FORMATION OF INFLATION EXPECTATIONS IN UKRAINE: DIFFERNTIAL DETERMINANTS ACROSS ECONOMIC AGENTS

by

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Abstract

FORMATION OF INFLATION EXPECTATIONS IN UKRAINE: DIFFERNTIAL DETERMINANTS ACROSS ECONOMIC AGENTS

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This thesis explores the formation of economic expectations, which play a central role in shaping economic behavior and influencing macroeconomic dynamics. Using survey data from different groups of economic agents, the study examines how expectations evolve in response to changes in the broader macroeconomic environment and the factors that influence them. The work contributes to understanding how perceptions of the future are shaped and how they vary across time and institutional contexts.

By examining how expectations respond to economic signals under imperfect information, the study contributes to a more nuanced understanding of expectation formation. This approach has implications for how policymakers interpret forward-looking behavior and design more effective policy responses.

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LIST OF ABBREVIATIONS

CPI. Consumer Price Index.

DWt. Durbin-Watson test.

IE. Inflation Expectation.

NBU. National Bank of Ukraine.

YoY. Year over year

Chapter 1

INTRODUCTION

Inflation expectations (IE) play a major role in shaping the macroeconomic environment. IE force households, businesses and policy officials, as a factor promoting consumption and investment, to react to specific conditions. When we deal with rapidly developing economies or economies faced with a shock from external circumstances, the issue of inflation expectations becomes critical. The research focuses on the expectation in Ukrainian economy, which has witnessed a lot of inflationary pressures, pandemic shock, armed conflicts, in addition to several economic policies in only a few years. More specifically, it tries to provide an explanation to the following question: "How are inflation expectations formed in Ukraine, and what are the key factors influencing their accuracy across different economic agents?"

Furthermore, studying inflation expectations provides insight not only into how agents form forecasts, but also how these forecasts influence actual inflation. In countries where inflation targeting is the main framework of monetary policy, managing expectations becomes just as critical as controlling actual inflation drivers. When market believe that inflation will rise, they act accordingly—demanding higher wages, adjusting prices, or accelerating purchases—which may result in a self-fulfilling prophecy. Thus, expectations can be both a symptom and a cause of inflationary trends.

The motivation behind this research stems from the essential role of expectations in modern monetary policy frameworks, especially in such unstable conditions, taken place in Ukraine. For central banks, including the National Bank of Ukraine (NBU), inflation expectations become one of the anchors in the inflation targeting regime. However, there are also techniques which assist in controlling

inflationary expectations. They include the direction of exchange rates and the ability to adjust economic activities. A study of the Ukrainian situation makes it possible to understand the nature of inflation expectations in developing or transition type economies and broaden understanding of the factors and the effects.

The novelty of this research is that it studies how inflation expectations are formed in Ukraine, a country facing economic changes and external shocks. While many studies focus on developed countries, fewer examine how expectations work in Ukraine. This research adapts international methods to Ukraine's specific conditions. It also combines survey data with economic models to better understand how different groups — households, enterprises, and financial analysts —form and adjust their expectations. This helps to identify which expectations are more accurate and how they respond to economic policies.

This research engages various models such as rational expectations, adaptive expectations and a blend of other theoretical and empirical methods. Some of them were needed for a basic overview of expectation in general, some for practical estimation for the case of Ukraine.

While existing research mainly addresses advanced economies, this work is focused on such elements as geopolitical instability and the processes of economic structures' transition in Ukraine as an important factor in forming the expectations of households and businesses.

The war and its consequences have added an extraordinary layer of uncertainty to inflation expectations in Ukraine. The full-scale invasion in 2022 disrupted supply chains, weakened consumer and business confidence, and drastically changed monetary and fiscal responses. These factors make it even more important to assess how different economic agents perceive and anticipate

inflation under prolonged instability. In such times, expectations are influenced not only by economic indicators, but also by perceptions of security, migration trends, and aid dependency.

Moreover, information availability and communication by public institutions, especially the central bank, play a significant role in shaping expectations. The degree of transparency, credibility and predictability of policy decisions determines how strongly expectations are anchored. This study pays particular attention to how effective the NBU's communication strategy has been in maintaining inflation expectations during crisis periods.

Additionally, this research seeks to explore how inflation expectations behave differently across stable and crisis periods. A particular focus is placed on identifying structural breaks — such as the 2014–2015 macroeconomic crisis and the 2022 full-scale invasion — and comparing them with relatively calm, inter-crisis periods. This inter-crisis period continued from mid 2016 up to 2022. Understanding how expectation formation mechanisms shift during structural breaks versus more stable phases will provide insights into the adaptability and persistence of different expectation models. It also allows the analysis to test whether certain economic agents react more strongly to sudden changes, or whether expectations gradually adjust over time.

This thesis is organized in the following way: Review of relevant literature on inflation expectations, theoretical aspects of adaptive expectation analysis are presented in chapter 2. Chapter 3 sets the framework for analysis of the dynamics of the expectations, implementing the ideas of the works mentioned in the previous chapter. This thesis aims to research Ukrainian context in context of adaptive expectation theory. Also test whether take place the memory effect in formation of IE. Chapter 4 provides the actual information for Ukraine, specification of data sources and descriptive statistics of the own dataset. The

results obtained from the empirical work and key results are presented in chapter 5, demonstrating the ways in which expectations may determine macroeconomic variables. Also, in this chapter there is a comparison of different agent's expectation formation. Lastly, Chapter 6 ends the paper with conclusions and a discussion on policy and policy recommendations and implementations.

Chapter 2

LITERATURE REVIEW

Studies on expectations can be grouped into two main categories. The first category includes theoretical works on adaptive and rational expectations. The second category consists of empirical studies that apply expectation models to real-world data, focuses on specific countries or regions.

2.1. Theoretical works

The formation of inflation expectations has been a central topic in macroeconomic theory since the mid-20th century. There are two main dominant paradigms: adaptive expectations and rational expectations.

The adaptive expectations hypothesis said that agents form their expectations of future inflation based on past inflation values. According to Cagan (1956), Nerlove (1958), the framework assumes that individuals revise their beliefs gradually, following errors made in previous periods. This approach gained traction in the 1960s and 1970s, particularly in models explaining the Phillips Curve dynamics.

In contrast, the rational expectations hypothesis, formalized by Muth (1961) and later popularized by Lucas (1972), assumes that agents utilize all available information efficiently when forming their forecasts. That's called rational expectation and widely used in later works. According to this view, expectations are model-consistent and incorporate current and expected future policies, implying that systematic monetary policy should have limited real effects.

