectations intensified, heightening the risk of an uncontrollable inflationary spiral and a potential currency crisis. In response, the National Bank adapted its monetary policy to align with the prolonged realities of a war of attrition, balancing immediate economic stability with longer-term financial resilience (Lepushynskyi, 2023).

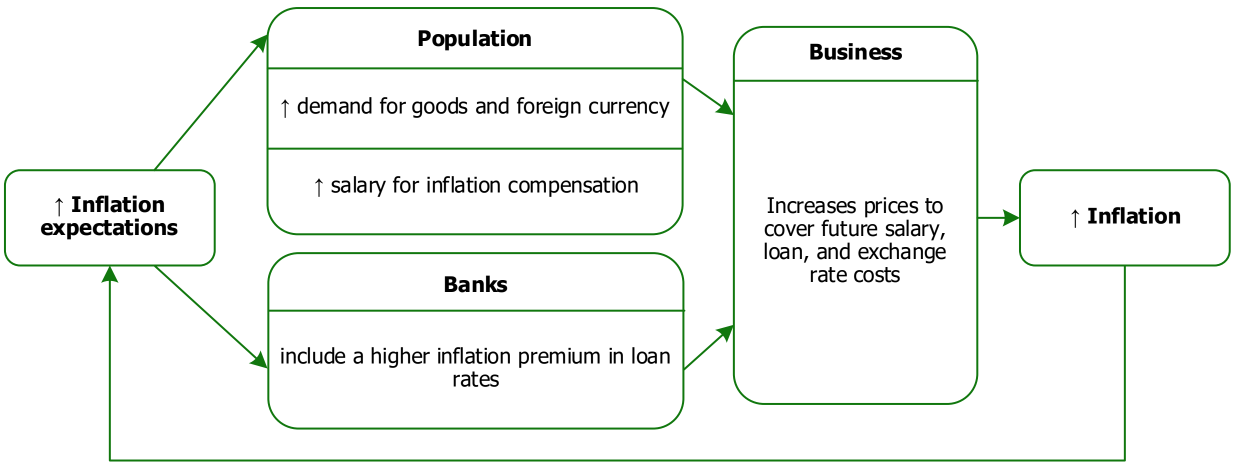

Figure 1. The self-sustaining cycle of price increases. *(Source: made by authors based on Lepushynskyi (2003); Tsapin & Faryna (2024))*

DOI: 10.55643/fcaptp.3.62.2025.4724

The development of the "inflation-expectations-exchange rate-wages" (Figure 1) spiral can lead to a self-sustaining cycle of price increases, where inflationary pressures begin to reinforce themselves. Persistent imbalances in inflation expectations make central bank intervention essential to control inflation through monetary tools; without such action, the imbalance can adversely affect financial stability and impede economic growth. Recognizing this, central banks have expedited the tightening of interest rate policies, both in emerging markets (such as Brazil (Monetary Policy Committee, 2024), Chile (Banco Central Chile, 2022), Hungary (Magyar Nemzeti Bank, 2022), and Mexico (Banco de Mexico, 2022) and in advanced economies, including the Federal Reserve (Board of Governors of the Federal Reserve System, 2022), the European Central Bank (2022), and the Bank of England (2022). This proactive approach aims to stabilize inflationary expectations and maintain economic resilience amid rising global uncertainties.

In such a complex and dynamic environment, the use of advanced econometric models, such as the Markov Switching Vector Autoregressive (MS-VAR) model, is essential for analyzing the interconnections between inflation, inflation expectations, and monetary instruments. MS-VAR models are particularly valuable due to their ability to account for abrupt structural changes in the economy, such as those caused by the war. These models are especially effective for studying data characterized by regime shifts, capturing transitions between periods of stability and crisis. By accommodating the nonlinear behaviour of macroeconomic variables across different conditions, MS-VAR models provide a more accurate and nuanced representation of economic dynamics during such volatile periods (Kole & Dijk, 2023).

AIMS AND OBJECTIVES

The aim of this research is to analyze the behaviour of inflation and inflation expectations under high- and low-volatility regimes using a Markov Switching Vector Autoregressive (MS-VAR) model. To address this purpose, there are several tasks arise:

- to estimate the transition probabilities between high- and low-volatility regimes in Ukraine during the period 2021–2024 and evaluate how these findings can inform policy decisions in countries experiencing similar crises or wartime conditions;
- to investigate how the responses of the consumer price index (CPI) and inflation expectations differ across high- and low-volatility regimes, providing insights into regime-specific economic behaviour;
- to analyze the varying effectiveness of central bank interventions, particularly through changes in the key policy rate, in influencing inflation and inflation expectations during periods of macroeconomic stability versus destabilization.

METHODS

Numerous methodologies based on econometric tools are available to analyze the interrelationships within economic systems, with a particular focus on monetary policy. In light of recent global instabilities, crises, and ongoing conflicts, it has become increasingly important to employ advanced models—such as those incorporating a Markov-switching component. These models are well-suited to capture shifts between regimes characterized by low, moderate, or high volatility and account for nonlinear dynamics. By differentiating between these regimes, policymakers and researchers can better understand economic fluctuations and adjust strategies accordingly, improving the robustness of forecasts and policy responses.

