Analyzing the Co-movement between Exchange Rate and Inflation Expectations in case of Uzbekistan: An Empirical Approach

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Table of Contents

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Abstract

Purpose: The primary objective of thesis is empirically to investigate the impact of exchange rate, administrated price inflation and selected macroeconomic variables on inflation expectations of households and business entities in Uzbekistan.

Methodology: Applying the Ordinary Least Squares techniques, the underlying research employs a time-series data for Uzbekistan throughout the period from January 2018 to December 2022 in order to empirically analyze the role of exchange rate and regulated prices in inflation expectations of individuals and firms through controlling inflation, short-term interest rate, real Gross Domestic Product and external debt.

Findings: The empirical findings of thesis reveal that exchange rate and administrated prices have been an essential factor in formulating inflation expectations of market participants in Uzbekistan during the period of 2018-2022. Moreover, headline inflation, perceived rate of inflation are also found to have a statistically significant and positive impact on inflation expectations whereas, short-term nominal interest rate acquired statistically insignificant and negative effect on expected inflation of Uzbek households and business entities. Additionally, statistically significant and positive relationship in the long-run is found based on the Bound test of the ARDL model. Finally, the impulse response functions based on VAR models emphasize that inflation expectations positively reflect to the shocks from exchange rate and regulated prices despite the effects of exchange rate and administrated price shocks are not long-lasting.

Research originality: The originality of the underlying research analysis is empirically analyzing the determinants of inflation expectations through simultaneously applying three different models, the OLS technique, ARDL and VAR models which differ the underlying empirical study from previously investigated research analyses on the determinants of expected inflation.

Key words: Uzbekistan, inflation expectations, households and firms, exchange rate, regulated prices, inflation, interest rate, OLS, ARDL and VAR.

Introduction

Nowadays, inflation expectations play an essential role in implementing effective monetary policy by monetary authorities such as the Central banks. Particularly, modern economic theory emphasizes that inflation expectations are considered as one of the most essential factors in the formulating inflation because households and firms consider the expected rate of inflation while making economic decisions such as negotiations in wage contracts and firms' pricing decisions. Therefore, the long-term inflation expectations of economic agents have to be anchored by the Central banks in order to achieve low and stable inflation. Moreover, there are two main methods to gauge inflation expectations, namely, survey-based and market-based measures. Typically, survey-based measures of inflation expectations are widely applied methods in evaluating inflation expectations compared with the market-based measures. In the following paragraphs, aforementioned measures of inflation expectations will be profoundly explained.

Survey-based inflation expectation of households and firms

Survey-based measures of inflation expectations are basically derived from the surveys of households and firms, and professional forecasters, in which respondents are asked about their expectations for inflation Kose *et al.*, (2019). For instance, among emerging market and developing economies (*EMDEs*), survey-based measures of households and firms' inflation expectations are primarily conducted by the Central banks in East Asia, Europe and Asia Kose *et al.*, (2019). Furthermore, among advanced economies, the University of Michigan's Surveys of Consumers in the United States while the European Commission's Consumer Survey in European Union countries are commonly known survey-based measures of inflation expectations Kose *et al.*, (2019).

Survey-based inflation expectation of professional forecasters

In fact, the Consensus Economics produces the commonly known survey of professional forecasters based on the views of more than 700 professional forecasters from advanced economies and EMDEs Kose *et al.*, (2019). Particularly, short-term inflation expectations of professional forecasters are basically reported and published by the Consensus Economics at monthly frequency, whereas long-term expected inflation of professional

forecasters are published and announced at semi-annually and quarterly frequency Kose *et al.*, (2019). Essentially, the Surveys of Professional Forecasters on inflation expectations are usually conducted by the Federal Reserve bank in the United States whereas, the European Central Bank is responsible for conducting surveys in EU member countries Kose *et al.*, (2019).

Highlighting the main difference between inflation expectations of households, firms and professional forecasters is that expected inflation of households and business entities, on average, are generally higher than professional forecasters' expected inflation in both advanced economies and EMDEs. Additionally, perceived inflation plays an important role in formulating inflation expectations households. Therefore, Kose *et al.*, (2019) concluded that households' inflation expectations are more comparatively backward looking compared with inflation expectation of professional forecasters; therefore, the expected inflation of professional forecasters are more significantly forward looking than households' expected inflation. In fact, Carroll (2003) emphasized that main reason why inflation expectations of individuals are more backward looking than expected inflation of professional forecasters is that expectations of households and firms on inflation are basically updated more slowly than professional forecasters.

Market-based inflation expectation

Particularly, there are two securities, specifically, nominal and real securities with the same maturity, which can be traded in the market Kose *et al.*, (2019). Particularly, the price difference between nominal security and real security can be explained as the inflation expectations of market participants over the horizon of security; moreover, the price difference between nominal and real securities is also known as breakeven inflation rate Kose *et al.*, (2019). Additionally, inflation swap rate based on derivative instruments is another common market-based measures which include inflation risk premium and liquidity premium and inflation expectations Kose *et al.*, (2019).

Survey-based inflation expectations in Uzbekistan

The Uzbek economy has been undertaking massive structural reforms since 2016. Particularly, the Central bank of Uzbekistan (CBU) has also experienced significant progress not only in operational framework but also, in communication and research framework. Essentially, CBU announced to switch its monetary policy into inflation targeting (IT) regime from monetary targeting regime. Since January 2018, the CBU started continuously analyzing inflation expectations of market participants and ensure their formation within inflation target level which is essential in improving the effectiveness of monetary policy. More specifically, since the beginning of 2018, the CBU has been constantly examining the inflation expectations of households and firms among all regions in Uzbekistan through conducting online and offline surveys from households and firms. In fact, on average, approximately 4000 (around 2500 households, 1500 firms) economic participants' viewpoints on inflation expectations for the next 12-month ahead period is collected by the CBU every month. Furthermore, respondents in households are basically working in the fields of banking and finance, education, mass media, medicine, tourism, agriculture, construction, trade and pensioner. In addition, the respondents in business entities are mainly operating in the fields of manufacturing, transport, trade, health care, agriculture, construction, culture, catering, and information technologies. Essentially, the weighted average method is applied in methodology of evaluating inflation expectations of households and firms in order to determine the aggregate level of inflation expectations in Uzbekistan.

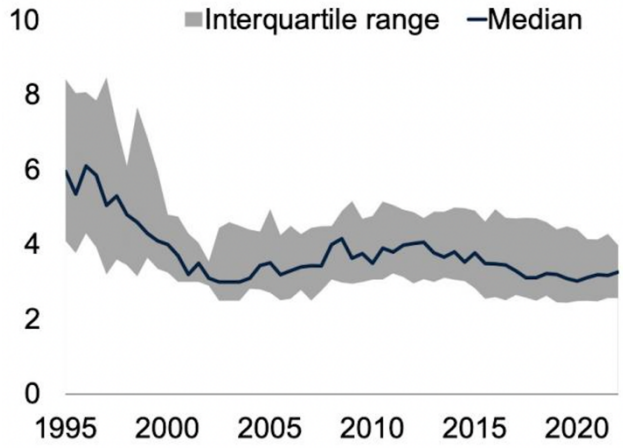
Evolution of Inflation Expectations in Global Economy

Inflation expectations reflect the future pattern of inflation and a gauge of monetary policy credibility. Hence, when economic participants are sufficiently credible about monetary policy conducted by central banks, inflation expectations are considered as well-anchored and less sensitive to short-term inflation shocks. The evolution of inflation expectations in advance economies and EMDEs will be briefly overviewed in the following paragraphs.

Vorisek *et al*., (2022) emphasized that the long-term (five-year-ahead) inflation expectations declined gradually in advanced and developing economies during the past three decades. More specifically, Vorisek *et al*., (2022) underlined, after sharp decrease in the 1990s, inflation expectations of households and firms in advanced economies have not fluctuated significantly and have remained stable at approximately 2 percent yearly since the middle of the 2000s. Although, inflation increased dramatically in 2021, the long-term inflation expectations of economic agents remained unchanged in advanced economies. Contrary to advanced economies, the inflation expectations of households and business entities in EMDEs have experienced significant fluctuations after the noticeable decrease during the second half of the 1990s (Kose *et al*., 2019).

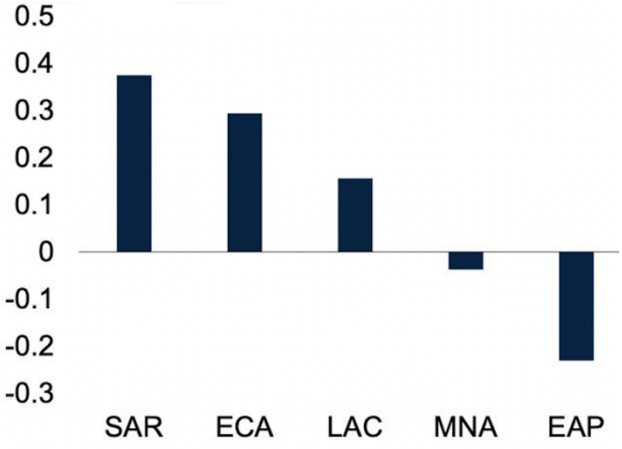
A. Inflation Expectations

percent



B. Change in inflation expectations

percentage point



Source: Consensus Economics, World bank

Moreover, Vorisek *et al*., (2022) mentioned that a rapid growth has experienced in inflation and inflation expectations in Europe and Central Asia (ECA), South Asia (SAR), Latin America and Caribbean (LAC) after the emergence of pandemic. The principal reason behind a sharp increase in inflation expectations of economic agents in the ECA, SAR and LAC regions have primarily been associated with the impacts of food and energy inflations, depreciation in local currency, and recovery in domestic demand (Vorisek *et al*., 2022). However, inflation expectations did not fluctuate and declined in East Asia and Pacific (EAP), Middle East and North Africa (MENA).

Evolution of Inflation Expectations in Uzbekistan

As it is aforementioned, since the beginning of 2018, the Central Bank of Uzbekistan has started conducting regular surveys among households and firms to examine their inflation expectations and determine primary factors effecting on inflation expectations (CBU, monetary policy report, 2018). According to the results of survey-based inflation expectations, inflation expectations of economic agents in Uzbekistan has changed significantly in 2018. Particularly, inflation began slowing down in January 2018 after a sharp acceleration at the end of 2017, which impacted positively on increasing inflation expectations in the first quarter of 2018 (CBU, monetary policy report, 2018).