While rational expectations theory became the standard in modern macroeconomics, it has been widely criticized for assuming unrealistic levels of information and cognitive capacity. In response, Chow (1989) and Roberts (1997) proposed hybrid frameworks, combining backward-looking (adaptive) and forward-looking (rational) elements. These hybrid models better reflect empirical evidence and provide a richer basis for analyzing expectation formation and dynamic in heterogeneous agent environments.

2.2. Empirical studies and Ukrainian context

Empirical research on inflation expectations has expanded considerably over the past decades, employing both survey data and econometric techniques to investigate how different types of agents—households, firms, and analysts—form their views on future inflation.

A foundational study by Figlewski and Wachtel (1981) used survey data from U.S. consumers to test whether expectations were adaptive or rational. Their regression analysis showed that while past inflation significantly influenced expectations (supporting the adaptive model), consumers also responded to other macroeconomic indicators. The results indicated bounded rationality, as agents incorporated partial but not full information when forming expectations.

More recent research by Coibion and Gorodnichenko (2015) and Coibion, Gorodnichenko, and Kumar (2018) reveals the prevalence of information rigidity and heterogeneity in expectation formation. Their studies document that both households and firms display limited awareness of official inflation statistics and tend to update expectations infrequently, often relying on salient price changes such as food or fuel. Firms were found to have slightly more accurate expectations than households, though far from fully rational.

These findings align with the results of Candia, Coibion, and Gorodnichenko (2020), who demonstrate that effective communication from central banks can significantly influence beliefs, especially in low-trust or high-uncertainty environments. Meanwhile, Armantier et al. (2016) confirm that inflation expectations do affect economic behavior—higher expected inflation leads to greater consumer spending, for example—underscoring the importance of expectation management in monetary policy.

In the Ukrainian context, Coibion (2020) compares expectation data across countries including Ukraine, the U.S., and the EU. The study finds that enterprises generally produce more accurate inflation forecasts than households or analysts. However, it also cautions against designing policy based solely on firms' expectations, noting that all agents react to salient price changes, which in turn shape consumption and investment behavior.

A related case is Poland, where Łyziak (2016) examines cross-sectoral differences in expectations—households, firms, analysts—and their role in the monetary transmission mechanism. Using survey data from GUS and the National Bank of Poland for the period 2001–2014, and embedding them in a simplified New Keynesian model, the study finds that enterprise expectations are the most responsive to monetary shocks and thus most valuable for forecasting inflation and output dynamics. This methodology—combining qualitative and quantitative data using probabilistic techniques—may serve as a model for improving inflation expectation analysis in Ukraine.

Finally, Gaspar et al. (2011) offer a theoretical yet empirically applicable critique of the rational expectations framework by incorporating adaptive learning into inflation forecasting. They use the New Keynesian Phillips Curve to demonstrate how agents form expectations through recursive learning based on past inflation, rather than full model-consistent forecasts. This approach shows that monetary

policy can and should shape expectation dynamics, especially when agents do not fully understand the economy. Their key result is that even modest deviations from rational expectations substantially alter the optimal conduct of policy. In such settings, central banks must manage not only inflation itself but also the learning process of economic agents.

Taken together, this literature suggests that inflation expectations are heterogeneous, sticky, and sensitive to salient price trends. Most empirical evidence favors adaptive or hybrid models, providing strong motivation for the approach taken in this study.

Chapter 3

METHODOLOGY

The first step of the empirical analysis involves testing the hypothesis that inflation expectations are adaptive. Adaptive expectations imply that economic agents form their forecasts based solely on past inflation data, without incorporating broader economic information. The model is specified as follows:

$$\hat{\pi}_t = \alpha_0 + \alpha_1 \pi^y_{t-1} + \varepsilon_t \quad (1)$$

where: $\hat{\pi}_t$ denotes the inflation expectation formed in period *t,*

π^y_{t-1} is the actual year-over-year inflation in period *t–1,*

ε_t is error term.

In this model, the expectations are derived from surveys conducted by the National Bank of Ukraine. Actual inflation is computed as the annual percentage change in the Consumer Price Index (CPI), comparing each month to the same month of the previous year. A statistically significant and positive coefficient α_1 would support the presence of adaptive expectations.

The second model aims to test whether expectations are shaped not only by past inflation but also by fundamental macroeconomic variables. This hybrid model combines adaptive expectations with structural determinants and is specified as:

$$\hat{\pi}_t = \alpha_0 + \alpha_1 \pi^y_{t-1} + \beta_1 \Delta W_t + \beta_2 \Delta EX_t + \beta_n \Delta X_n + \varepsilon_t \quad (2)$$

where ΔW_t is the monthly percentage change in nominal wages,

ΔEX_t is the percentage change in the EUR/UAH exchange rate,

$\beta_n \Delta X_n$ are the other structural determinants.

This model allows for testing whether inflation expectations incorporate real economic signals, such as currency depreciation and wage growth. A significant coefficient for these variables would suggest that expectations are not purely adaptive, but also forward-looking to some extent.

An alternative approach considers the possibility that agents form expectations not only based on external information, but also by referring to their own previous expectations — reflecting inertia or habit formation. This is referred to as the memory effect and is modelled as:

$$\hat{\pi}_t = \gamma_0 + \gamma_1 \hat{\pi}_{t-1} + \gamma_2 \pi^y_{t-1} + \varepsilon_t \quad (3)$$

where $\hat{\pi}_{t-1}$ is the inflation expectation in the previous period.

A statistically significant coefficient would suggest that agents adjust expectations slowly, anchoring them to previous beliefs rather than fully incorporating new information. According to the literature, the memory effect is a common phenomenon in expectation formation, as economic agents often rely on past experiences and previous decisions when making judgments about the future. This behavioral pattern reflects adaptive expectations, where past inflation or previous expectations heavily influence current beliefs. As a result, even when new information becomes available, agents may adjust their expectations gradually rather than instantaneously. Understanding the strength of this effect is therefore essential for designing communication strategies and timing policy actions appropriately.

Finally, the most comprehensive model combines adaptive learning, memory, and structural macroeconomic signals. This extended specification is written as:

$$\hat{\pi}_t = \delta_0 + \delta_1 \hat{\pi}_{t-1} + \delta_2 \pi^y_{t-1} + \delta_3 \Delta W_t + \delta_4 \Delta EX_t + \delta_n \Delta X_n + \varepsilon_t \qquad (4)$$

This model enables the analysis of the relative contribution of each mechanism — memory, past inflation, and real-time economic conditions — in the process of expectation formation.