According to Krolzig's (1997) findings, regime changes in the y_t process, which follows a Vector Autoregressive (VAR) model, are governed by the value of an unobserved discrete state variable, s_t. This state variable dictates the switching behaviour of parameters, such as means and variances, enabling the model to capture structural breaks and shifts across different regimes (Rubio-Ramirez, Waggoner & Zha, 2005). In the switching intercept model, regime changes lead to gradual shifts in the time series, whereas the switching mean specification causes an abrupt jump in the mean. In this research authors applied to switching mean specification of the VAR model:

$$y_t - \mu_t(s_t) = \sum_{j=1}^{p} A_j(s_t)\left(y_{t-1} - \mu_{t-1}(s_{t-j})\right) + \epsilon_t, \tag{1}$$

where $S_t = (s_t, s_{t-1}, \dots, s_{t-p})$ is $(p+1)$ vector that representing current and previous regimes with $M^* = M^{p+1}$ possible states; A_j is k x k matrices of estimated lag coefficients; y_{t-p} is vector of endogenous variables; μ_t is vector of intercepts.

The Markov-switching approach for estimating transition probabilities between different regimes is grounded in fundamental probability theory principles. Each iteration of the recursion starts from the filtered estimates of the probabilities obtained for the previous period. These probabilities serve as the foundation for updating the state estimates, allowing the model to incorporate new information sequentially over time. Firstly, using basic probability rules and the Markov matrix of transition, one-step-ahead predictions are formed:

$$P(S_t = m|\zeta_{t-1}) = \sum_{j=1}^{M^*} P(S_t = m|S_{t-1} = j) \times P(S_{t-1} = j|\zeta_{t-1}), \quad (2)$$

where $P(S_{t-1} = j|\zeta_{t-1})$ is predicted probability.

At the subsequent stage, the one-step-ahead probabilities are utilized to generate the corresponding one-step-ahead densities for both the data and the regimes in period t. This step integrates the probabilistic forecasts with the underlying model dynamics, ensuring that the predicted distributions accurately reflect the potential regime switches and data behaviour:

$$f(\epsilon, S_t = m|\zeta_{t-1}) = f(\epsilon_t|S_t = m, \zeta_{t-1}) \times P(S_t = m|\zeta_{t-1}), \quad (3)$$

where ϵ_t is normally distributed errors ($\epsilon_t \sim N(0, \sum_\epsilon(s_t))$) for $s_t = 1, \dots, M$.

In the next step, the joint probabilities across unobserved states are summed to derive the likelihood contribution for period t. This contribution is then used to compute the marginal distribution of the observed data, ensuring that all latent state configurations are accounted for in the final distribution:

$$L_t(\mu, A, \sum, \delta) = f(\epsilon_t|\zeta_{t-1}) = \sum_{j=1}^{M^*} f(\epsilon_t, S_t = j|\zeta_{t-1}), \quad (4)$$

where $\mu = (\mu_1, \dots, \mu_M)$, $A = (A_{11}, \dots, A_{1p}, \dots, A_{pM})$, $\sum = (\sum_1, \dots, \sum_M)$ are parameters of the VAR model, δ is a parameter that identifies the regime probabilities.

Finally, the results from equation (1.4) are applied to update the one-step-ahead probability predictions. This step ensures that the forecasted probabilities incorporate the most recent information, refining the model's understanding of potential state transitions:

$$P(S_t = m|\zeta_{t-1}) = \frac{f(\epsilon_t, S_t = m|\zeta_{t-1})}{\sum_{j=1}^{M^*} f(\epsilon_t, S_t = j|\zeta_{t-1})}. \quad (5)$$

The likelihood can be maximized with respect to the parameters $\mu, A, \sum, \delta$ by employing iterative optimization methods.

RESULTS

The literature review confirms the relevance of using a nonlinear Markov-switching model to analyze the behaviour of inflation and inflation expectations during periods of instability. This approach effectively captures regime shifts and nonlinear dynamics in economic conditions. The model is built using monthly data spanning from September 2021 to July 2024, providing insights into inflation trends over both stable and volatile periods. In generalized form, the developed Markov-switching Vector Autoregressive (MS-VAR) model can be described by the following equations:

$$Y_t = f(Y_t, Y_{t-1}, \epsilon_t)$$

$$Y_t = \begin{pmatrix} D(D(Infl\_exp_t)) \\ D(D(CPI_t)) \\ D(KPR_t) \end{pmatrix},$$

where $Infl\_exp_t$ – inflation expectations in the t time period; CPI_t – consumer's price index in the t time period; KPR_t – key policy rate in the t time period; ϵ_t – errors; D – first differences.

The estimated MS-VAR model incorporates regime-switching between two states: low and high volatility. The calculation results for the average duration of each regime are summarized in Table 1. These durations provide insight into how long

DOI: 10.55643/fcaptp.3.62.2025.4724

the economy typically remains in each volatility state before transitioning, offering valuable information for understanding market dynamics and forecasting. The results indicate that the system remains in a high-volatility regime for an average of 4 months. In contrast, the low-volatility regime lasts just 1.4 months—more than twice as short. These findings are consistent with the sample period from 2021 to 2024, which encompasses the financial and economic disruptions caused by the Russian-Ukrainian war. The brief duration of low volatility reflects the extended period of inflation stabilization triggered by several factors, including rising fuel prices, supply shortages at the onset of the war, and exchange rate devaluation. These conditions have prolonged market instability, reducing the frequency of low-volatility phases.

Additionally, the model passed the Stability Condition Check, confirming its robustness and reliability for forecasting. Further details on this check can be found in the APPENDIX: VAR Stability Condition Check. This stability ensures that the model can accurately capture economic dynamics and is suitable for analysis under volatile conditions.