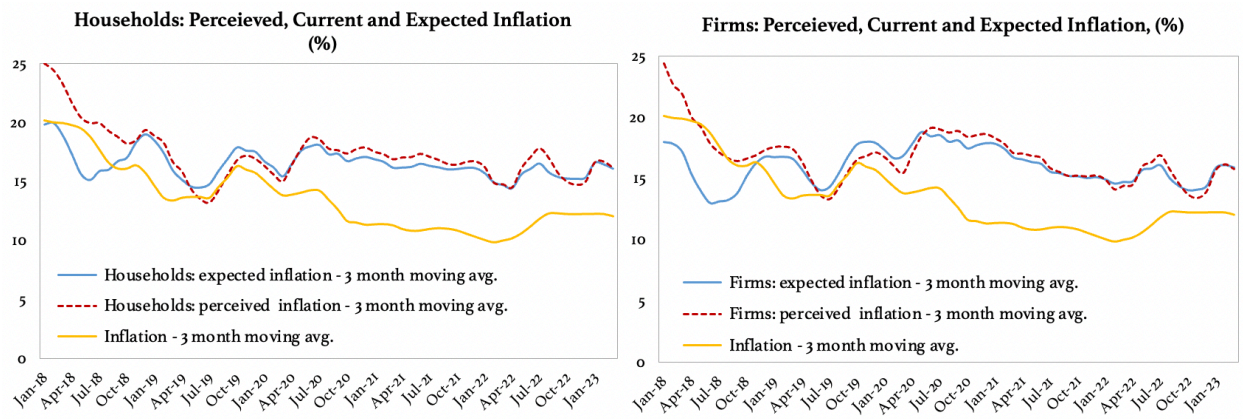
Although regulated prices have increased during the second quarter of 2018, households and business entities' inflation expectations remained relatively stable which was mainly explained by expectations on seasonal decrease in prices of fruits and vegetables and strengthening of national currency against US dollar (CBU, monetary policy report, 2018). However, due to increase in wages, utility bills and seasonal growth in prices for agricultural products, inflation expectations of economic agents, both households and firms, started accelerating in the third quarter. During the last quarter in 2018, an unstable trend was experienced in expected inflation of households and business entities. More precisely, 12-month ahead expected inflation of economic agents continued increasing during October-November; however, dropped significantly in December 2018 (CBU, monetary policy report, 2018).

Furthermore, the trend of inflation expectations was volatile during the first three quarters of 2019. Particularly, expectations of market participants on inflation formed a downward trend during January-June which was primarily explained by the optimistic views of households and firms about growth in the volume of domestic production and saturation of domestic market (CBU, monetary policy report, 2019). Increasing the price of energy resources, devaluation of national currency in August 2019, indexation of wages in budget sector impacted significantly and resulted in accelerating inflation expectations of economic agents during the third quarter of 2019 (CBU, monetary policy report, 2019). After a dramatic increase in August 2019, inflation expectations of

households and legal entities decreased significantly by the end of 2019. Particularly, after a gradual increase in October-November 2019, inflation expectations of households decreased significantly in December (CBU, monetary policy report, 2019).

Inflation expectations of households and business entities were formed a volatile trend during January-September 2020 (CBU, monetary policy report, 2020). In particular, the introduction of quarantine restrictions in March due to the pandemic caused expected inflation of the economic agents to rise significantly because of a growth in aggregate demand for staple foods and rising their prices (CBU, monetary policy report, 2020). Moreover, reduction in aggregate production was experienced due to quarantine measures which further caused inflation expectations of firms to accelerate. Particularly, the main determinants in formulating the inflation expectations of market participants were the devaluation of national currency, increasing in wages and utility bills in the first quarter of 2020 (CBU, monetary policy report, 2020).

Graph-1. Dynamics of Current, Perceived and Expected Inflations in Uzbekistan during 2018-2023



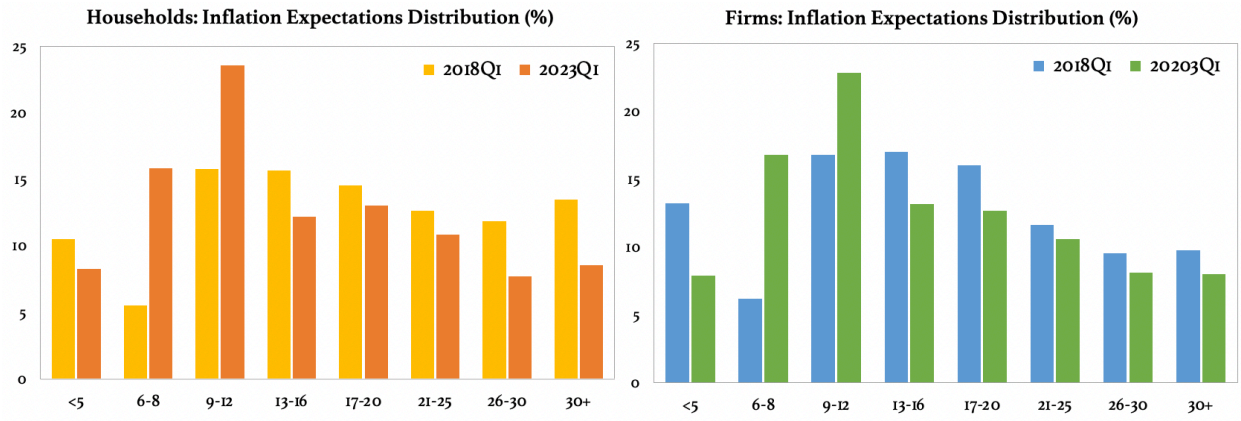
Source: The Central bank of Uzbekistan

Afterwards, during April-May 2020, inflation expectations of business entities increased significantly which was primarily due to devaluation of national currency in April and decline in imports due to restrictions and disruptions in foreign trade (CBU, monetary policy report, 2020). Although the gradual easing of lockdowns in June 2020 resulted in significantly declining inflation expectations of economic agents, the reintroduction of

quarantine measures in July 2020 impacted adversely and caused inflation expectations to return to an upward trend. However, during August-December 2020, the easing of quarantine restrictions and the gradual recovery of economic activity led to a decrease in inflation expectations (CBU, monetary policy report, 2020).

Based on the survey results of inflation expectations, conducted by the Central bank of Uzbekistan, it should be emphasized that the CBU has started gradually gaining the credibility among households and firms because the share of households and firms who indicated "6-8" and "9-12" answer ranges to inflation expectations for the next 12-months significantly increased in first quarter of 2023 compared with the first quarter of 2018. Particularly, the share of households who reported inflation expectations within "9-12" percent increased from 15 percent in 2018Q1 to approximately 25 percent in 2023Q1. Similar to households, the share of business entities which indicated their expectations about inflation within "9-12" percent rose from 17 percent in 2018Q1 to around 23 percent in 2023Q1.

Graph-2. Households and Firms: Respondents' Answers Distribution, 2018Q1 vs 2023Q1



Source: The Central bank of Uzbekistan

Additionally, the percentage of respondents from both households and legal entities who reported expected inflation within "6-8" percent for the next 12-months increased dramatically from 5 percent in 2018Q1 to more than 15 percent in 2023Q1. Considering aforementioned statements, economic agents, households and firms, gradually started to

trust the CBU monetary policy. Undoubtedly, transition from monetary targeting into inflation targeting regime also impacted significantly positive on the transparency and credibility of the Central bank of Uzbekistan to regain the trust of market participants.

Structure of Thesis

Essentially, the main sections of thesis include introduction, literature review, research questions and objectives, methodology, empirical analyses and findings, and conclusion. Importance of inflation expectations, measures of inflation expectations, evolution of inflation expectations in global economy as well as Uzbekistan have been explained in introduction. Empirical findings and methodologies of previous empirical studies will be summarized and examined in literature review. Main research questions, objectives and the originality of thesis will be stated in research question and objectives section. Methodology section will primarily discuss data collection, dependent and independent variables in regression models, empirical models as well as equations. Empirical results, obtained from applying OLS, ARDL and VAR models to investigate the empirical relationship between inflation expectations and its determinants, will profoundly be explained in empirical analysis and discussion. Finally, the main statements and findings of thesis will be restated and also policy recommendations will be provided in conclusion section.

Literature Review

An empirical study investigated by **Jonung (1981)** using cross-sectional survey data for households though employing the Ordinary Least Squares (OLS) technique in order to estimate the impact of perceived inflation, age, gender and income level on expected inflation of Swedish households. Based on the empirical findings from OLS regression analysis, Jonung concluded that perceived inflation acquired statistically significant and positive impact on inflation expectations in Sweden, whereas age possessed statistically significant and negative effects. However, gender and income are applied as dummy variables into the OLS regression model and the author found insignificant impacts of gender and income on households' inflation expectations. In fact, one year increase in age

will further lead expected inflations of Swedish households to decline by approximately 0.05 percent. Additionally, each percentage increase in perceived inflations will cause expected inflations to rise by around 0.5 percentage point. Thus, the author concluded that perceived inflation, which is the knowledge of public about historical price level, plays an essential role in formulating the Swedish individuals' inflation expectations. Moreover, Jonung found that the perceived rate of inflation by women were higher than men since women were primarily responsible for doing major share of daily purchases.

Cerisola and Gelos (2005) empirically examined the macroeconomic determinants of inflation expectations in Brazil since the adoption of inflation targeting regime through applying three different econometric models, namely the ordinary least squares (OLS), the generalized methods of moments (GMM) and fully modified ordinary least squares (FMOLS). In regression models, the 12-month ahead inflation expectations were applied as endogenous variable, whereas the past inflation (lagged 12-month inflation rate), the inflation target, fiscal balance as percentage of GDP, real interest rate (proxied for the stance of monetary policy), real effective exchange rate gap and real wage gap were used as exogenous variables.

Particularly, Cerisola and Gelos found statistically significant and positive impact of the inflation target, past inflation, REER and wage gaps on inflation expectations, whereas statistically significant and negative effect of the fiscal surplus as percentage of GDP based on results of the OLS regression model. However, the authors emphasized that there are statistically significant and positive impacts of the inflation target and reer gap on expected rate of inflation, whereas a statistically insignificant and positive effects of real interest rate and real wage gaps on inflation expectations was found by the author based on the results of GMM regression model. More precisely, one percentage increase in inflation target will lead expected rate of inflation to rise by approximately one percent based on the results of GMM regression model whereas, a single percentage growth in the inflation targeted causes inflation expectations to increase by 0.66 percent was identified based on the OLS regression results. Moreover, one percent increase in the fiscal surplus will further lead inflation expectations to decrease by almost one percent

based on the OLS regression results, whereas based on the GMM regression model, a single percentage growth in fiscal surplus will cause inflation expectations to decline by approximately 1.2 percent in Brazil. Therefore, the authors concluded that inflation target and fiscal policy are found as significant determinants in the formulation of inflation expectations, whereas the role past inflation in determining inflation expectations is found as less important.