In addition to estimating the above models, this research investigates how the process of expectation formation differs across economic regimes — particularly, between inter-crisis periods and times of structural breaks. Structural breaks are defined as major economic disruptions that significantly alter the macroeconomic environment and the behavior of key variables. For Ukraine, two such periods are examined in detail: the 2014–2015 crisis and the 2022 full-scale invasion. By comparing the estimation results across these distinct phases, the analysis aims to identify whether certain models hold better under stable versus unstable conditions.

The models are estimated not only on the full sample period, but also separately for the sub-period between the two crises (2016–2021), which represents a relatively stable phase of inflation targeting and institutional development in Ukraine. This segmentation allows for a clearer understanding of how expectations evolve in more predictable environments, where monetary policy transmission is likely to be more effective.

To ensure the robustness of the results, a series of robustness checks are performed. These include estimating alternative specifications, using different data transformations (such as quarterly instead of monthly changes), and applying the models to different subsets of agents (households, financial analysts,

businesses, banks). Additionally, diagnostic tests for autocorrelation, heteroskedasticity, and model stability are conducted. These steps aim to validate the consistency of the results and to confirm that the conclusions drawn are not sensitive to specific modeling choices.

Given that the primary variables used in the analysis — such as inflation, wages, and exchange rates — are YoY percentage changes, they tend to exhibit strong persistence and autocorrelation. Autocorrelated regressors may lead to autocorrelated residuals, which violate one of the key Gauss-Markov assumptions of the classical linear regression model. As a result, standard errors may be underestimated, and significance tests may be misleading.

To address this issue, residual autocorrelation is tested using the Durbin–Watson test and autocorrelation function (ACF) plots. These diagnostics confirmed the presence of serial correlation in many models, particularly at low lags (e.g., 1–6 months).

To correct for this problem without altering the structure of the models, robust standard errors are calculated using the Newey–West estimator, which adjusts for both autocorrelation and heteroskedasticity. This adjustment increases the reliability of inference by ensuring that the reported t-statistics and p-values are not biased due to serial correlation. In several cases, coefficients that were not statistically significant under conventional OLS became significant when Newey–West corrections were applied — highlighting the importance of robust diagnostics.

To further assess the robustness of the findings, the analysis incorporates variations in data frequency, agent types, and macroeconomic context. Models are estimated using both monthly and quarterly data to verify the consistency of results across different temporal resolutions. Additionally, separate estimations are performed for households, businesses, banks, and financial analysts to capture

heterogeneity in expectation formation. The sample is also segmented into distinct economic regimes, allowing for comparison between stable and crisis periods. These robustness checks strengthen the credibility of the empirical results and reduce the risk that conclusions are driven by sample-specific or model-specific factors.

Chapter 4

DATA DESCRIPTION

To begin with, it is necessary to consider the selected dataset in more detail. One of main data source which used in this research is survey-based data, collected by NBU. The survey asked respondents: "How do you think the level of consumer prices will change in the next 12 months?". There are 4 agent categories who took place in surveys: banks, businesses (enterprises), households and financial analysts.

Figure 1 highlights two major shocks that led to structural breaks in the Ukrainian economy: the Russian aggression in 2014 and the full-scale invasion in 2022. These events mark distinct turning points in both actual inflation and expectations across different economic agents. A few clear trends emerge from the data: financial analysts tend to form more conservative and stable expectations compared to other groups. Businesses and banks respond more quickly to external shocks, while households demonstrate more inertia. Among all groups, business expectations appear to be the most volatile — exhibiting the highest values during crisis periods and some of the lowest during relatively stable times.

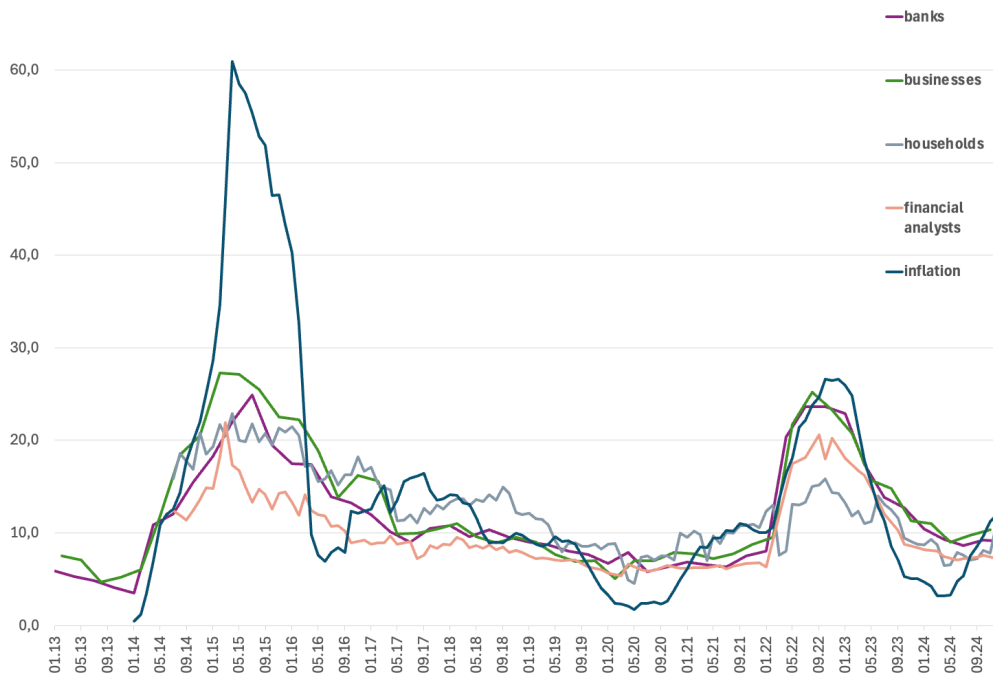

Figure 1. Inflation expectations and actual inflation over the next 12 months

While all groups respond to major economic shocks, the magnitude and speed of their reactions differ substantially. For instance, businesses and banks appear to incorporate new information more rapidly, whereas households tend to revise their expectations more gradually. Financial analysts, in turn, show the least volatility, indicating a more measured or informed approach to expectation formation. This heterogeneity in behavior points to the need for differentiated modeling strategies and underlines the importance of agent-specific regressions.