Table 1. Duration of regimes. *(Source: author's calculations made in E.Views 12)*

Volatility	Months
High	4.0
Low	1.4

In addition to understanding the duration of each regime, it is equally important to examine the probabilities of transitioning from one regime to another. Table 2 presents the estimated probabilities of regime switching. The results indicate a relatively high probability—72%—of transitioning from a low-volatility state to a high-volatility state. However, the probability of remaining in the high-volatility regime is even greater, at 75%. These probabilities suggest that once the system enters a high-volatility phase, it is more likely to persist in this state than to revert to lower volatility. Switching from a high to a low volatility state is only 25%, and staying in the low-fluctuation mode is possible only at 28%. These effects are closely linked to the broader economic situation in the country, including macroeconomic destabilization caused by rising inflation, currency devaluation, and disruptions in the functioning of the financial system as a result of the Russian invasion. Such instability has created significant economic challenges, exacerbating volatility and uncertainty across various sectors.

Table 2. Markov transition probabilities matrix. *(Source: author's calculations made in E.Views 12)*

	Regimes of volatility	Volatility	
		High	Low
Volatility	High	75%	25%
	Low	72%	28%

Figure 2 (a, b) below illustrates the response of inflation expectations to a one-standard-deviation shock under both high and low volatility regimes. In each regime, inflation expectations initially react to the shock with an immediate increase. However, in the high-volatility regime, the effect of the shock is less pronounced compared to the low-volatility regime. Notably, the shock impact is strongest during periods 1 to 4 but gradually diminishes, levelling off by around period 7. This pattern suggests that during more stable economic periods, the effects of shocks on inflation expectations are more predictable and pronounced. A similar response pattern is observed in inflation expectations following a key policy rate shock, where a stable economic environment (low-volatility regime) leads to a stronger response across variables, as indicated by a larger magnitude of reaction. This implies that a more stable economy provides clearer and more robust responses to policy changes, reinforcing the impact of shocks in low-volatility conditions. The consumer price index (CPI) also shows a strong response to shocks, particularly during short periods of economic stabilization.

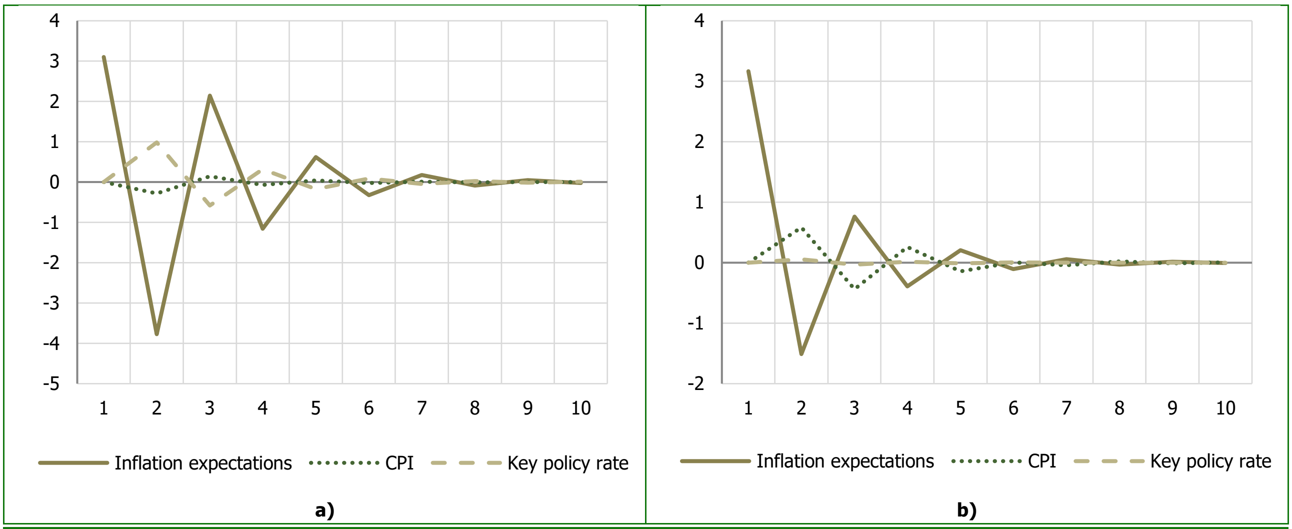

Figure 2. Impulse Response Function of Inflation Expectations to One S. D. Note.: a) within Low Volatility regime; b) within High Volatility regime. *(Source: author's calculations made in E.Views 12)*

According to the estimations, the CPI response to shocks shows a distinct pattern: it is more pronounced during periods of low volatility than in times of high fluctuations. Notably, the CPI shock has the greatest impact on inflation expectations (Figure 3a). This increase in inflation expectations can be attributed to the immediate reaction of economic agents (e.g., banks, analysts, and households) to rising prices (Tsapin & Faryna, 2024). Their expectations for future inflation are shaped not only by the immediate CPI increase but also by their perception of the broader economic environment, which remains predominantly unstable throughout the study period. During periods of high volatility, the consumer price index (CPI) responds only weakly to shocks. Specifically, a one standard deviation shock to inflation expectations and the key policy rate (Figure 3b) fades quickly after the initial few periods. Notably, in times of heightened economic uncertainty and high volatility, the CPI shows a particularly muted response to changes in the key policy rate, reflecting a limited influence of monetary policy on inflation under these conditions.