Similar to Cerisola and Gelos (2005), **Minella et al., (2008)** also conducted empirical study on the main drivers of inflation expectations in case of Brazil using time-series data for the period from 2000 to 2006 through applying the OLS technique. In the empirical study, investigated by Minella et al., 12-month ahead inflation expectation was utilized as dependent variable, while inflation target, output gap, past inflation, nominal exchange rate and real effective exchange rate (reer) gap were used as independent variables in the OLS regression model. The main findings of empirical study conducted by Minella et al., disclosed statistically significant and positive relationship between inflation expectations and inflation target, nominal exchange rate, real effective exchange rate gap. Particularly, one percentage growth in inflation target will cause expected rate of inflations to increase by 0.6 percent; therefore, Minella at al., supported the empirical findings and conclusions made by Cerisola and Gelos regarding the essential role of inflation target in formulating inflation expectations in Brazil.

According to Mehra and Herrington (2008), inflation expectations of households play an important role in curbing headline inflation and achieving price stability by the monetary authorities. Particularly, Mehra and Herrington empirically analyzed the macroeconomic determinants of inflation expectations through applying structural VAR model based on time-series data for the period from 1953 to 2007 in case of the United States. In fact, the authors utilized actual inflation, unemployment rate, short-term interest rate, commodity and oil price indices as main macroeconomic determinants, whereas the households' expectation on inflation was applied as dependent variable in regression model.

The primary results of empirical study, investigated by Mehra and Harrington indicate that inflation expectations of households acquire a positive relationship with headline

inflation, past inflation expectations, commodity and oil prices, whereas a negative relationship is found between unemployment rate and expected rate of inflation in the United States. Additionally, the authors also found that shocks to past inflation expectations, actual inflation and commodity prices are considered as the primary three sources for variations in inflation expectations of US households. More precisely, shocks to aforementioned three sources accounted for approximately 95 percent of variations in expected inflation at four-year horizon.

Similar to Mehra and Herrington (2008), **Sommer and Troëng (2009)** empirically analyzed the elasticity of inflation expectations to shocks from several macroeconomic variables through using time-series data for Sweden during the period from 1981 to 2008 and applying structural VAR model in order to conduct impulse response analysis and forecast error variance decomposition (FEVD) technique to investigate the importance of independent variables (several macroeconomic variables) in explaining the variations of dependent variable (inflation expectations). Similar to Mehra and Herrington, Sommer and Troëng (2009) included the lag of inflation expectations, actual inflation, commodity price indices, unemployment rate and short-term nominal interest rate into structural VAR model.

Based on empirical findings of the structural VAR model and impulse response analyses, Sommer and Troëng (2009) concluded that shocks from the lag of expected inflation, actual inflation and unemployment significantly impacted on the variations of inflation expectations of Swedish individuals. In fact, one percentage temporary growth in the lag of expected inflation will lead Swedish households' inflation expectations to increase by 0.5 percent. Additionally, one percent temporary growth in actual inflation will cause expected inflation of households in Sweden to increase by 0.4 percent within one year. Moreover, a single percentage point temporary growth in unemployment rate will further result in declining inflation expectations of households by 0.3 percent within two years. Therefore, empirical study, investigated by Sommer and Troëng (2009), supported the empirical findings and conclusion made by Mehra and Herrington (2008) regarding

the positive correlation of inflation expectations with actual inflation and the lag of expected inflations, whereas a negative relationship with unemployment rate.

Moreover, **Araujo and Gaglianone (2010)** in their empirical research analysis on the title "Survey-based Inflation Expectations in Brazil" highlighted that inflation expectations are currently monitored by the large number of Central banks because of its importance in forecasting and curbing inflation. Particularly, the authors empirically investigated the primary drivers of inflation expectations in Brazil through applying the Ordinary Least Squares technique based on time-series data for the period from 2002 until 2008. Survey-based inflation expectations, collected by the Central bank of Brazil, was utilized as left-hand side variable in regression model, whereas inflation target, inflation rate, the Selic short-term interest rate, nominal exchange rate, industrial production and industrial capacity utilization were applied as right-hand side variables into the OLS regression model. In fact, the empirical results of research analyses, investigated by Arujo and Gaglianone, revealed that inflation target, inflation rate and nominal exchange rate acquired statistically significant and positive impact on inflation expectations; however, the Selic short-term nominal interest rate possessed a statistically significant and negative effect on expected inflations in Brazil.

Gaglianone (2017) mentioned that inflation expectations of firms play a significant role in theory and practice of monetary policy, especially in inflation-targeting countries. Particularly, the author summarized the empirical findings and stylized facts regarding inflation expectations in case of Brazil. Particularly, Gaglianone mentioned fiscal policy as one of the principal instrumental variables in driving the inflation expectations of professional forecasters, together with inflation, exchange rate, economic activity, commodity prices and monetary policy interest rate.

Furthermore, **Vo *et al.*, (2020)** empirically analyzed the main determinants of inflation expectations in case of Czech Republic, small open inflation targeting economy, through employing Nonlinear Autoregressive Distributed Lag (NARDL) approach using time-series data throughout the period from 1999 to 2018. Particularly, output growth (the real GDP growth proxied), real exchange rate, inflation, unemployment, fiscal stance (budget

deficit/surplus), money supply and oil prices were applied into regression models as main independent variables, whereas inflation expectations were utilized as dependent variable into regression models.

Particularly, the results of Nonlinear ARDL model in empirical study, conducted by the authors suggested that expected rate of inflation in Czech Republic are strongly and positively affected by actual inflation and past inflation expectations which underlined inflation expectations as adaptive expectations. More specifically, the authors found statistically significant and negative impacts on inflation expectations from past inflation expectations and real exchange rate in short run and long run, whereas statistically significant and positive effects from actual inflation on inflation expectations were also observed by authors in short run and long run. Additionally, the Nonlinear ARDL model also indicated that unemployment, output growth, money supply, fiscal stance and oil prices acquired considerable impacts on expected rate of inflation however results varied significantly in short run and long run.

Weber *at al.*, (2022) theoretically studied the determinants of households and firms' subjective inflation expectations in their research analysis, "The Subjective Inflation Expectations of Households and Firms". In particular, the authors emphasized that inflation expectations of households and firms are usually comparatively higher than professional forecasters. Indeed, the authors mentioned that inflation expectations of households and business entities in the United States were systematically higher than financial market analysts' expected inflation. Furthermore, Weber *at al.*, (2022) highlighted that recent inflation observed by households is one of the strongest predictors for inflation expectations; therefore, the authors suggested that there might be strong and positive relationship between perceived inflation and expected inflation. Particularly, the authors argued that households who have experienced higher inflation recently will make higher expectations on general price level for the future periods. Moreover, Weber *at al.*, (2022) underlined that there might be also strong relationship between food inflation and inflation expectations of individuals because households basically make

expectations about general price levels based on the daily shopping of groceries and gasoline (**D'Acunto et al. 2021b; Cavallo et al. 2017; Kumar et al. 2015**).

Additionally, numerous empirical studies have been investigated in order to estimate the impact of fiscal variables, particularly, fiscal deficit, public and external debt on inflation expectations of households and firms. Particularly, **Coibion *et al.*, (2021)** analyzed the elasticity of household inflation expectations to shocks from fiscal variables, current debt or deficit, through applying randomized control trials method in the United States. More precisely, randomized control trial on the U.S household inflation expectations applied by Coibion *et al*., (2021) to address how inflation expectations of households sensitive to fiscal variables by comparing their expectations towards future inflation, government spending and taxes based on before and after treatments about fiscal outlook. The empirical findings stressed that information about current level of deficit and debt has insignificant impacts on the U.S households inflation expectations, whereas news about future deficit and debt level significantly influences and leads the U.S households to make higher inflation expectations.

Similar to Coibion *et al*., (2021), **Grigoli and Sandri (2023)** applied randomized control trials technique in order to examine the causal effect of public debt on household inflation expectations in case of the United Kingdom, the United States and Brazil. Particularly, based on empirical findings, Grigoli and Sandri concluded that public debt had a significant and positive effect on inflation expectations. In fact, 10 percent growth in public debt as a share of GDP caused expected inflation of households to increase in the UK by 0.6 percent, in the US by 0.45 percent, in Brazil by 0.6 percent.

Research Questions and Objectives

The Purpose of Research

The Uzbek economy acquire unique characteristics such as persistent inflation, high inflation expectations among economic agents, not strong confidence in national currency due to regular devaluation of national currency Uzbek Sum against US dollar; therefore,

Graph-3. Main Determinants for Households' Inflation Expectations during 2022-2023

Households' Factors	2022												2023	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Change in the exchange rate	37	49	54	43	26	25	33	35	42	44	51	49	42	46
Increase in the price of fuel and energy resources	25	20	18	23	27	27	36	34	27	30	38	40	47	45
Artificial increase in prices	35	30	37	34	37	41	43	37	31	34	35	36	37	38
Increase in the price of stable foods	41	43	49	53	55	56	55	48	42	49	37	27	32	28
Increase in wages	31	28	23	22	39	34	29	31	28	27	28	35	24	24
Increase in accomodation and rent prices	15	14	11	14	11	11	12	15	18	22	22	20	19	18
Difference between prices in supermarkets and bazaars	10	11	11	14	14	14	14	11	11	11	11	11	12	11

Source: The Central bank of Uzbekistan

Graph-4. Main Determinants for Business Entities' Inflation Expectations during 2022-2023

Firms' Factors	2022												2023	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Change in the exchange rate	37	43	51	41	24	19	34	33	39	44	48	49	44	48
Increase in the cost of fuel and transportation	42	36	36	37	25	27	31	29	35	39	50	35	38	46
Increase in wages	26	21	17	21	30	29	23	26	23	22	24	30	21	25
Supply chain issues in importing raw materials	16	16	22	22	21	22	23	21	19	16	20	19	17	20
Worsening the competitive enviroment in the economy	16	13	14	14	16	32	33	16	14	13	15	18	15	19
Increase in the price of imported raw materials	20	18	22	14	14	24	28	22	21	21	32	15	17	17
Increase in the price of commercial buildings and its rent	13	11	10	9	9	10	12	13	11	11	14	13	15	12

Source: The Central bank of Uzbekistan

high dollarization in economy, shallow and underdeveloped financial market, and significant role of administrative prices in domestic economy.