Understanding the nature and dispersion of expectations across these groups is essential for evaluating the effectiveness of monetary policy and central bank communication. If expectations are not well-anchored or respond asymmetrically across agents, policy signals may be transmitted unevenly throughout the economy. These initial visual observations motivate a closer look at the statistical

properties of the data. Descriptive statistics presented on the following page summarize the key patterns in expectations and macroeconomic indicators, providing a foundation for the empirical analysis that follows. Table 1 presents summary statistics for all variables used in the empirical analysis.

Table 1. Descriptive statistic

Variable	Observations	Min	Max	Std. Dev.	Units
Households	126	4,51	22,89	4,32	%
Financial analysts	103	5,34	21,90	3,92	%
Banks	49	3,49	24,90	5,69	%
Businesses	48	4,70	27,30	6,56	%
Inflation (CPI YoY)	144	-1,50	61,00	11,20	year-over-year %
Wage YoY	97	-12,30	32,50	7,40	year-over-year %
USD/UAH YoY	146	-25,40	67,20	12,60	year-over-year %
EUR/UAH YoY	146	-20,10	55,80	10,80	year-over-year %

Source: author's calculations based on National Bank of Ukraine "Inflation expectation in next 12-month survey", exchange rates and State Statistic Service of Ukraine CPI and wage data, 2025

The dataset includes inflation expectations from four types of agents — households, businesses, banks, and financial analysts — as well as key macroeconomic indicators: CPI inflation, wage growth, and changes in the USD/UAH and EUR/UAH exchange rates. All variables are expressed in year-over-year percentage changes to ensure consistency with the forward-looking 12-month expectation horizon used in the surveys.

Among the agents, business expectations exhibit the highest variability, with values ranging from 4.7% to 27.3% and a standard deviation of 6.56 percentage

points. Banks show similar volatility, while expectations of financial analysts are more stable, reflected in a narrower range and lower standard deviation. Household expectations also remain within a relatively moderate range but display a slightly wider dispersion than analysts.

CPI inflation is the most volatile macroeconomic indicator in the sample, peaking above 60% during crisis periods, while also dropping into negative territory in certain months. Wage growth, though positive in most periods, fluctuates significantly in response to labor market disruptions and policy changes. Exchange rate movements (USD/UAH and EUR/UAH) demonstrate strong variability, consistent with Ukraine's transition from a fixed to a floating exchange rate regime and periods of external shock. The high standard deviations for both exchange rate series confirm the intensity of currency market fluctuations over the sample period.

Figure 2 presents the year-over-year dynamics of household inflation expectations alongside three key macroeconomic indicators: nominal wage growth (wage_yy), the USD/UAH exchange rate change (usd_yy), and the EUR/UAH exchange rate change (eur_yy). The period under observation spans from early 2015 to early 2024.

The data reveals several noteworthy patterns. First, there are two distinct periods of heightened volatility: during the aftermath of the 2014–2015 crisis and following the 2022 full-scale invasion. These shocks are clearly reflected in the sharp spikes in exchange rate volatility and wage adjustments, particularly in the USD/UAH series. Household inflation expectations, however, appear more stable in comparison, showing moderate sensitivity to abrupt macroeconomic changes.

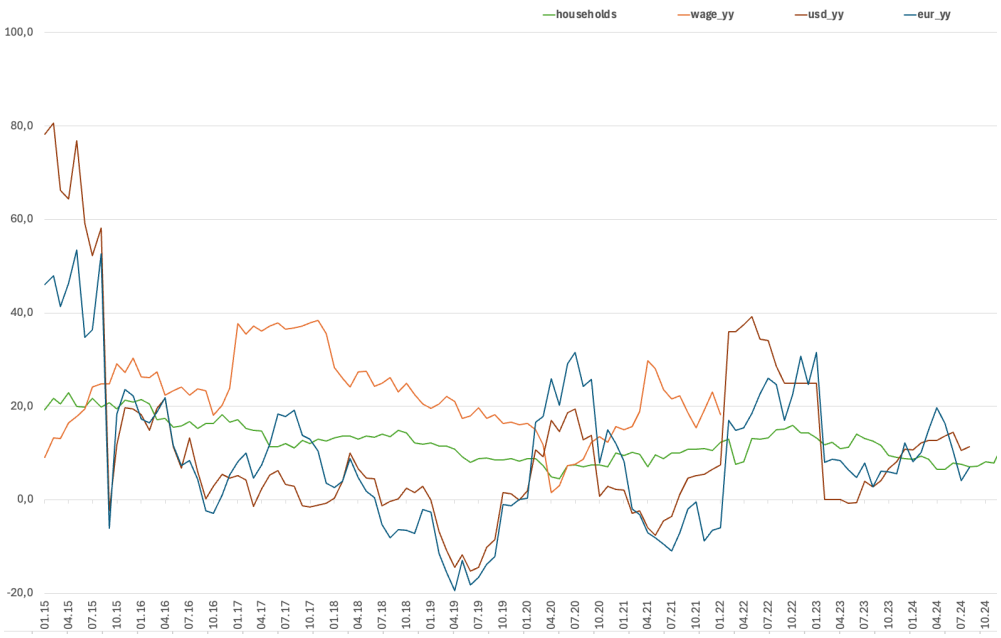

Figure 2. Year to year wage and exchange rate

These observations confirm that the macroeconomic environment in Ukraine over the study period was marked by pronounced volatility, with recurring external shocks and regime changes influencing both actual indicators and expectations. While household expectations show relative smoothness, their reactions to major events such as currency devaluations or wage shifts tend to be partial and delayed, indicating a gradual adjustment process. This supports the idea that expectations are not formed purely in response to current data but are shaped by prior experiences, limited information, and cognitive frictions.

Differences in data frequency further complicate the analysis. Since data for banks and businesses are collected quarterly, the number of available observations is substantially lower than for households and financial analysts. This limits the precision of estimation for these groups and requires more cautious interpretation of regression outputs. Nonetheless, the descriptive

patterns strongly justify a segmented modeling strategy. They also highlight the importance of examining expectation formation across different economic agents and under varying macroeconomic conditions — which is the focus of the empirical analysis in the sections that follow.

Chapter 5

RESULTS

5.1 Full sample estimation results

This section presents the results of the baseline estimations using four alternative specifications of inflation expectation models: adaptive, hybrid, memory-based, and full. Each model is estimated separately for four groups of economic agents — households, financial analysts, banks, and businesses — using the full sample period.

Table 2 reports the results of the adaptive expectations models estimated for each agent group using the full sample. The models regress inflation expectations on lagged actual inflation, testing the hypothesis that expectations are formed in an adaptive manner based on past price developments.