The impulse response function analysis reveals several key insights. Firstly, in a stable, low-volatility macroeconomic environment, responses to shocks tend to be more predictable, clearer, and aligned with economic theory. For instance, the CPI exhibits a notable reaction to key policy rate shocks in low-volatility periods. Secondly, in times of high volatility—typically associated with crises or economic instability—responses to shocks are significantly weaker. This creates challenges, particularly with planned interventions; for example, if a central bank raises the key policy rate by a substantial percentage to curb inflation and manage inflation expectations, the intended effect may be limited due to the muted response in a high-volatility setting.

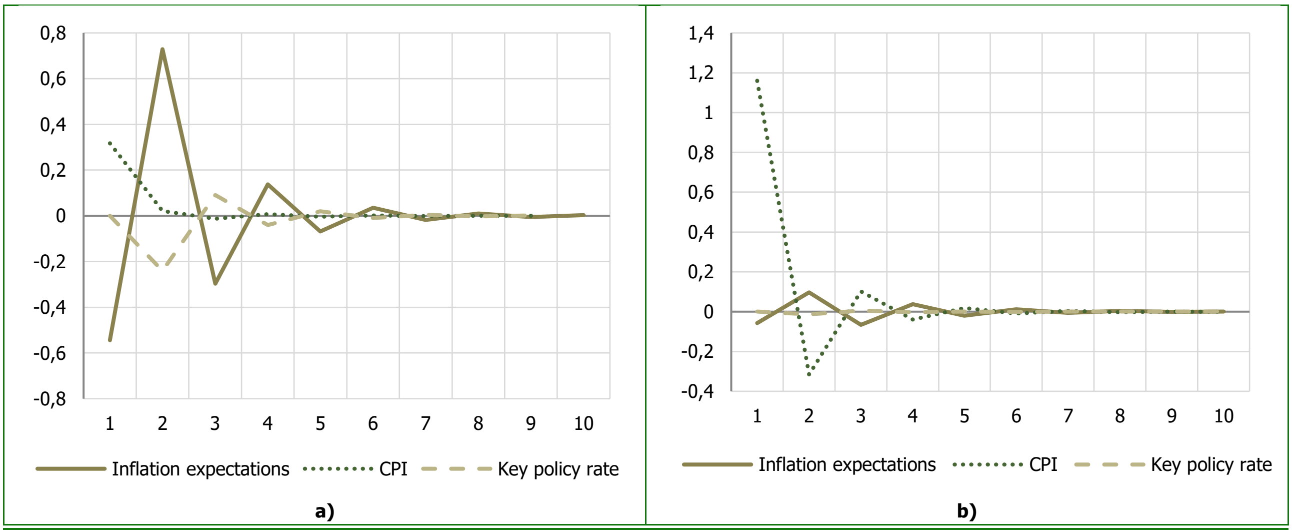

Figure 3. Impulse Response Function of CPI to One S. D. Note.: a) within Low Volatility regime; b) within High Volatility regime. *(Source: author's calculations made in E.Views 12)*

 DOI: 10.55643/fcaptp.3.62.2025.4724

In addition to impulse response analysis, the developed MS-VAR model enables the exploration of variable interdependence through variance decomposition. Figure 4 (a, b) the variance decomposition of the CPI under low- and high-volatility regimes. During stable, low-volatility periods, the consumer price index is influenced by inflation expectations at 82%, underscoring the strong impact of the inflation expectations channel within the monetary transmission. Approximately 5% of the CPI variance is attributed to the key policy rate, suggesting that inflation control is more effective and central bank influence stronger during periods of macroeconomic stability. This pattern shifts dramatically in high-volatility periods, where CPI variance is almost entirely self-driven (approximately 97%), with other factors having minimal impact. This phenomenon likely reflects the limited influence of central bank interventions on CPI during crises, as inflation becomes harder to manage directly. This analysis, conducted on data from the period of the ongoing Russo-Ukrainian war, highlights how the war initially destabilized the economic system. Nonetheless, the National Bank of Ukraine managed to regain a degree of control within a few months, mitigating several potential negative impacts (Lepushynskyi, 2023).