In fact, in May 2023, dollarization in the deposits, loans and liabilities of banking sector accounts for around 30 percent, 44 percent and 53 percent in respectively. Therefore, majority of respondents of households and business entities in inflation expectations survey indicate the changes in exchange rate and the price growth of fuel and energy resources, which is basically administrated and monitored by government, as the main determinants for 12-month ahead inflation expectations.

Particularly, the results on survey-based inflation expectations of households and firms indicate that approximately 50 percent out of total respondents in households reported both "change in the exchange rate" and "growth in the price of fuel and energy resources" as the main factors for the next 12-months expected rate of inflation (*Graph-3*). Similar to households, almost 50 percent out of total respondents in business entities also indicated both "change in the exchange rate" and "increase in the price of fuel and transportation" as the primary determinants for inflation expectations (*Graph-4*).

Therefore, considering abovementioned factors, the primary objective of thesis is to empirically investigate the impacts of exchange rate and administrated prices on inflation expectations of individuals and legal entities in Uzbekistan based on monthly time-series data during the period from January 2018 to December 2022. Furthermore, in empirical analyses, the impact of in exchange rate and regulated price on inflation expectations of market participants will be analyzed through applying different econometric models to examine whether the influences of exchange rate and administrated prices on expected inflation are statistically significant or not.

Research Questions

1. Does volatility in exchange rate have a statistically significant and positive impact on inflation expectations of households and business entities in Uzbekistan?

2. Does increase in administrated prices have a statistically significant and positive effect on inflation expectations of individuals and firms in Uzbekistan?

3. How does expected inflation of households and business entities respond to the shocks from exchange rate in Uzbekistan?

4. How does inflation expectation of individuals and firms respond to shocks from administrated prices in Uzbekistan?

Research Objectives

A. To provide background information and build foundational understanding on the relationship between exchange rate, administrated prices and inflation expectations of firms and households.

B. To critically analyze previously conducted empirical studies on the nexus between exchange rate, regulated price and inflation expectations and its main determinants.

C. To empirically investigate impacts of exchange rate and administrated prices on inflation expectations of economic agents in Uzbekistan.

D. To empirically examine how does inflation expectations of households and business entities respond to shocks from exchange rate and regulated prices in Uzbekistan.

Contribution/Originality of Research Analysis

Essentially, investigated research study will add its own and unique contribution to the existing literature and assists prospective researchers to obtain better understanding in inflation expectation, main determinants of inflation expectation, empirical relationship between exchange rate, regulated prices and inflation expectations of economic agents. Additionally, another originality of the underlying research analysis is to empirically analyze the main determinants of inflation expectations through applying three various

models, namely, the OLS, ARDL and VAR models which differ the underlying empirical study from previously investigated empirical research analyses on the determinants of expected inflation.

Data, Variables and Research Methodology

Data Collection and Variables

In addition to exchange rate and regulated prices, specific macroeconomic variables will be included into the OLS regression model in order to obtain more robust and unbiased estimates. Particularly, perceived inflation of households and firms, actual inflation, nominal exchange rate, regulated prices inflation, short-term interest rate, the real GDP, the CBU policy rate and external debt are applied as primary independent variables whereas, 12-month ahead inflation expectations of individuals and firms will be utilized as dependent variables in regression models. Moreover, the secondary data for aforementioned macroeconomic variables will be obtained and gathered from reliable sources, specifically the Central bank of Uzbekistan, Statistics Agency, and Ministry of Economy and Finance in Uzbekistan.

Research Methodology

The empirical analyses will be divided into three main sections; firstly, the Ordinary Least Square technique will be employed to investigate the impact of exchange rate and regulated prices on inflation expectations and estimate whether the effects of exchange rate, regulated prices and certain macroeconomic variables on inflation expectations of households and firms are statistically significant or not. Secondly, the ARDL approach will be applied to analyze the short-run and long-run relationship between inflation expectations and its determinants. Thirdly, the VAR approach and impulse response analysis will be employed to analyze the sensitivities of economic agents' inflation expectations to the shocks from exchange rate and administrated prices.

The OLS regression equations for households and business entities

Inflation Expectations Equation for Business Entities (Equation - 1)

$$E\pi_t = \alpha_0 + \alpha_1 Perceived\_inflation_t + \alpha_2 Inflation_t + \alpha_3 Exchange\_rate_t + \alpha_4 Regulated\_prices_t + \alpha_5 CBUpolicyrate_t + \alpha_6 LogRGDP_t + \alpha_7 LogExternalDebt_t + \varepsilon_t$$

Inflation Expectations Equation for Households (Equation – 2)

$$E\pi_t = \alpha_0 + \alpha_1 Perceived\_inflation_t + \alpha_2 Inflation_t + \alpha_3 Exchange\_rate_t + \alpha_4 Regulated\_prices_t + \alpha_5 interest\_rate_t + \alpha_6 LogRGDP_t + \alpha_7 LogExternalDebt_t + \varepsilon_t$$

where,

Inflation Expectations (Eπ)	*Inflation expectations of households and business entities for the next 12-months*
Perceived_Inflation	*Perceived rate of inflation by households and business entities for the past 12-months*
Inflation	*CPI Inflation rate, yearly*
Exchange_Rate	*Nominal exchange rate, yearly*
Regulated_Prices	*Administrated price growth, yearly*
Interest Rate	*Short-term nominal interest rate*
CBU_Policy_Rate	*Central bank of Uzbekistan policy rate*
Log_RGDP	*Logarithm form of Real Gross Domestic Product in billion Uzbek Sum*
Log_External_Debt	*Logarithm form of External Debt in million USD*

Dependent and Independent Variables

Inflation Expectations. 12-months ahead inflation expectations of households and business entities, collected by the Central bank of Uzbekistan though conducting monthly surveys, will be proxied for inflation expectations which will be dependent variable in regression models. Particularly, inflation expectations equations for households and business entities will be constructed separately.

Perceived Inflation. The perceived rate of inflation by market participants for the past 12-months, collected by the Central bank of Uzbekistan through conducting monthly surveys, is one of the essential determinants in formulating the inflation expectation of households and business entities in Uzbekistan. Particularly, several empirical research analyses, investigated by Jonung (1981), Kose *et al.,* (2019), Weber *et al.,* (2022), found a strong and positive relationship between perceived inflation and inflation expectations of economic agents. Therefore, perceived rate of inflation by individuals and firms added into regression models as one of the main independent variables which significantly explain the variations on expected rate of inflation.

Exchange Rate (Interest variable). Exchange rate acquires significant impact on inflation through affecting on price level of imported good and services in domestic market which is known as exchange rate pass-through. Therefore, exchange rate is considered as one of the crucial factors for inflation expectations since exchange rate indirectly impacts on inflation expectations of economic agents though effecting on price of imported products and services in local market. In particular, numerous empirical studies, conducted by Cerisola and Gelos (2005), Minella et al., (2008), Araujo and Gaglianone (2010), Vo et al., (2020), examined the relationship between exchange rate and inflation expectations and found statistically significant and positive effects in nominal exchange rate on inflation expectations of market participants. Therefore, based on the results of previous empirical research analyses, a positive relationship is expected between expected inflation and exchange rate.

Inflation. The CPI inflation rate is another important determinant in the formulation of economic agents' inflation expectations. Particularly, numerous empirical studies, conducted by Mehra and Herrington (2008), Sommer and Troëng (2009), Araujo and Gaglianone (2010), Vo *et al*., (2020), Weber *et al*., (2022), found that inflation plays an essential role in formulating inflation expectations of households and firms. Moreover, in the literature review, it is observed that households will primarily make expectations about future inflation based on the daily shopping of grocery. Thus, different types of inflation, such as CPI inflation and food inflation, fruits will be applied into regression model as another essential determinant in order to investigate their impacts separately.

Regulated Price (Interest variable). The administrated prices include different types of goods and services. In fact, 15 percent of goods and services' prices in Consumer Price Index basket are basically administrated by the government of Uzbekistan. In particular, the regulated prices include different types of goods and public services such as energy resources (gasoline, methane, and coal), utility bills (electricity, natural gas and water) and public transports (subway, busses, airline tickets). Particularly, the majority of goods and services in regulated prices have a significant impact on daily lifestyle of households and daily operation of firms; therefore, growth in administrated prices will directly impact on inflation expectations of market participants. An empirical investigation on the effects of regulated prices on expected inflation, conducted by Cerisola and Gelos (2005), declare that expected inflation of economic agents for the next 12-mothns is significantly impacted by the goods and services which prices are administrated by the government. Therefore, a positive sign in the coefficient of regulated prices in empirical findings will be expected.

The real Gross Domestic Product. The real GDP growth will be proxied for the output growth in empirical analyses and regression model. In fact, a positive output growth underlines that the economy is performing above its potential level which will result in increasing pressure on inflation in economy. Therefore, a positive output growth will lead inflation expectations of individuals and firms to increase though rising inflation, whereas a negative output growth will decline the growth of general price level in the

domestic market. A negative output growth will lead inflation expectations to decrease through reducing additional pressure on inflation. In particular, Minella et al., (2008), Gaglianone (2017) and Vo et al., (2020) in their empirical research analyses found a statistically significant and positive relationship between output growth and inflation expectations. Thus, a positive sign in the coefficient of output growth (the real GDP) is expected in the regression analyses. Considering aforementioned findings, the real GDP growth will be selected and employed as one of the main independent variables in regression models.

Interest rate. The short-term nominal interest rate also acquires indirect effect on inflation expectations though impacting on inflation and economic activity. Particularly, higher nominal interest rate implies higher cost of borrowing, which will cause economic activity to decline due to decrease in investment since the cost of borrowing will be expensive. Decline in economic activity will reduce additional pressure on inflation in the economy which will further result in decreasing inflation expectations of households and firms. In fact, numerous empirical investigations, conducted by Cerisola and Gelos (2005), Mehra and Herrington (2008), Sommer and Troëng (2009), Araujo and Gaglianone (2010), found a statistically significant and negative relationship between short-term interest rate and inflation expectations. Therefore, a negative sign in the coefficient of short-term interest rate in empirical findings is expected.

The CBU policy rate. The CBU policy rate will be a measure of monetary policy. Particularly, tightening monetary policy by the CBU, increasing the policy rate, will increase the short-term nominal interest rate in money market which underline the increase in cost of borrowing. Therefore, tightening or loosening monetary policy by the CBU will directly impact on economic activity through interest rate channel which further impacts on inflation expectations of economic agents. Additionally, higher cost of borrowing will decline economic activity and inflation which further result in decreasing inflation expectations of households and firms. Considering aforementioned effects, a negative relationship between inflation expectations and the CBU policy rate is expected in the empirical findings.