Table 2. Adaptive models

Agent	R^2 (Adj.)	α_0 (Intercept)	α_1 (Inflation)
Households	0.596	8.811 ***	0.255 ***
		(0.371)	(0.019)
Analysts	0.4761	6.992 ***	0.196 ***
		(0.430)	(0.020)
Banks	0.6255	6.952 ***	0.349 ***
		(0.731)	(0.039)
Businesses	0.6755	7.448 ***	0.398 ***
		(0.757)	(0.040)

Source: author's estimations

Across all agents, the coefficient on lagged inflation (α_1) is positive and highly statistically significant, providing strong evidence in support of the adaptive expectations framework. However, there are notable differences in the strength of this relationship across agent types. The highest responsiveness to past inflation is observed among businesses, with a coefficient of 0.398 and an adjusted R^2 of 0.676, indicating that nearly 68% of the variation in their expectations is explained by past inflation alone. Banks also show a strong adaptive pattern ($\alpha_1 = 0.349$, $R^2 = 0.626$), suggesting they adjust expectations relatively quickly in response to inflation changes.

In contrast, households exhibit a more moderate degree of responsiveness ($\alpha_1 = 0.255$), though the relationship remains highly significant and explains about 60% of the variation in expectations. Financial analysts show the weakest adaptive response ($\alpha_1 = 0.196$, $R^2 = 0.476$), implying that their expectations may be informed by broader information sets beyond just historical inflation.

The intercept terms (α_0) represent the baseline level of inflation expectations when the lagged actual inflation rate is zero. In other words, it captures agents' long-term inflation beliefs or their implicit inflation anchor in the absence of recent price changes. Households report the highest intercept (8.811), suggesting that even when inflation is low or stable, they still tend to expect relatively high inflation over the next 12 months. This may reflect pessimism, inflationary memory, or a lack of confidence in price stability. Businesses (7.448) and banks (6.952) also maintain relatively elevated baseline expectations, while financial analysts have the lowest α_0 (6.992), indicating more moderate long-term views. The variation in intercepts across agents further confirms that expectations are shaped not only by recent inflation data but also by deeper beliefs, experiences, and institutional trust.

These findings are consistent with previous studies highlighting the adaptive nature of inflation expectations, particularly among households and businesses. Similar patterns have been observed in other emerging economies, such as in Łyziak (2016) for Poland, where enterprises demonstrated stronger responsiveness to past inflation than households or analysts. The relatively low sensitivity among financial analysts aligns with Coibion et al. (2018), suggesting their expectations are informed by broader information sets beyond recent price dynamics.

The results of the hybrid models, presented in Table 3, indicate that while the economic magnitude of the additional macroeconomic variables is relatively modest, their relationship with inflation expectations is statistically robust and consistently observed across agents.

Table 3. Hybrid models

Agent	R^2 (Adj.)	α_0	α_1	γ_1	γ_2
Households	0.7295	6.667 ***	0.181 ***	0.138 ***	0.042 ***
		(0.778)	(0.020)	(0.035)	(0.006)
Analysts	0.7688	5.790 ***	0.139 ***	0.032	0.032 ***
		(0.598)	(0.014)	(0.025)	(0.005)
Banks	0.8634	5.256 ***	0.243 ***	0.056	0.049 ***
		(0.796)	(0.026)	(0.040)	(0.008)
Businesses	0.8743	5.588 ***	0.281 ***	0.049	0.083 ***
		(0.992)	(0.035)	(0.051)	(0.011)

Source: author's estimations.

Specifically, the coefficients for wage growth (γ_1) and exchange rate changes (γ_2) are small, ranging from 0.03 to 0.14, yet remain significant for most agents,

particularly households and businesses. This suggests that even though the direct impact of these variables is limited, they still contribute meaningfully to the formation of expectations.

These findings are in line with existing literature, where macroeconomic fundamentals such as nominal wages and exchange rates are often shown to influence expectations, albeit with relatively low elasticities. Studies like Gaspar et al. (2011) and Łyziak (2016) find that such factors tend to operate as background signals rather than dominant predictors — especially in models where inflation inertia already plays a central role. In our estimates, households appear more sensitive to wage dynamics, while businesses exhibit stronger reactions to currency movements. This aligns with their respective exposure to income volatility and input costs, further validating the relevance of structural indicators in expectation modeling.

The estimation results for the memory models, which incorporate both lagged inflation and lagged expectations, are presented in Table 4.

Table 4. Memory models

Agent	R^2 (Adj.)	α_0 (Intercept)	α_1 (Inflation)	β_1 (Lagged expectation)
Households	0.8886	1.267 **	0.036 *	0.854 ***
		(0.462)	(0.016)	(0.048)
Analysts	0.8988	0.637	0.010	0.911 ***
		(0.427)	(0.013)	(0.053)
Banks	0.7644	2.101 *	0.057	0.759 ***
		(1.009)	(0.050)	(0.118)
Businesses	0.778	1.682	0.015	0.858 ***

Source: author's estimations.

These specifications aim to capture the extent to which agents rely on their own past expectations when forming current beliefs — a behavioral mechanism often referred to as expectational inertia.

Across all four agent types, the coefficient on the lagged expectations variable is strongly significant and close to or above 0.75, suggesting that agents heavily rely on their previous beliefs. The highest degree of persistence is observed among households (0.85), followed closely by businesses (0.86) and financial analysts (0.91). This supports the idea that expectations are adjusted gradually, rather than fully incorporating new information immediately. These findings are consistent with behavioral models of expectation formation discussed in the literature by Carroll (2003) Gaspar et al. (2011), which argue that limited information processing, uncertainty, or cognitive frictions often cause agents to update slowly.

The estimation of full model results, presented in Table 5.

Table 5. Full models

Agent	R^2 (Adj.)	α_0	α_1	β_1	γ_1	γ_2
Households	0.9125	1.351 *	0.027	0.838 ***	0.008	0.008 .
		(0.594)	(0.016)	(0.063)	(0.022)	(0.004)
Analysts	0.9036	1.281 .	0.018	0.773 ***	0.013	0.012 **
		(0.659)	(0.015)	(0.075)	(0.018)	(0.003)
Banks	0.9114	2.790 **	0.108 **	0.510 ***	0.013	0.036 ***
		(0.861)	(0.038)	(0.119)	(0.034)	(0.007)
Businesses	0.940	2.784 **	0.081 .	0.603 ***	-0.011	0.054 ***
		(0.834)	(0.041)	(0.102)	(0.037)	(0.009)

Source: author's estimations.