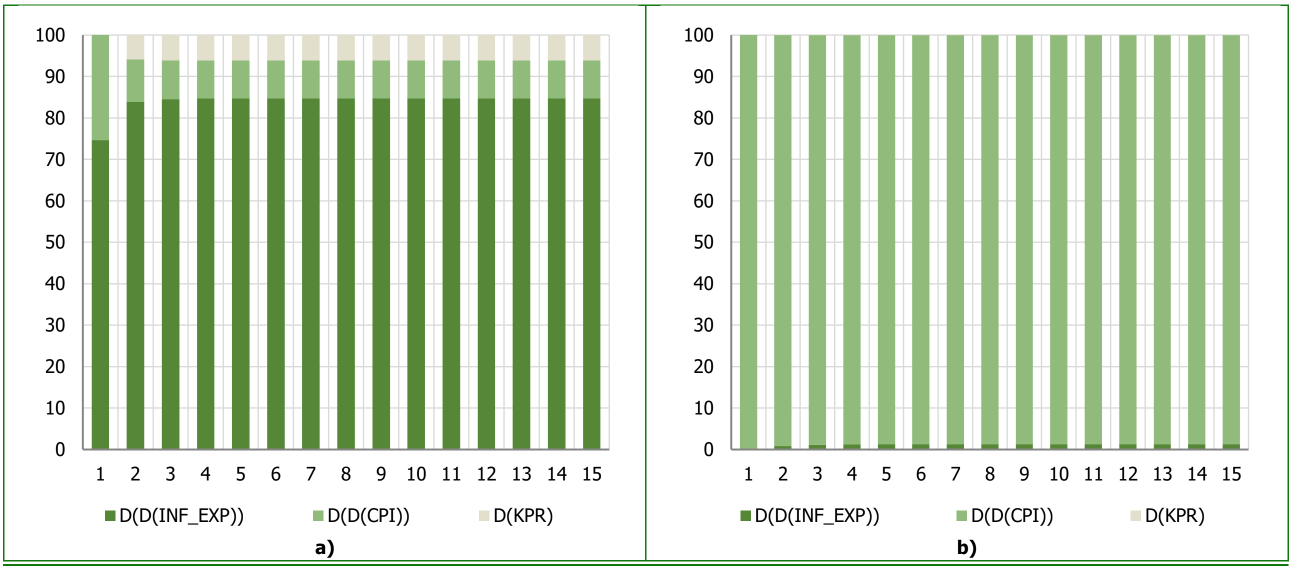

Figure 4. Variance Decomposition of CPI. Note.: a) under the Low Volatility regime; b) under the High Volatility regime. *(Source: author's calculations made in E.Views 12)*

The variance decomposition analysis for the key policy rate, shown in Figures 8 and 9, reveals distinct interconnection patterns under high- and low-volatility regimes. Given similar conditions, there is a notable shift in the variance structure depending on the volatility level. During periods of low volatility, as observed in the CPI decomposition example, the variance structure of the key policy rate aligns more closely with theoretical expectations: 78% of the key policy rate variance is influenced by changes in inflation expectations, while 18% and 2% are attributed to its own dynamics and the consumer price index, respectively (Figure 8). This suggests that the central bank prioritizes the inflation expectations transmission channel as the most effective tool under current conditions, making the key policy rate highly sensitive to anticipated inflation over the next 12 months. Following the National Bank of Ukraine's shift from a fixed exchange rate regime to inflation targeting, the strength of transmission channels has evolved, with inflation expectations now emerging as one of the most influential channels for transmitting policy instrument changes (Grui, et al, 2023). This shift underscores the bank's reliance on inflation expectations to anchor economic stability and guide monetary policy effectively.

Under the high-volatility regime (Figure 5), the variance of the key policy rate is primarily driven by its own dynamics (95%), with inflation expectations and CPI contributing only 4% and 1%, respectively. This pattern likely reflects the central bank's focus during crisis periods on previous adjustments to the key policy rate, assessing their cumulative effect on the economy rather than closely following specific levels of current inflation or inflation expectations. In such volatile conditions, the central bank may prioritize the broader economic impact of past policy decisions to maintain stability, rather than reacting to short-term fluctuations in inflation metrics.

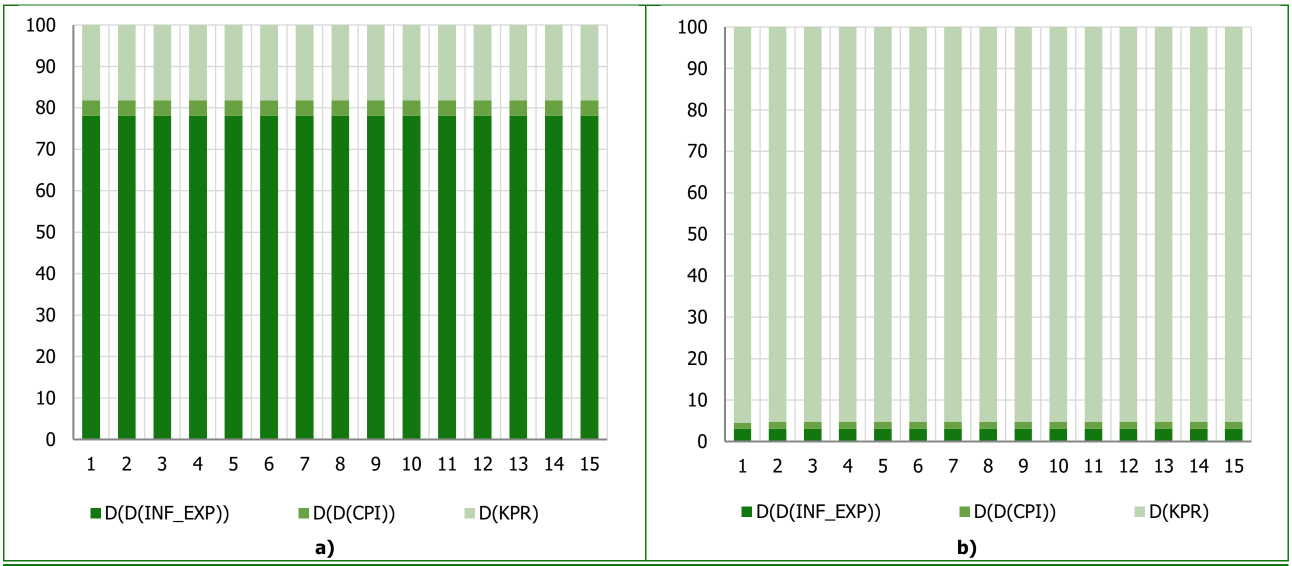

Figure 5. Variance Decomposition of Key policy rate. Note.: a) under the Low Volatility regime; b) under the High Volatility regime. *(Source: author's calculations made in E.Views 12)*

In summary, the variance decompositions differ significantly between low- and high-volatility regimes. During low-volatility periods, the central bank can adjust the key policy rate with greater responsiveness to the dynamics of primary macroeconomic indicators. In contrast, under high-volatility conditions, the consumer price index and key policy rate become largely self-driven, limiting the influence of external economic factors and reducing the effectiveness of direct monetary interventions.