External debt. The external debt will be proxied for the fiscal stance in regression analyses. In particular, higher external debt implies higher government spending and budget deficit. Consequently, fiscal deficit and excessive government spending will cause inflation to surge which further lead inflation expectations of economic agents to intensify. Essentially, empirical findings on the relationship between inflation expectations and fiscal policy stance is mixed and inconclusive. Particularly, Sargent and Wallace (1986) declared that fiscal policy stance plays a critical role in inflation expectations. Additionally, Minella *et al.,* (2003) and Cerisola and Gelos (2009), Gaglianone (2017) and Vo *et al.,* (2020) on their empirical studies found statistically significant and negative relationship between inflation expectations and fiscal policy stance; therefore, concluded that inflation expectations are strongly influenced by fiscal policy stance. Therefore, a negative sign in the coefficient of the external debt is expected in empirical findings from regression analyses.

Empirical Analyses and Results

Descriptive Statistics

According to descriptive statistics, average inflation expectations in Uzbek firms was equal to 16.2 percent during 2018-2022, whereas the minimum and maximum rate of expected inflation accounted for 12.8 and 20.2 percent respectively. The average rate in inflation expectations of households equaled to 16.5 percent, whereas minimum and maximum rate of expected inflation were 14.0 and 20.9 percent in respectively.

Furthermore, average perceived rate of inflation by Uzbek entrepreneurs was equal to 16.8 percent, while minimum and maximum percentage of perceived inflation in firms were 12.7 and 25.9 percent in respectively. Regarding perceived inflation of households, average perceived inflation was equal to 17.4 percent, whereas minimum and maximum rate of perceived inflation in individuals were equal to 12.8 and 26.5 percent respectively.

Turing to exchange rate, average exchange rate depreciation was equal to 7.3 percent per

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Business Expectations	60	16.19	1.84	12.77	20.18
Household Expectations	60	16.53	1.57	14.04	20.89
Business Perceived	60	16.84	2.42	12.68	25.94
Households Perceived	60	17.36	2.61	12.84	26.54
Exchange Rate	60	7.31	6.39	-7.64	19.74
Administrated Prices	60	15.19	5.43	6.95	26.70
Inflation	60	13.44	2.7	9.69	20.14
Food Inflation	60	16.71	2.86	13.03	26.71
PPI Inflation	60	23.1	13.36	6.99	52.45
CBU Policy Rate	60	14.98	1	14	17
Interest Rate	60	21.80	1.81	18.4	25.74
Log RGDP	60	11.76	.34	10.95	12.34
Log External Debt	60	10.29	.36	9.76	10.82

year, while minimum and maximum depreciation rate in nominal exchange rate were (-7.6) and 19.7 percent throughout the period 2018 to 2022. Regarding regulated prices by local government, average growth rate in administrated prices equaled to 15.2 percent, whereas minimum and maximum growth rate were equal to 6.9 as well as 26.7 percent respectively.

Regarding CPI inflation, average inflation equaled to 13.4 percent, whereas average PPI inflation accounted for 23.1 percent. Particularly, minimum and maximum rate in CPI inflation were 9.7 and 20.1 percent respectively. Additionally, minimum and maximum rate in PPI inflation were 7.0 and 52.5 percent respectively. Turning to short-term nominal interest rate, average rate was equal to 21.8 percent, while minimum and maximum interest rates accounted for 18.4 and 25.7 percent in respectively during 2018-2022.

The OLS Regression Results for Households and Business Entities

Prior to turning into discussion of estimated coefficients, it is essential to underline that empirical results and findings were estimated based on regression equations in line with the methodology part. In fact, the *Table 1* and *Table 2* illustrate the regression results for inflation expectations of households and firms, the derived coefficients of independent variables and corresponding standard errors in parentheses.

Essentially, constructed regression equations for inflation expectations of households are found to be reasonable since the R-squares is equal to 0.58 in regression model in the first three models (around 0.65 in business entities), whereas the R-squares is increased to around 0.85 after the inclusion of the perceived inflation by both households and firms into regression model in the last three models which underlines 85 percent of variation in inflation expectations of economic agents are explained by selected macroeconomic variables (*Table 1* and *Table 2*).

Following research objectives, it is paramount to start discussion of empirical findings with the impacts of exchange rate and administrative prices on households and business entities' inflation expectations. Essentially, being in line with previous empirical studies and theoretical assumptions, the underlying study found a positive influence of exchange rate and regulated prices on both households and firms' expected rate of inflations in Uzbekistan at 1 percent significance level (*Table 1* and *Table 2*). In fact, the OLS regression results indicated that exchange rate and regulated prices acquired statistically significant and positive impacts on inflation expectations of market participants in Uzbekistan.

Holding all other variables constant, one percent increase (depreciation) in exchange rate will lead to increase inflation expectations of Uzbek households and firms by the range of 0.10 – 0.18 percent and 0.12 – 0.24 percent in respectively. Consequently, it can be concluded that 10 percent depreciation in local currency (Uzbek Sum) against US dollar might result in increasing inflation expectations of households by the range of 1.0 – 1.8 percent and firms by the range of 1.2 – 2.4 percent in respectively (*Table 1* and *Table 2*). Essentially, empirical findings derived from the underlying empirical study support and

are in line with empirical results of research analyses conducted by Cerisola and Gelos (2005), Minella et al., (2008) and Araujo and Gaglianone (2010).

Administrative prices are another interest variable in the underlying empirical study, theoretically and previous research analyses indicated a positive relationship among inflation expectations of economic agents and administrative prices; particularly, the underlying study also supports empirical findings of previously investigated research analyses and finds statistically strong and positive relationship between administrated prices and inflation expectations of Uzbek households (*Table 1*). Despite a positive correlation is observed between Uzbek firms' expected inflation and regulated prices, the impact of regulated prices on inflation expectations of Uzbek firms is found statistically insignificant which emphasizes that inflation expectations of Uzbek business entities are less sensitive for changes in regulated prices compared with Uzbek households' inflation expectations.

More specifically, holding all control variables fixed, one percentage growth in regulated prices will lead inflation expectations of Uzbek households to increase by the range of 0.10 – 0.17 percent, whereas expected rate of inflation in Uzbek firms will be increased by the range of 0.02 – 0.15 percent due to one percent growth in regulated prices. Therefore, when government increases regulated prices by 10 percent, it might contribute expected inflations of Uzbek households and firms to increase by the range of 1.0 – 1.7 percent and 0.2 – 1.5 percent in respectively. A positive relationship between regulated prices and expected inflation of economic agents in empirical findings of the underlying study find similar results and support conclusions made by Cerisola and Gelos (2005).

Since the complementary objectives of the underlying research analysis is to identify the main determinants and contributing factors for households and business entities' inflation expectations in Uzbekistan. Commencing with perceived rate of inflation by households, theoretically positive relationship is expected between perceived inflation and expected inflation of market participants. Particularly, the OLS regression results for households and firms, illustrated in *Table 1 & Table 2*, report statistically significant and positive impacts in perceived inflation on inflation expectations of Uzbek households and

Table 1. Regression Results for Inflation Expectations (Households)

VARIABLES	Hh_Exp (1)	Hh_Exp (2)	Hh_Exp (3)	Hh_Exp (4)	Hh_Exp (5)	Hh_Exp (6)
Hh_Perceived				0.469***	0.520***	0.537***
				(0.0536)	(0.0566)	(0.0571)
Inflation			0.116			0.185**
			(0.103)			(0.0707)
Food_Inflation		0.0855			0.126**	
		(0.0829)			(0.0565)	
Admin_Prices	0.177***	0.165**	0.159**	0.109**	0.119***	0.128***
	(0.0658)	(0.0667)	(0.0675)	(0.0432)	(0.0419)	(0.0416)
Exchange Rate	0.177***	0.155***	0.166***	0.104***	0.128***	0.112***
	(0.0252)	(0.0329)	(0.0272)	(0.0183)	(0.0207)	(0.0177)
Interest Rate	-0.636***	-0.562***	-0.580***	-0.147	-0.203*	-0.165
	(0.142)	(0.159)	(0.150)	(0.107)	(0.106)	(0.102)
Log RGDP	0.935	1.169	1.162	3.047***	2.935***	2.993***
	(1.410)	(1.428)	(1.421)	(0.942)	(0.911)	(0.895)
Log External Debt	-0.411	-0.339	-0.0556	-1.362	-1.571	-2.063*
	(1.772)	(1.772)	(1.795)	(1.149)	(1.113)	(1.123)
Constant	19.60***	13.41	10.86	-12.68**	-7.101	-3.450
	(6.311)	(8.708)	(9.950)	(5.499)	(5.870)	(6.302)
Observations	60	60	60	60	60	60
R-squared	0.57	0.58	0.58	0.82	0.84	0.85
Root MSE	1.06	1.06	1.06	0.69	0.66	0.65

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2. Regression Results for Inflation Expectations (Business Entities)

VARIABLES	Bs_Exp (1)	Bs_Exp (2)	Bs_Exp (3)	Bs_Exp (4)	Bs_Exp (5)	Bs_Exp (6)
Bs_Perceived				0.514***	0.498***	0.564***
				(0.0806)	(0.0784)	(0.0634)
Inflation			-0.228**			0.394***
			(0.105)			(0.0663)
PPI		-0.0406**			0.0314**	
		(0.0191)			(0.0145)	
Interest_rate		-0.212		0.131	0.159	-0.0194
		(0.151)		(0.132)	(0.128)	(0.106)
CBU_Policyrate	-0.0598		-0.0937			
	(0.190)		(0.184)			
Admin_Prices	0.0244	0.145**	0.0234	0.0768	0.102*	0.133***
	(0.0520)	(0.0705)	(0.0503)	(0.0544)	(0.0539)	(0.0434)
Exchange Rate	0.223***	0.235***	0.238***	0.118***	0.116***	0.145***
	(0.0254)	(0.0267)	(0.0255)	(0.0285)	(0.0275)	(0.0227)
Log RGDP	1.263	0.647	1.174	2.663**	2.785**	2.114**
	(1.475)	(1.483)	(1.427)	(1.211)	(1.173)	(0.948)
Log External Debt	-1.311	-0.593	-2.719	-0.469	-1.249	-1.761
	(1.655)	(1.921)	(1.726)	(1.462)	(1.459)	(1.159)
Constant	13.71**	16.30**	32.72***	-23.90***	-17.27**	2.570
	(6.473)	(7.426)	(10.75)	(7.325)	(7.722)	(7.237)
Observations	60	60	60	60	60	60
R-squared	0.62	0.67	0.65	0.80	0.81	0.88
Root MSE	1.18	1.12	1.14	0.86	0.85	0.68

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

business entities. More specifically, one percent growth in perceived rate of inflation by households and business entities is estimated to contributed approximately 0.5 percent increase in inflation expectations of Uzbek individuals and firms (*Table 1 & Table 2*). The aforementioned findings in the underlying study correspond with empirical results and conclusions made by Jonung (1981), Kose *et al.,* (2019) and Weber *et al.,* (2022).