The full model integrates all components of expectation formation: lagged expectations, lagged inflation, nominal wage growth, and changes in the exchange rate. This allows for a comprehensive assessment of how memory, past inflation, and structural macroeconomic signals jointly shape inflation expectations.

The estimation results, demonstrate that across all agent types, the lagged expectation variable (β_1) remains highly statistically significant and retains a dominant role in the model. This confirms the strong persistence of inflation expectations over time. The models explain a very high proportion of the variation in expectations, with adjusted R-squared values exceeding 0.90 for all groups. The best fit is observed for businesses (0.94), followed by households, analysts, and banks.

Overall, the results across all four model types are broadly consistent with existing literature on inflation expectations. Adaptive and memory-based models confirm that agents rely heavily on past inflation and, even more so, on their own prior expectations — a finding in line with studies such as Łyziak (2016), Carroll (2003), and Gaspar et al. (2011). Hybrid models also show that macroeconomic variables like wages and exchange rates are statistically significant, but their estimated effects are small, which echoes patterns found by Coibion et al. (2020). However, the results diverge slightly from international evidence in that banks and businesses in Ukraine appear more responsive to exchange rate changes than financial analysts, likely due to greater exposure to external shocks. In contrast, past inflation becomes statistically insignificant in the full models once memory and structural factors are included. This suggests that under conditions of macroeconomic instability and high uncertainty, such as those experienced in Ukraine, expectations are shaped less by current data and more by inertia, institutional trust, and sensitivity to key external variables.

5.2 Inter-crisis period estimation

This section presents model estimates for the inter-crisis period from 2016 to 2021 — a time of relative macroeconomic stability in Ukraine, marked by moderate inflation and active inflation targeting by the central bank. The same set of models as in the full-sample analysis is estimated separately for each agent group. Table 6 summarizes the results for households.

Table 6. Households' inter-crisis models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0.3963	7.548 ***	0.412 ***	—	—	—
		(0.657)	(0.061)			
Memory	0.8697	1.175 *	0.006	0.882 ***	—	—
		(0.507)	(0.038)	(0.056)		
Hybrid	0.4556	5.876 ***	0.236 **	—	0.140 **	0.084 *
		(0.844)	(0.085)		(0.051)	(0.039)
Full	0.8689	0.961	-0.025	0.862 ***	0.033	0.008
		(0.536)	(0.046)	(0.060)	(0.026)	(0.020)

Source: author's estimations.

During this period, the hybrid model shows that inflation expectations remain significantly associated with past inflation, wage growth, and exchange rate changes. However, the overall explanatory power is lower than in memory-based specifications. The memory model performs substantially better, with a strong and highly significant coefficient on lagged expectations, while past inflation becomes statistically irrelevant. In the full model, macroeconomic variables lose their significance entirely, and the model fit is only slightly improved compared to the memory model. This suggests that under stable conditions, household

expectations are driven primarily by inertia rather than real-time economic signals.

Table 7 presents the estimation results for financial analysts during the inter-crisis period.

Table 7. Analysts' inter-crisis models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0.4394	5.637 ***	0.239 ***	—	—	—
		(0.394)	(0.035)			
Memory	0.8886	0.923 *	0.070 ***	0.792 ***	—	—
		(0.397)	(0.020)	(0.053)		
Hybrid	0.5193	5.249 ***	0.194 ***	—	0.028	0.073 **
		(0.486)	(0.046)		(0.027)	(0.022)
Full	0.8918	1.267 **	0.088 ***	0.772 ***	-0.016	0.011
		(0.435)	(0.024)	(0.059)	(0.013)	(0.012)

Source: author's estimations.

The adaptive model confirms that past inflation remains a significant driver of expectations, with a relatively strong coefficient (0.24) and moderate explanatory power (adjusted $R^2 \approx 0.44$). The hybrid model improves slightly on fit, indicating that financial analysts also react to exchange rate movements, particularly USD/UAH changes, while the effect of wage growth remains insignificant.

The memory model substantially increases explanatory power (adjusted $R^2 \approx 0.89$), with a high and significant coefficient on lagged expectations (0.79), suggesting strong inertia in expectation formation. In the full model, the influence of macroeconomic variables becomes negligible, while both memory and past

inflation remain statistically significant. This again supports the conclusion that financial analysts, although more responsive to real-time inflation than other agents, still primarily rely on previous forecasts, especially under stable conditions.

It is important to note that, due to the quarterly frequency of surveys for banks and businesses, the sample size for these groups is considerably smaller than for households and financial analysts. As a result, estimation results for these agents should be interpreted with caution, especially regarding the robustness of coefficient significance.

Banks are expected to form relatively informed inflation expectations. However, the small number of quarterly observations limits the depth of statistical inference. Despite this, estimating all four models for banks allows for a comparison of how sensitive their expectations are to past inflation, internal inertia, and structural economic variables under stable macroeconomic conditions. The results are summarized in Table 8.

Table 8. Banks' inter-crisis models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0.3239	5.901 ***	0.334 **	—	—	—
		(0.993)	(0.100)			
Memory	0.8722	1.789 **	0.113 *	0.652 ***	—	—
		(0.617)	(0.050)	(0.070)		
Hybrid	0.338	5.240 ***	0.329 .	—	0.025	0.082
		(1.128)	(0.161)		(0.069)	(0.053)
Full	0.868	1.913 **	0.171 *	0.674 ***	-0.037	-0.010
		(0.636)	(0.074)	(0.079)	(0.032)	(0.026)

Source: author's estimations

The adaptive model reveals a moderately strong and statistically significant association between past inflation and inflation expectations (coefficient = 0.33), though the explanatory power remains limited (adjusted $R^2 \approx 0.32$). The hybrid model does not substantially improve the fit, with only weak significance for macroeconomic variables, and a low overall R^2.

In contrast, the memory model offers a significantly better explanation of banks' expectations. The coefficient on lagged expectations is high (0.65) and strongly significant, with adjusted R^2 rising to 0.87. The full model maintains this pattern, confirming the dominance of expectation persistence. Once again, inflation and macroeconomic signals lose their statistical significance once memory effects are included. This suggests that even under stable conditions, banks primarily rely on their previous expectations when forecasting inflation.

Table 9 summarizes the results of all four models estimated for businesses over the inter-crisis period.