DISCUSSION

The findings of this research underline the significant role of volatility regimes in shaping inflation dynamics, inflation expectations, and the effectiveness of monetary policy interventions in Ukraine during 2021–2024. By employing a Markov Switching Vector Autoregressive (MS-VAR) model, the study captures the intricate relationships between these variables under distinct high- and low-volatility regimes, offering critical insights into the macroeconomic impacts of crises and instability.

The results highlight substantial differences between volatility regimes. High-volatility periods, which dominate Ukraine's macroeconomic landscape during the analyzed timeframe, are characterized by prolonged durations (averaging four months) and limited responsiveness of inflation to policy tools. These findings align with studies by Hubrich and Tetlow (2014) and Kole and Dijk (2023), which also emphasize the diminished effectiveness of monetary policy during periods of financial stress and heightened uncertainty. Conversely, low-volatility regimes demonstrate stronger policy transmission, with inflation expectations significantly influencing the Consumer Price Index (CPI). This is consistent with research on regime-dependent dynamics in Markov-Switching models, such as those explored by Krolzig (1997) and Rubio-Ramirez et al. (2005).

The study underscores the necessity for adaptive monetary strategies in high-volatility contexts. In particular, the results reveal the limitations of relying solely on the key policy rate during crises, highlighting the need for supplementary tools, such as foreign exchange interventions or fiscal coordination. The proactive measures taken by central banks globally, as documented by Banco Central Do Brasil (2024), Banco de Mexico (2022), and the European Central Bank (2022), demonstrate the importance of timely and multifaceted approaches to stabilize inflation and expectations during crises.

The findings extend beyond Ukraine, offering valuable insights for countries facing similar crises or transitioning to inflation-targeting frameworks, such as Ethiopia and Sudan. Research by Lepushynskyi (2023) and Tsapin and Faryna (2024) reinforces the importance of financial literacy and robust monetary policies in anchoring inflation expectations during periods of instability. Furthermore, the global macroeconomic implications of the war in Ukraine, as detailed by the Centre for Economic Policy Research (2022), highlight the interconnectedness of financial systems and the cascading effects of geopolitical conflicts on inflation and policy responses.

This research validates the utility of MS-VAR models for analyzing regime-dependent macroeconomic phenomena, complementing the work of Rivero et al. (2025) on fiscal and monetary transmission shocks. The model's robustness, supported

DOI: 10.55643/fcaptp.3.62.2025.4724

by its stability condition check, affirms its applicability for studying non-linear dynamics and policy effectiveness under volatile conditions.

While the study provides a comprehensive analysis of inflation dynamics in Ukraine, future research could incorporate additional variables, such as external trade shocks or fiscal policy measures, for a more holistic understanding. Comparative studies across countries with similar economic conditions could further enhance the generalizability of these findings. This discussion highlights the critical importance of adaptive monetary strategies and advanced econometric tools in navigating economic crises, offering actionable insights for policymakers globally.

CONCLUSIONS

The full-scale Russian invasion of Ukraine in 2022 has significantly destabilized the macroeconomic environment. This has led to sharp price increases and severe shortages of goods and services, particularly in the initial stages of the conflict. As a result, high-volatility regimes in Ukraine lasted approximately three times longer (averaging four months) than low-volatility regimes (1.3 months). This prolonged period of instability is further confirmed by a 75% probability of the economy remaining in a high-volatility state during the period from 2021 to 2024.

Under low-volatility conditions, the transmission of key policy rate changes to domestic prices is more efficient and aligns better with economic expectations. Conversely, during high-volatility regimes, the dynamics of the Consumer Price Index (CPI) and inflation expectations shift markedly. For instance, CPI variance is predominantly driven by its own fluctuations (95%) in high-volatility scenarios, whereas in low-volatility regimes, 82% of the variance is explained by inflation expectations. This highlights the contrasting mechanisms of macroeconomic interactions depending on the prevailing regime.

To mitigate the effects of economic instability, central banks globally have taken proactive measures to stabilize inflationary expectations and maintain economic resilience. Central banks in emerging markets, such as Brazil (Monetary Policy Committee, 2024), Chile (Banco Central Chile, 2022), Hungary (Magyar Nemzeti Bank, 2022), and Mexico (Banco de Mexico, 2022), as well as those in advanced economies, including the Federal Reserve (Board of Governors of the Federal Reserve System, 2022), the European Central Bank (2022), and the Bank of England (2022), have expedited the tightening of interest rate policies. These actions underscore the importance of proactive monetary policies in addressing rising global uncertainties and stabilizing financial markets.