Moreover, inflation is undoubtedly another essential variable which plays a significant role in the formulation of inflation expectations of economic agents. The literature review of previously investigated empirical studies on expected inflation indicates that economic agents usually consider about current inflation while making expectations about price level for the next 12-months. However, being in line with theory and literature, a positive relationship between current inflation and inflation expectations of Uzbek households and firms is not fully observed in the underlying study. The OLS regression results for both households and business entities display negative coefficients for inflation without the inclusion of perceived inflation into regression models (*Table 1 and Table 2*). More precisely, after the inclusion of perceived rate of inflation into the OLS regression model, a positive relationship is found between inflation and inflation expectations of Uzbek households and business entities. Furthermore, it was abovementioned in literature review, households basically make expectations towards general price level based on daily shopping of food products; therefore, theoretically positive association is expected. Essentially, as hypothetically positive relationship between food inflation and inflation expectations of individuals are also proved with the OLS estimates in the underlying empirical study in *Table 1.* Indeed, the inclusion of perceived inflation into regression model might cause the sign in the coefficients of inflation and food inflation to be positive in regression model 5 and model 6 in *Table 1*.

Hypothetically, growth in interest rate and tightening monetary policy regime by the Central bank (increasing the policy rate) should adversely influence on inflation expectations of economic agents, both households and firms. Essentially, empirical results in the underlying study are also in line with theoretical expectations and find a negative relationship between inflation expectations and interest rate, the CBU policy

rate. Particularly, the OLS regression results for inflation expectations of Uzbek households report statistically significant and negative relationship between short-term interest rate and expected rate of inflation in Uzbek households (*Table 1*); however, the OLS regression results for inflation expectations of Uzbek firms reveal statistically insignificant and inverse association between short-term interest rate, the CBU policy rate and expected inflations of business entities (*Table 2*).

According to empirical findings for households, one percent increase in interest rate will result in declining inflation expectations of Uzbek households by around 0.6 percent, which is statistically significant at 1 percent level. However, inclusion of perceived inflation into regression models for Uzbek households decline significance in the impact of short-term interest rate on inflation expectations. Furthermore, the CBU policy rate and short-term nominal interest rate acquire statistically insignificant impact on expected rate of inflations for business entities in Uzbekistan. The empirical findings disclose statistically insignificant and negative relationship between short-term interest rate, the CBU policy rate and inflation expectations of firms (expect from regression model 4 and model 5) which is showed in *Table 2*. All in all, empirical findings in the underlying study and conclusions on the relationship between nominal interest rate and expected inflation partially in line with empirical findings of research analyses investigated by Cerisola and Gelos (2005), Mehra and Herrington (2008), Sommer and Troëng (2009), Araujo and Gaglianone (2010).

Moreover, output growth is also known as one of the main determinants of inflation expectations. In the literature review, it was observed that higher output growth leads to higher inflation expectations. In fact, the logarithm form of real GDP is proxied for the output growth in the underlying empirical study. Particularly, being in line with theory and literature, underlying empirical study found positive and statistically insignificant impacts in output growth on inflation expectations of both households and business entities when the perceived rate of inflation was not included into regression models, illustrated in *Table 1* and *Table 2*. More specifically, holding other variables fixed, one percent increase in real GDP growth will lead inflation expectation of Uzbek households

and firms to rise by approximately 0.01 percent (the exclusion of perceived inflation into regression model). Afterwards, the inclusion of perceived rate of inflation by households and firms into OLS regression models resulted in increasing R-squares and also causes the logarithm of real GDP to become one of statistically significant control variables into regression models. Holding other variable constant, a single percent growth in real GDP will result in increasing expected rate of inflation in Uzbek households by 0.03 percent and Uzbek firms by 0.02 percent. Aforementioned empirical findings correspond and are in line with previous empirical findings investigated by Minella et al., (2008), Gaglianone (2017) and Vo et al., (2020) on nexus output growth and inflation expectation.

Finally yet importantly, the logarithm form of external debt is proxied for the fiscal stance in the underlying study and negative sign in the coefficient of external debt is predicted based on the empirical findings of previously investigated empirical research studies in literature review. Particularly, regression results for inflation expectations of households and business entities, in *Table 1* and *Table 2*, reveal that external debt acquires statistically insignificant and negative effect on inflation expectations of Uzbek households and firms. More precisely, holding other variables fixed, one percent growth in external debt will cause expected inflation of economic agents in Uzbekistan to decrease by approximately 0.01 percent which support and are in line with the findings and conclusions made by Cerisola and Gelos (2005), Gaglianone (2017) and Vo et al., (2020) on the empirical relationship between fiscal stance and inflation expectations.

Diagnostics Tests

Wald Test

The primary objective of applying Wald test (1943) in the underlying study is to examine the significance of explanatory variables into regression model. Therefore, Wald test will assist to identify overall significance and insignificance of independent variables into OLS regression models. According to the Wald test (1943), when the p-value is lower than critical value (0.05), null hypothesis will be rejected and alternative hypothesis will be accepted which underlines control variables acquire impacts on dependent variables.

Hypotheses of the Wald test:

H0: Coefficient of independent variables in regression model is zero.

H1: Coefficient of independent variables in regression model is not zero.

Wald Test results

Country	Test Statistics	Value	df	Prob>F
Households	F-statistics	40.41	(7, 52)	0.00000
Firms	F-statistics	53.44	(7, 52)	0.00000

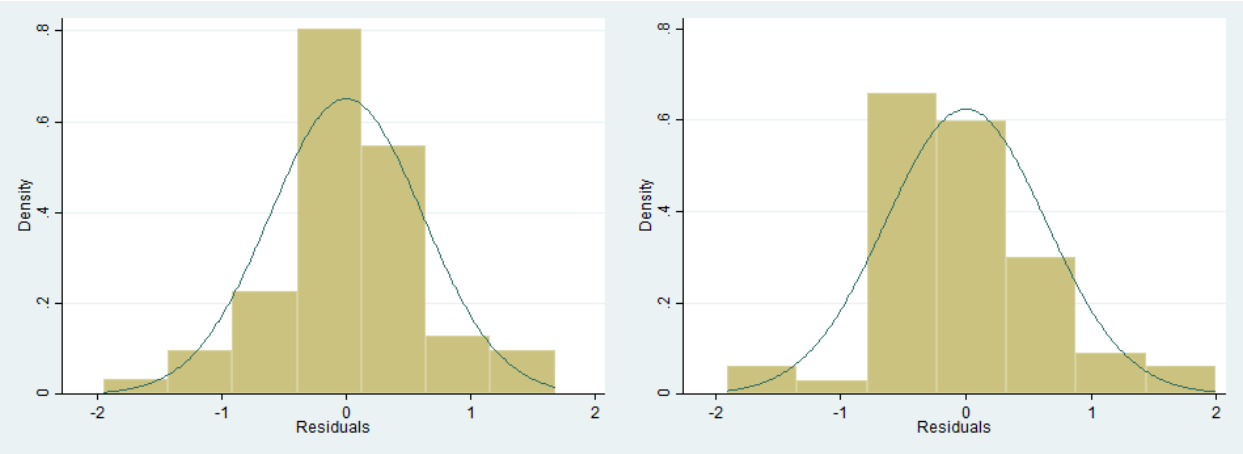
The Wald test results shows that probability of f-statistic values in both households and business entities are equal to 0.000, which leads to reject the null hypothesis (coefficients of all independent variables in regression model are zero) and accept the alternative hypothesis (coefficients of all independent variables in regression model are not zero). At the 1 percent level of significance, it has been proven that coefficients of all explanatory variables in regression models for both households and firms are not zero. Therefore, it can be concluded that all independent variables in the regression models are adding their own contributions on dependent variable.

Normality Test

Undoubtedly, normal distribution of residuals in linear regression models is considered as one of the most essential assumptions of the OLS technique. Indeed, the normality of residuals plays an important role in ensuring the validity of estimates. Particularly, histogram is known as one of the most common methods to graphically illustrate the shape of the residual's distribution.

Histogram of Residuals Distribution for Households and Firms

Households **Business Entities**



Histogram displays the distribution of the residuals in inflation expectations models for Uzbek households and business entities. As it can be illustrated in histogram, distribution of the residuals is almost bell shape in case of households and firms which indicates that residuals are normally distributed. Additionally, the Skewness/Kurtosis or Jarque-Bera test will be also applied in order to make a final decision regarding the shape of residuals' distribution in regression model. In fact, the Skewness/Kurtosis test is also known as one of commonly employed techniques to check normality in the distribution of residuals.

Hypothesis of the Skewness/Kurtosis or Jarque – Bera test:

H0: Residuals are normally distributed.

H1: Residuals are not normally distributed.

The Skewness/Kurtosis Test results:

Skewness/Kurtosis for Normality (Households)

				------ joint ------	
Variable	Obs	Pr (Skewness)	Pr (Kurtosis) adj	chi2(2)	Prob>chi2
Residuals	60	0.4809	0.0184	5.75	**0.057**

Skewness/Kurtosis for Normality (Business Entities)

				------ joint ------	
Variable	Obs	Pr (Skewness)	Pr (Kurtosis) adj	chi2(2)	Prob>chi2
Residuals	60	0.4465	0.0256	5.37	**0.068**

The results of Skewness/Kurtosis test for Uzbek households indicate that the distribution of residuals is normal because the p-value is statistically insignificant (0.057) which is higher than critical value (0.05). Since null hypothesis cannot be rejected due to the statistical insignificance of p-value, null hypothesis will be accepted which states the normal distribution in residuals. Moreover, the results of the Skewness/Kurtosis test for Uzbek firms suggest that the distribution of residuals is also normal because the p-value is statistically insignificant (0.068) which is higher than critical value (0.05). Since null hypothesis cannot be rejected because of statistical insignificant of the p-value, the null hypothesis will be accepted which means normality in the distribution of residuals.

Multicollinearity VIF Test

Multicollinearity problems exist when high correlation among independent variables into regression model is observed. Therefore, checking for multicollinearity is considered as one of important assumptions of the OLS estimations. Particularly, multicollinearity issue among explanatory variables plays an important role in ensuring the validity of estimates. In fact, variance inflation frequency (VIF) test is commonly known method to check the level of correlation among independent variables and examine whether there is multicollinearity issue or not in regression model.