Table 9. Businesses' inter-crisis models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0.123	6.720 ***	0.280 .	—	—	—
		(1.401)	(0.141)			
Memory	0.6738	2.562 *	0.026	0.665 ***	—	—
		(1.108)	(0.096)	(0.113)		
Hybrid	0.1889	5.362 **	-0.016	—	0.173	0.103
		(1.525)	(0.278)		(0.121)	(0.085)
Full	0.6467	2.461 *	0.110	0.674 ***	-0.037	0.033
		(1.166)	(0.185)	(0.137)	(0.090)	(0.058)

Source: author's estimations

The adaptive model shows a weak and only marginally significant relationship between past inflation and business expectations, with limited explanatory power (adjusted $R^2 \approx 0.12$). The memory model performs considerably better, with a highly significant coefficient on lagged expectations (0.67) and a much higher adjusted R^2 of 0.67. In this case, as with other agents, past inflation becomes statistically insignificant once expectations inertia is accounted for.

The hybrid model does not significantly improve the fit, and none of the macroeconomic variables are statistically significant. The full model confirms this result: only the lagged expectations variable remains significant, while past inflation, wages, and exchange rates fail to show explanatory power. These findings suggest that even for businesses — typically expected to respond to cost and pricing signals — inflation expectations during stable periods are primarily driven by internal persistence rather than current economic conditions.

The estimation results for the inter-crisis period reveal both consistencies and important shifts compared to the full-sample analysis. Across all agent groups, memory models remain dominant, with lagged expectations consistently showing the strongest and most significant impact on current inflation forecasts. This confirms the persistent and inertial nature of expectations, even under more stable macroeconomic conditions.

However, in contrast to the full-sample results, macroeconomic variables such as wage growth and exchange rate changes become less relevant in the hybrid and full models during the inter-crisis period. Their coefficients are often statistically insignificant and smaller in magnitude, particularly for businesses and financial analysts. Moreover, the role of past inflation tends to weaken when macroeconomic volatility is low — in many cases, becoming non-significant in memory and full models.

Overall, while the general structure of expectation formation remains similar, the stable environment appears to reinforce reliance on prior beliefs and reduces sensitivity to real-time inflation signals or structural indicators. This highlights the importance of economic context in shaping expectation dynamics and suggests that the responsiveness of agents may increase only during periods of heightened uncertainty or shock.

5.3 Quarterly transformation of monthly survey data

To evaluate the potential influence of survey frequency on model performance, an alternative specification was constructed using quarterly averages of household and analyst expectations, mirroring the data structure used for banks and businesses. Estimation results based on the quarterly data remain generally consistent with those derived from monthly observations. Memory effects continue to dominate across models, with lagged expectations retaining their explanatory strength, while the role of past inflation and macroeconomic indicators becomes even less pronounced. In several cases, model fit improves modestly, and standard errors are reduced, likely due to the smoothing effect of lower-frequency data. These findings suggest that expectation inertia is robust across different timeframes, whereas higher-frequency surveys may reflect more short-term volatility without substantially altering the underlying dynamics of inflation expectation formation. This points to the relevance of survey design and temporal aggregation when interpreting expectations across agent types.

To assess the robustness of the results across different data frequencies, inflation expectations of households were also modeled using quarterly data. Table 10 presents the estimation outcomes for all four model specifications.

Table 10. Households' expectation quarterly models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0,4887	9.043 ***	0.243 ***	—	—	—
		(0.758)	(0.038)			
Memory	0,8117	1.511	0.033	0.823 ***	—	—
		(1.052)	(0.036)	(0.107)		
Hybrid	0,7486	6.671 ***	0.158 ***	—	0.133 *	0.065 ***
		(1.331)	(0.036)		(0.060)	(0.012)
Full	0,8525	2.504 .	0.053	0.593 ***	0.059	0.031 *
		(1.375)	(0.038)	(0.145)	(0.053)	(0.012)

Source: author's estimations.

To assess the influence of data frequency on expectation formation, household survey responses were aggregated to quarterly averages, mirroring the structure used for banks and businesses. Table 10 reports the results of all four models estimated on this lower-frequency dataset.

Compared to the monthly baseline (see Tables 2-5), the adaptive model on quarterly data yields a very similar coefficient for lagged inflation (0.24 vs. 0.25) and maintains its statistical significance. However, the explanatory power decreases slightly (adjusted R^2 of 0.49 vs. 0.60), suggesting that some short-term variability is smoothed out in quarterly form.

The memory model continues to dominate, with lagged expectations remaining highly significant (coefficient = 0.82), and adjusted R^2 rising to 0.81. Notably, the coefficient on past inflation becomes insignificant, just as in the monthly version — reaffirming that once behavioral inertia is accounted for, historical inflation adds little additional explanatory value.

The hybrid model in quarterly form shows a slightly stronger role for structural variables than in the monthly model: both wage growth and exchange rate changes are statistically significant, and the model achieves a solid adjusted R^2 of 0.75. This may reflect the reduced noise and higher signal-to-noise ratio of lower-frequency data. However, in the full model, the importance of macroeconomic variables weakens again, with only USD/UAH changes remaining significant, while the lagged expectation variable still plays a central role.

To further examine the role of data frequency in expectation formation, the models for financial analysts were re-estimated using quarterly data. Table 11 summarizes the results across the four specifications.

Table 11. Analyst's' expectation quarterly models

Model Type	R^2(Adj.)	α_0	α_1	β_1	γ_1	γ_2
Adaptive	0.3646	7.270 ***	0.169 ***	—	—	—
		(0.687)	(0.034)			
Memory	0.8708	0.838	0.008	0.863 ***	—	—
		(0.616)	(0.021)	(0.076)		
Hybrid	0.7822	5.337 ***	0.104 ***	—	0.058	0.042 ***
		(0.768)	(0.019)		(0.034)	(0.007)
Full	0.8797	1.555	0.017	0.671 ***	0.028	0.020 **
		(0.982)	(0.025)	(0.152)	(0.027)	(0.007)

Source: author's estimations

The adaptive model shows a slightly stronger coefficient on lagged inflation (0.24) compared to the monthly version (0.20), and the adjusted R^2 increases modestly

(0.49 vs. 0.48). This suggests that quarterly averaging may reduce noise in analysts' expectations without fundamentally altering their backward-looking behavior.

The memory model again significantly improves model fit, with the coefficient on lagged expectations remaining high (0.79) and highly significant, closely matching the monthly results. Past inflation remains statistically insignificant, as it did in the monthly specification, reinforcing the conclusion that financial analysts rely heavily on their own previous forecasts rather than on raw inflation data.

In the hybrid model, macroeconomic variables show relatively stronger effects than in the monthly version. Exchange rate changes (particularly USD/UAH) and wage growth become statistically significant, and the adjusted R^2 improves to 0.77 — up from 0.77 in the monthly model, but with more precise estimates due to reduced short-term volatility.