Stability in Ukraine's financial and economic systems, achieved through timely crisis prevention and proactive policies by the National Bank of Ukraine (NBU), has facilitated the economy’s ability to return to equilibrium following external shocks. The Ukrainian experience of conducting monetary policy under conditions of active military conflict offers valuable lessons for other nations facing similar crises. Countries like Ethiopia, Sudan, and others facing similar challenges of economic instability while transitioning to inflation targeting could gain valuable insights from Ukraine's approach to managing inflation and stabilizing expectations during conflict. By adopting strategies employed in Ukraine's monetary policy, these nations could better navigate their own crises, ensuring more effective economic stabilization and inflation control in the face of external shocks and domestic challenges.

Ukraine’s approach to addressing rapid price increases and inflation expectations in the context of war could serve as a blueprint for developing anti-crisis policies in other countries. This analysis underscores the critical role of adaptive monetary policies in navigating economic crises and highlights Ukraine’s resilience as an example for other nations.

While this study provides important insights into the impact of volatility regimes on monetary policy effectiveness, further research is needed to explore additional macroeconomic factors that influence inflation dynamics in times of crisis. Future studies could extend the MS-VAR model by incorporating external shocks, such as global commodity price fluctuations, fiscal policy interventions, and geopolitical risks, to develop a more comprehensive understanding of monetary transmission mechanisms. Additionally, a comparative analysis of Ukraine’s experience with monetary policy responses in other conflict-affected economies—such as Israel in the 1980s or Germany after World War II—could provide deeper insights into the long-term effectiveness of different policy strategies. Moreover, integrating high-frequency financial data, such as investor sentiment indices and sovereign risk spreads, into MS-VAR models could enhance real-time assessments of monetary policy effectiveness under extreme uncertainty. As Ukraine transitions into post-war economic recovery, future research should also focus on the coordination between monetary and fiscal policies in rebuilding macroeconomic stability.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All Authors have contributed equally.

FUNDING

The Authors received no funding for this research.

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

REFERENCES

1. Banco Central Chile, (2022, March). Monetary Policy Meeting. https://www.bcentral.cl/c/document_library/get_file?uuid=c9549a86-8729-6bf4-83a2-3f1516cd0734&groupId=33528
2. Banco Central Do Brasil. (2024, September 17-18). Minutes of the Meeting of the Monetary Policy Committee — Copom. https://www.bcb.gov.br/content/copom/copomminutes/MINUTES%20265.pdf
3. Banco de Mexico. (2022). Meeting of Banco de México's Governing Board on the occasion of the monetary policy decision announced on May 12, 2022. https://www.banxico.org.mx/publications-and-press/minutes-of-the-board-of-governors-meetings-regardi/%7B8C8D624F-0776-EC50-1E12-CF81B85A615B%7D.pdf
4. Bank of England. (2022). Monetary Policy Summary and minutes of the Monetary Policy Committee meeting ending on 15 June 2022. https://www.bankofengland.co.uk/-/media/boe/files/monetary-policy-summary-and-minutes/2022/monetary-policy-summary-and-minutes-june-2022.pdf
5. Board of Governors of the Federal Reserve System. (2022). Transcript of Chair Powell’s Press Conference June 15, 2022. Chair Powell’s Press Conference. https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20220615.pdf
6. Centre for Economic Policy Research. (2022). *Global Economic Consequences of the War in Ukraine Sanctions, Supply Chains and Sustainability.* CERP Press. https://cepr.org/system/files/publication-files/172987-global_economic_consequences_of_the_war_in_ukraine_sanctions_supply_chains_and_sustainability.pdf
7. European Central Bank. (2022). Combined monetary policy decisions and statement. https://www.ecb.europa.eu/press/press_conference/monetary-policy-statement/shared/pdf/ecb.ds220609~7434064bed.en.pdf
8. Grui, A., Aragon, N., Faryna O., Krukovets, D., Savolchuk, K., Sulimenko, O., Vdovychenko, A., & Zholud, O. (2023). Between russian Invasions: The Monetary Policy Transmission Mechanism in Ukraine in 2015-2021. NBU Working Papers, National bank of Ukraine. https://bank.gov.ua/admin_uploads/article/WP_2023-02_Grui_et_al.pdf?v=9
9. Hubrich, K., & Tetlow, R. (2014). Financial Stress and Economic Dynamics the Transmission of Crises. European Central Bank, Working Paper Series No 1728, September. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1728.pdf
10. Kole, E., & Dijk, D., (2023). Moments, Shocks and Spillovers in Markov-Switching VAR Models. *Tinbergen Institute Discussion Paper*, TI 2021-080/III. https://papers.tinbergen.nl/21080.pdf
11. Krolzig, H-M. (1997). The Markov-Switching Vector Autoregressive Model. In: Markov-Switching Vector Autoregressions. *Lecture Notes in Economics and Mathematical Systems*, *454.* Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-51684-9_2
12. Lepushynskyi, V. (2003). The role of monetary policy in wartime and post-war recovery. *Seminar: Designing the Institutional Setting for Ukrainian Reconstruction*. National bank of Ukraine. https://bank.gov.ua/admin_uploads/article/Volodymyr_Lepushynskyi_Role_monetary_policy_in_wartime_and_post-war_recovery_pr_2023-04-13_eng.pdf?v=9
13. Magyar Nemzeti Bank. (2022, May 31). Minutes of the Monetary Council Meeting. https://www.mnb.hu/letoltes/roviditett-jegyzokonyv-a-monetaris-tanacs-2022-majus-31-i-uleserol-en.pdf
14. Rivero, R., Ramirez, M., & Mendivil, Y. (2025). Fiscal and Monetary Policy Transmission Shocks. *Montenegrin Journal of Economics*, *21*(2), 7-20. https://doi.org/10.14254/1800-5845/2025.21-2.1
15. Rubio-Ramirez, J-F., Waggoner, D., & Zha, T. (2005). Markov-Switching Structural Vector Autoregressions: Theory and Application. *Federal Reserve Bank of Atlanta*, Working Paper Series 2005-27. http://dx.doi.org/10.2139/ssrn.870478
16. Tsapin, A., & Faryna, O. (2024). The Role of Financial Literacy in Anchoring Inflation Expectations: The Case of

DOI: 10.55643/fcaptp.3.62.2025.4724

Ukraine. *National Bank of Ukraine*, Working Paper 02/2024. https://bank.gov.ua/admin_uploads/article/WP_2024-02_Tsapin_Faryna.pdf?v=9

Лук'яненко І., Насаченко М., Токарчук Т.