The results of Variance Inflation Frequency (VIF) test indicate that multicollinearity problem is not found in variables (expect from log of RGDP and log External Debt) of the Uzbek households and business entities' inflation expectation models. Essentially, high correlation between logarithm form of real GDP and external debt in both households and firms' inflation expectations regression models is observed based on VIF test.

Variance Inflation Frequency Test Results

VIF test (Households)		
Variable	VIF	1/VIF
Households_Perceived	3.09	0.323575
Inflation	5.29	0.188994
Exchange Rate	1.76	0.567837
Administrated Prices	7.12	0.140417
Interest Rate	4.88	0.205040
Log RGDP	12.8	0.078101
Log External Debt	22.5	0.044418
Mean VIF	8.2	

VIF test (Business Entities)		
Variable	VIF	1/VIF
Business_Perceived	3.02	0.330659
Inflation	4.28	0.233768
Exchange Rate	2.66	0.375927
Administrated Prices	7.11	0.140549
Interest Rate	4.82	0.207341
Log RGDP	13.2	0.075697
Log External Debt	22.0	0.045410
Mean VIF	8.2	

Essentially, generally accepted the rule of thumb for the mean VIF is equal to 10. Therefore, when the values of VIF in variables are higher than 10, then multicollinearity problem is anticipated among variables in regression model. Particularly, the mean VIF value for both households and business entities in VIF test were 8.2 which is lower than 10; therefore, it could be concluded that there is not multicollinearity issue in regression models. However, the value of VIF in logarithm of real GDP and external debt is higher than 10 in case of both households and firms. Thus, high correlation between logarithm of real GDP and external debt is expected.

Heteroscedasticity Test

Heteroscedasticity test is primarily employed to investigate the variance of residuals. Particularly, the Breusch-Pegan test is commonly known test to examine the variance of residuals. In fact, the variance of residuals to be heteroscedastic or homoscedastic will be identified through the p-value in the Breusch-Pegan test. More precisely, heteroscedastic residuals in regression model are differently scattered, whereas homoscedastic residuals are constantly scattered.

Hypotheses of the Breusch-Pegan test:

H0: Variance of residuals in regression model is homoscedastic.

H1: Variance of residuals in regression model is heteroscedastic.

Breusch-Pegan Test Result (Households)

Households
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of hh_exp
chi2(1) = 6.52
Prob > chi2 = 0.0107

Breusch-Pegan Test Result (Business Entities)

Business Entities
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of hh_exp
chi2(1) = 0.34
Prob > chi2 = 0.5603

When the p-value is higher than 0.05 (statistically insignificant), then null hypothesis will be accepted which underline that the variance of residuals in regression model will be homoscedastic. However, when the p-value is lower than 0.05 (statistically significant),

null hypothesis will be rejected and alternative hypothesis will be accepted which defines that the variance of residuals in regression model will be heteroscedastic.

Aforementioned tables display results for Breusch-Pegan test for households and firms. According to Breusch-Pegan test for households, the results of test indicate that p-values equals to **0.0107** which is lower than critical value (0.05), which underlines the rejection of null hypothesis and the acceptance of alternative hypothesis (variance of residuals are heteroscedastic). Furthermore, the results of Breusch-Pegan test for legal entities report that p-value is equal to **0.5603** which is higher than critical value (0.05), which means the acceptance of null hypothesis (variance of residuals are homoscedastic).

Stationary Test

Before employing the Autoregressive Distributed Lag technique, checking for the stationary is required in order to verify the existence of unit root in dataset; therefore, the Augmented Dickey-Fuller and Phillips-Perron tests are applied to determine the order of integration.

Table 3. Augmented Dickey-Fuller and Phillips-Perron Unit Root Tests

Unit Root Testing at level

Variables	***Augmented Dickey-Fuller***	***Phillips-Perron***
Inflation Expectations (Households)	-5.037***	-4.975***
Inflation Expectations (Firms)	-3.299**	-3.386**
Perceived_Inflation (Households)	-4.120***	-4.111***
Perceived_Inflation (Firms)	-4.488***	-4.487***
Inflation	-2.546	-2.540
Exchange_Rate	-2.050	-2.489
Regulated_Prices	-1.567	-1.648
Interest Rate	-2.208	-2.261
Log_RGDP	-0.975	-1.100

Symbols "", "**", "***" denotes the significance level at 10%, 5% and 1% levels, respectively.*

In fact, results of the ADF a Phillips-Perron tests report that there are only four variables which are stationary at the level, namely perceived inflation of households, expected inflation of households, perceived inflation of business entities and expected inflation of business entities. However, all variables into regression model are found to be stationary at first difference.

Trough applying the ADF and Phillips-Perron tests, the level of integration in dataset is analyzed. In fact, the results of abovementioned tests indicate that all variables into regression model are stationary at first difference level. Particularly, when the variables are stationary at first difference level and the existence of cointegration is found, then the ARDL with Error Correction Model (ECM) can be derived. Initially, all variables are stationary at first difference level in regression analyses; secondly, cointegration (long-run relationship) between dependent and independent variables is found based on Bound test. Consequently, the ARDL with Error Correction Model will be applied in further analyses.

Table 4. Augmented Dickey-Fuller and Phillips-Perron Unit Root Tests

Unit Root Testing at first difference		
Variables	***Augmented Dickey-Fuller***	***Phillips-Perron***
Inflation Expectations (Households)	-9.913***	-10.105***
Inflation Expectations (Firms)	-8.438***	-8.461***
Perceived_Inflation (Households)	-8.526***	-8.591***
Perceived_Inflation (Firms)	-8.583***	-8.722***
Inflation	-6.937***	-6.926***
Exchange_Rate	-4.323***	-4.327***
Regulated_Prices	-8.718***	-8.659***
Interest Rate	-9.618***	-9.403***
Log_RGDP	-4.723***	-4.657***

Symbols "", "**", "***" denote the significance level at 10%, 5% and 1% levels, respectively.*

ARDL model for Households' Inflation Expectations (Equation - 3)

$$(hh\_exp)_t = \alpha + \beta\,(hh\_sensed)_t + \chi\,(inf)_t + \delta\,(exch\_rate)_t + \phi\,(reg\_price)_t + \gamma(interest\_rate)_t + \omega\,(LogRGDP)_t + \varepsilon_t$$

Error Correction Model for the ARDL model for Households' Inflation Expectations (Equation - 4)

$$\Delta(hh\_exp)_t = \alpha_0 + \sum_{i=1}^{p} \beta_i\,\Delta(hh\_exp)_{t-i} + \sum_{i=1}^{p} \gamma_i\,\Delta(hh\_sensed)_{t-i} + \sum_{i=1}^{p} \delta_i\,\Delta(inf)_{t-i} + \sum_{i=1}^{p} \theta_i\,\Delta(exchrate)_{t-i} + \sum_{i=1}^{p} \varphi_i\,\Delta(reg\_prices)_{t-i} + \sum_{i=1}^{p} \omega_i\,\Delta(interest\_rate)_{t-i} + \sum_{i=1}^{p} \tau_i\,\Delta(LogRGDP)_{t-i} + \lambda_1(hh\_exp)_{t-1} + \lambda_2(hh\_sensed)_{t-1} + \lambda_3(inf)_{t-1} + \lambda_4(exch\_rate)_{t-1} + \lambda_5(reg\_prices)_{t-1} + \lambda_6(interest\_rate)_{t-1} + \lambda_7(LogRGDP)_{t-1} + \mu_t$$

Where,

hh_exp – inflation expectations of households for the next 12-months.

hh_sensed – perceived inflation of households for the past 12-months.

inf – inflation (computed based on Consumer Price Indices).

exch_rate – nominal exchange rate (US dollar to Uzbek sum).

reg_price – price growth for goods and services which are monitored and administrated by government.

interest-rate – short-term nominal interest rate (interest rate of loans up to 90 days).

logRGDP – logarithm form of real Gross Domestic Products.

$\beta - \omega$ – coefficients of control variables in ARDL model (Equation - 3).

$\beta_i - \omega_i$ – represents short-run dynamics of the model (Equation - 4).

$\lambda_1 - \lambda_7$ – represents long-run relationship (Equation - 4).

ARDL model for Firms' Inflation Expectations (Equation - 5)

$$(bs\_exp)_t = \alpha + \beta(bs\_sensed)_t + \chi(inf)_t + \delta(exch\_rate)_t + \phi(reg\_price)_t + \gamma(cbu\_policyrate)_t + \omega(LogRGDP)_t + \varepsilon_t$$

Error Correction Model for the ARDL model for Firms' Inflation Expectations (Equation -6)

$$\Delta(bs\_exp)_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta(bs\_exp)_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta(bs\_sensed)_{t-i} + \sum_{i=1}^{p} \delta_i \Delta(inf)_{t-i} + \sum_{i=1}^{p} \theta_i \Delta(exchrate)_{t-i} + \sum_{i=1}^{p} \varphi_i \Delta(reg\_price)_{t-i} + \sum_{i=1}^{p} \omega_i \Delta(cbu\_policyrate)_{t-i} + \sum_{i=1}^{p} \tau_i \Delta(LogRGDP)_{t-i} + \lambda_1(bs\_exp)_{t-1} + \lambda_2(bs\_sensed)_{t-1} + \lambda_3(inf)_{t-1} + \lambda_4(exchrate)_{t-1} + \lambda_5(reg\_prices)_{t-1} + \lambda_6(cbu\_policyrate)_{t-1} + \lambda_7(LogRGDP)_{t-1} + \mu_t$$

Where,

bs_exp – inflation expectations of households for the next 12-months.

bs_sensed – perceived inflation of households for the past 12-months.

inf – inflation (computed based on Consumer Price Indices).

exch_rate – nominal exchange rate (US dollar to Uzbek sum).

reg_price – price growth for goods and services which are monitored and administrated by government.

cbu_policyrate – the policy rate of Central bank of Uzbekistan.

logRGDP – logarithm form of real Gross Domestic Products.

$\beta - \omega$ – coefficients of control variables in ARDL model (Equation - 5).

$\beta_i - \omega_i$ – represents short-run dynamics of the model (Equation - 6).

$\lambda_1 - \lambda_7$ – represents long-run relationship (Equation - 6).