The full model confirms these patterns: the persistence of expectations (coefficient on lagged expectations ≈ 0.77) remains the key driver, while only inflation and exchange rate changes retain partial statistical significance. Overall, the model fit improves to an adjusted R^2 of 0.89, on par with the monthly version.

The results based on quarterly data confirm the robustness of the findings from monthly estimations. Across both households and financial analysts, the memory component remains the strongest and most consistent determinant of inflation expectations. While structural variables (wages and exchange rates) gain slightly more significance in hybrid and full models, particularly for households, their overall influence remains secondary. These findings suggest that lower-frequency data smooth short-term fluctuations but do not fundamentally alter the behavioral patterns of expectation formation. The persistence of expectations, especially among analysts, continues to dominate across specifications and timeframes.

5.4 Robustness and diagnostic tests

To evaluate the reliability of regression results, this section reports the outcomes of the Durbin–Watson test, which assesses the presence of first-order autocorrelation in model residuals. Detecting autocorrelation is essential, as it violates the OLS assumption of error independence and can result in biased estimates—most notably, understated standard errors and inflated significance levels. The Durbin–Watson statistic takes values between 0 and 4, where a value near 2 suggests no autocorrelation. Substantially lower values point to positive autocorrelation, whereas values well above 2 signal negative autocorrelation. Table 12 summarizes the DW statistics and corresponding p-values for all models across all four agents.

Table 12. Durbin-Watson statistics of models

Model	DW statistic	p-value
adaptive_households	0.328	< 2.2e-16
hybrid_households	0.576	< 2.2e-16
memory_households	2.225	0.8653
full_households	2.495	0.9771
adaptive_financial_analysts	0.308	< 2.2e-16
hybrid_financial_analysts	0.721	2.625e-12
memory_financial_analysts	2.092	0.5853
full_financial_analysts	2.208	0.6708
adaptive_banks	0.618	5.152e-09
hybrid_banks	1.399	0.01038
memory_banks	1.238	0.001413
full_banks	2.126	0.4352
adaptive_businesses	0.782	5.818e-07
hybrid_businesses	1.138	0.0007637
memory_businesses	1.24	0.001627
full_businesses	2.234	0.5401

The results clearly indicate the presence of strong positive autocorrelation in residuals for most of the adaptive and hybrid models. In particular, the adaptive models for households and financial analysts have very low DW statistics (0.33 and 0.31, respectively), with p-values close to zero, indicating serious autocorrelation issues. Similarly, hybrid models for these agents also suffer from autocorrelation, although to a slightly lesser extent.

In contrast, the memory and full models perform significantly better in terms of residual diagnostics. For these specifications, the DW statistics are consistently close to 2 and the associated p-values are high, meaning the null hypothesis of no autocorrelation cannot be rejected. This pattern is observed across all agent groups and suggests that incorporating past expectations (memory) and additional explanatory variables (macroeconomic fundamentals) helps absorb the serial correlation present in the simpler adaptive models.

Of note is that the full models exhibit the most stable diagnostic performance, with DW values around or slightly above 2 in every case. This consistency supports the idea that more comprehensive models better capture the dynamics of expectation formation and provide more reliable estimates for policy analysis.

Additionally, a robustness check was conducted by augmenting the hybrid models with the EUR exchange rate as an explanatory variable. While the USD remained statistically significant across all groups, the EUR coefficient was generally insignificant, except for households, where it had a small but significant negative effect. Detailed results are presented in Appendix A.

The diagnostic results demonstrate that adaptive and hybrid models are susceptible to autocorrelation in residuals, which may compromise the validity of statistical inference. In contrast, memory-based and full models successfully mitigate this issue across all agent categories. These findings confirm the importance of accounting for expectation inertia and macroeconomic

fundamentals when modeling inflation expectations. Going forward, models with memory and structural variables should be prioritized for robust and reliable estimation.

Chapter 6

CONCLUSIONS

This study set out to investigate the formation of inflation expectations in Ukraine across four categories of economic agents — households, financial analysts, banks, and businesses — over the period from 2014 to 2024. Using a series of adaptive, hybrid, memory-based, and full regression models, the analysis compared the explanatory power and dynamics of expectation formation across agent types, time horizons, and economic regimes (full sample vs. inter-crisis period).

The results confirm that inflation expectations in Ukraine are not uniform across agents and are influenced by a mix of backward-looking and forward-looking elements. While adaptive models show statistically significant responses to past inflation, they suffer from strong autocorrelation and limited explanatory power. Memory models, which incorporate agents' own previous expectations, dramatically improve fit and eliminate autocorrelation issues. Hybrid and full models — which include macroeconomic fundamentals such as exchange rate and wage growth — further enhance explanatory power, particularly during stable periods.

Notably, businesses and banks tend to have more responsive and structured expectations, often better aligned with macroeconomic indicators, whereas households show higher inertia and less sensitivity to fundamentals. Financial analysts exhibit moderate forward-looking behavior but also reflect memory persistence.

Across all agents, models estimated on the inter-crisis period (2016–2021) performed better, suggesting that stable macroeconomic environments enable clearer expectation formation. In contrast, crisis periods distort the relationship between expectations and fundamentals, leading to more volatile and less predictable behavior.

Based on the findings, several policy recommendations emerge. The National Bank of Ukraine should enhance its communication strategy, particularly targeting households, whose expectations show high inertia and limited responsiveness to fundamentals. Given the stronger alignment of banks and businesses' expectations with macroeconomic indicators, their assessments can serve as reliable inputs for short-term forecasting and policy calibration. Since expectations are highly sensitive to exchange rate dynamics, the central bank should ensure transparent and consistent messaging around exchange rate policy. Maintaining institutional credibility and macroeconomic stability is crucial, as expectation formation improves significantly during stable periods. Finally, increasing the frequency and depth of surveys, especially for businesses and banks, would enable more accurate monitoring and modeling of inflation expectations.

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APPENDIX A

Table 13. Hybrid Inflation Expectation Models with EUR Exchange Rate (γ_2)

Agent	R^2 (Adj.)	α_0	α_1	γ_1	γ_2 (euro)
Households	0.7473	6.56838	0.17553	0.1498	-0.08023 **
Analysts	0.7726	5.67357	0.13673	0.0404	-0.03504
Banks	0.8598	5.32424	0.24364	0.0541	-0.0163
Businesses	0.8712	5.63798	0.2839	0.04858	-0.02765