ОЦІНЮВАННЯ ІНФЛЯЦІЙНИХ ПРОЦЕСІВ НА ОСНОВІ МАРКІВСЬКОЇ ВЕКТОРНОЇ АВТОРЕГРЕСІЇ З ПЕРЕМИКАННЯМ РЕЖИМІВ: ВИПАДОК УКРАЇНИ

Автори досліджують динаміку інфляції та інфляційних очікувань в Україні в умовах макроекономічної нестабільності, спричиненої повномасштабною російсько-українською війною. На основі Марківської векторної авторегресійної моделі з перемиканням режимів (MS-VAR) проаналізовано особливості переходу від високої до низької волатильності інфляційних процесів у період із 2021 по 2024 рік. Отримані результати свідчать, що через нестабільну макроекономічну ситуацію в Україні домінує режим високої волатильності інфляції та інфляційних очікувань, який триває в середньому 4 місяці, водночас періоди стабілізації, що характеризуються низькою волатильністю, продовжуються лише протягом 1,4 місяця.

Крім того, проведений ґрунтовний аналіз інфляційних процесів із застосуванням економіко-математичного інструментарію виявив суттєві відмінності в динаміці інфляційних очікувань та індексу споживчих цін залежно від режиму волатильності. У періоди низької волатильності зміни ключової облікової ставки мають більш потужний і передбачуваний вплив на внутрішні ціни, що узгоджується з постулатами економічної теорії. Натомість, у періоди дестабілізації, яким притаманна висока волатильність, динаміка індексу цін та інфляційних очікувань менш контрольована й передбачувана, що обмежує можливості центрального банку впливати на економічну ситуацію. Унаслідок цього ефективність механізмів трансмісії знижується, що спричиняє послаблення впливу монетарної політики на макроекономіку.

Результати дослідження підтверджують ефективність застосування MS-VAR-моделі для аналізу динаміки інфляції та інфляційних очікувань в умовах криз і макроекономічної нестабільності. Крім того, розроблена та оцінена на реальній інформації Марківська векторна авторегресійна модель із перемиканнях режимів успішно пройшла тестування на адекватність і стабільність, що підтверджує ефективність її застосування на практиці. Досвід України в реалізації монетарної політики під час воєнних дій та особливості проведення наукових досліджень із застосуванням сучасного економіко-математичного інструментарію є важливим прикладом для інших країн, котрі намагаються зберегти макроекономічну стабільність у складних економічних умовах.

Отримані результати підкреслюють критично важливу роль адаптивних монетарних стратегій у підтримці економічної стійкості в умовах криз. Це дослідження надає цінну інформацію про взаємодію між макроекономічними показниками в періоди нестабільності, такі як кризи або воєнний час, і пропонує основу для політиків для орієнтування в труднощах управління інфляцією та очікуваннями в нестабільних умовах. Отримані результати є особливо актуальними для країн, які стикаються з подібними економічними викликами, оскільки вони підкреслюють важливість розуміння змін режимів і нелінійної динаміки інфляції та економічної політики під час кризи чи конфлікту.

Ключові слова: інфляція, інфляційні очікування, монетарна політика, макроекономічна нестабільність, монетарні інструменти, Марківське перемикання, MS-VAR, економетрична модель

JEL Класифікація: C32, C34, E31, E37

VAR STABILITY CONDITION CHECK

The test evaluates whether the estimated MS-VAR model satisfies the stability condition across both Regime 1 and Regime 2. Stability ensures that the model's parameters remain within bounds that allow for meaningful economic interpretation and prevent explosive behaviour in the system dynamics under each regime. This verification is essential to confirm that the switching process captures realistic economic fluctuations without compromising model reliability.

Table 1. VAR Stability Condition Check for Regime 1. *(Source: author's calculations made in E.Views 12)*

Roots of Characteristic Polynomial	
Endogenous variables: D(D(INF_EXP))	
D(D(CPI)) D(KPR)	
Exogenous variables: C	
Lag specification: 1 1	
Root	**Modulus**
-0.524700	0.524700
-0.221566	0.221566
0.005105	0.005105
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Table 2. VAR Stability Condition Check for Regime 2. *(Source: author's calculations made in E.Views 12)*

Roots of Characteristic Polynomial	
Endogenous variables: D(D(INF_EXP))	
D(D(CPI)) D(KPR)	
Exogenous variables: C	
Lag specification: 1 1	
Root	**Modulus**
-0.524700	0.524700
-0.221566	0.221566
0.005105	0.005105
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

This Appendix is part of the article: | Цей Додаток є частиною статті:

DOI: 10.55643/fcaptp.3.62.2025.4724