Table 5. Autoregressive Distributed Lag (ARDL) Results

Households			
Variables	*Coefficient*	*T-statistics*	*P-values*
hh_exp_{t-1}	-0.1556*	-1.78	0.083
hh_{sensed_t}	0.6652***	10.38	0.000
inf_t	0.1463*	2.01	0.051
reg_{price_t}	0.1560***	3.15	0.003
$reg_{price_{t-2}}$	0.1227***	3.29	0.002
$exch_{rate_t}$	0.1078**	2.50	0.017
$exch_{rate_{t-1}}$	0.1499**	2.28	0.028
$interest_{rate_t}$	-0.2761**	-2.48	0.017
$logRGDP_{t-1}$	2.294	1.68	0.101
Business Entities			
Variables	*Coefficient*	*T-statistics*	*P-values*
bs_exp_{t-1}	0.2761**	2.13	0.039
hh_{sensed_t}	0.6579***	10.6	0.000
$hh_{sensed_{t-1}}$	-0.2592**	-2.63	0.012
inf_t	0.1112	1.47	0.148
reg_{price_t}	0.0692**	2.24	0.030
$exch_{rate_t}$	0.0904***	4.06	0.000
$cbu_{policyrate_t}$	0.0214	0.23	0.821
$logRGDP_t$	-1.6571	-1.45	0.153
$logRGDP_{t-1}$	2.1275*	1.75	0.087

Table 6. Autoregressive Distributed Lag with Error Correction Model Results (Households)

Panel A. Short-run Estimates			
Variables	***Coefficient***	***T-statistics***	***P-values***
Δhh_exp_t	0.2271**	2.44	0.019
$d.reg_{price_t}$	-0.0907**	-2.05	0.047
$\Delta reg_{price_{t-1}}$	-0.1228***	-3.29	0.002
$d.exch_{rate_t}$	-0.0323	-0.68	0.503
$\Delta exch_{rate_{t-1}}$	0.1175***	2.80	0.008
$d.interest_{rate_t}$	0.2007	1.65	0.107
$\Delta interest_{rate_{t-1}}$	0.1465	1.42	0.163
$d.logRGDP_t$	-2.2940	-1.68	0.101
Panel A. Long-run Estimates			
Variables	***Coefficient***	***T-statistics***	***P-values***
hh_{sensed_t}	0.4811***	9.89	0.000
inf_t	0.1058**	2.11	0.041
reg_{price_t}	0.1785***	6.72	0.000
$exch_{rate_t}$	0.1013***	6.93	000
$interest_{rate_t}$	-0.3449***	-4.89	0.000
$logRGDP_t$	1.4632***	5.04	0.000

The symbols "", "**" and "***" denotes the significance level at 10%, 5% and 1% levels, in respectively.*

Table 7. Autoregressive Distributed Lag with Error Correction Model Results (Firms)

Panel A. Short-run Estimates			
Variables	***Coefficient***	***T-statistics***	***P-values***
$d.bs\_exp_t$	0.1227	1.26	0.213
$d.logRGDP_t$	-3.3896**	-2.60	0.012
Panel A. Long-run Estimates			
Variables	***Coefficient***	***T-statistics***	***P-values***
bs_{sensed_t}	0.6114***	8.95	0.000
inf_t	0.2702***	4.20	0.000
reg_{price_t}	0.1392***	5.34	0.000
$exch_{rate_t}$	0.1196***	6.55	0.000
$cbu\_policyrate_t$	-0.0826	-0.71	0.479
$logRGDP_t$	1.2191**	2.32	0.024

The symbols "", "**" and "***" denotes the significance level at 10%, 5% and 1% levels, in respectively.*

Table 8. ARDL Bound Test for Cointegration

Dependent Variable	*F-statistics*	*K*	*Lower bound (99%)*	*Upper-bound (99%)*	*Conclusion*
hh_exp (households)	33.756	6	3.15	4.43	*Cointegration*
bs_exp (firms)	7.916	6	3.15	4.43	*Cointegration*

ARDL Results (Households)

Finding the optimal and appropriate lag length in VAR modeling is essential. In fact, optimal number of lags for variables in ARDL models can be selected through lag length selection criteria. Particularly, Akaike Information Criterion (AIC) is known as the most commonly applied selection criteria for choosing optimal lag length. Moreover, Schwartz Bayesian criterion (SBC) and Hannan Quinn criterion (HQC) are also famous selection criteria for finding optimal lag lengths. The lag length (2, 0, 0, 2, 2, 2, 1) for ARDL model in inflation expectations of households is selected as optimal lag length based on the AIC criteria and the main findings of ARDL for households' inflation expectations are showed in *Table 5*.

Breusch-Godfrey LM Test for Autocorrelation (Households)

Lags (p)	*Chi2*	*Df*	*Prob>chi2*
4	*7.032*	*4*	*0.1342*

White Test for Heteroskedasticity (Households)

White's Test Hypotheses	*Ho: homoskedasticity*
	Ha: heteroskedasticity
	Chi2 (54) = 58.00
	Prob > chi2 = 0.4382

Durbin-Watson for Autocorrelation (Households)

Durbin-Watson d-statistics (16, 58) = 1.842036

Additionally, the Bound test for ARDL models, showed in *Table 8*, is conducted to examine cointegration among dependent and independent variables. The findings of Bound test indicate that there is a cointegration at 1 percent significance level between inflation expectations of households and its determinants since the F-statistics (33.8) is higher than value of upper bound (4.4). Consequently, the existence of the long run

relationship is statistically proved; therefore, it is decided to apply the Error Correction Model to analyze the short-run and long-run relationship between inflation expectations of households and its determinants in Uzbekistan.

According to the results of ARDL with ECM, the adjustment coefficient is equal to negative 1.37. Moreover, the R-squares equals to 0.91 which emphasizes that 91 percent variation in households' expected inflation can be explained by the movements in explanatory variables in short-run and long-run. Particularly, several diagnostic tests are also applied in order to check the robustness of results. Initially, Durbin-Watson and Breusch-Godfrey LM test are applied to check autocorrelation. No serial correlations are not found since null hypothesis (no autocorrelation) cannot be rejected due to the Durbin-Watson d-statistics (1.84) is larger compared with critical value (0.05). Furthermore, the results of White test reveal that the probability of Chi2 (0.134) is higher than critical value (0.05); therefore, the null hypothesis cannot be rejected and concluded that variance of errors in regression model is homoscedastic.

Summarizing main findings of the ARDL tests for households, a positive association is observed among inflation expectations of households and exchange rate, regulated prices, perceived rate of inflation, output growth (proxied by the log of RGDP) and CBU policy rate in long run; however, a negative impact of inflation on expected inflation of households is found in *Table 6*. The findings for long-run estimates are statistically significant expect from the CBU policy rate. Turning to short-run, positive relationships between past values of interest rate, exchange rate, expected inflation and expected inflation is identified based on the ARDL with ECM in *Table 6*. However, only estimates for the past values of exchange rate, regulated prices and inflation expectations are found to be statistically significant.

ARDL for (Business Entities)

Similar to households, Akaike Information Criterion (AIC) selection criteria is applied to ARDL model for expected inflation of business entities to choose optimal lag length. In fact, AIC selection criteria suggested that the ARDL (1, 1, 0, 0, 0, 0, 1) model for inflation expectations of business entities is found as optimal lag length and the main findings of ARDL for inflation expectations of firms were reported in *Table 5*.

Additionally, the ARDL Bound test, showed in *Table 8*, is also implemented to identify cointegration, the long run relationship, among exogenous and endogenous variables in ARDL model. Particularly, the findings of Bound test disclose a cointegration at 1 percent significance level between inflation expectations of firms and its determinants since the F-statistics (7.916) is higher than value of upper bound (4.43). As a result, the existence of the long run relationship, cointegration, is statistically proved; therefore, it is decided to apply the Error Correction Model to investigate the short-run and long-run relationship between inflation expectations of business entities and its determinants in Uzbekistan.

Breusch-Godfrey LM Test for Autocorrelation (Firms)

Lags (p)	*Chi2*	*Df*	*Prob>chi2*
4	*4.397*	*4*	*0.355*

White Test for Heteroskedasticity (Firms)

White's Test Hypotheses	*Ho: homoskedasticity*
	Ha: heteroskedasticity
	Chi2 (54) = 58.09
	Prob > chi2 = 0.3271

Durbin-Watson for Autocorrelation (Firms)

Durbin-Watson d-statistics (10, 59) = 1.692114

In fact, the results of the ARDL with ECM indicate that the adjustment coefficient equals to negative 0.93. Additionally, the R-squares is equal to 0.78 which means 78 percent of

variation in inflation expectations of business entities can be explained by independent variables in model in short-run and long-run.

Numerous diagnostics tests are employed to examine the robustness of aforementioned results. Particularly, the Durbin-Watson and Breusch-Godfrey LM test are implemented in order to check the presence of autocorrelation in error terms; serial correlation is not identified in empirical findings since null hypothesis cannot be rejected due to d-statistics (1.69) is higher compared with critical value (0.05). Afterwards, White test is applied in order to identify whether the variance of residuals is constant or not. Based on the result of White test, it is concluded that the variance of residuals is homoscedastic (constant) because null hypothesis cannot be rejected due to the probability of chi2 (0.327) is larger than critical value (0.05).

Summarizing empirical findings of ARDL with ECM, in short run, statistically significant and negative relationship is observed between expected inflation of firms and logarithm form of real GDP whereas, a positive association is found among inflation expectation and past values of inflation expectations in *Table 7*. Moreover, the perceived inflation, regulated prices, exchange rate, output growth and CBU policy rate acquire statistically significant (*expect from CBU policy rate*) and positive effects on inflation expectations of business entities in long run whereas, inflation possesses statistically significant and negative impact on expected inflation of Uzbek firms in *Table 7*.

Vector Autoregressive Models for Households (Equation - 7)

$$(hs\_exp)_t = \alpha_1 + \sum_{i=1}^{k} \beta_{1i}(hs\_exp)_{t-k} + \sum_{i=1}^{k} \beta_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \beta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \beta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \beta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \beta_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \beta_{7i}(logRGDP)_{t-i} + \varepsilon_{1t}$$

$$(hs\_sensed)_t = \alpha_2 + \sum_{i=1}^{k} \delta_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \delta_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \delta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \delta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \delta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \delta_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \delta_{7i}(logRGDP)_{t-i} + \varepsilon_{2t}$$

$$(inf)_t = \alpha_3 + \sum_{i=1}^{k} \gamma_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \gamma_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \gamma_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \gamma_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \gamma_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \gamma_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \gamma_{7i}(logRGDP)_{t-i} + \varepsilon_{3t}$$

$$(exchrate)_t = \alpha_4 + \sum_{i=1}^{k} \lambda_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \lambda_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \lambda_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \lambda_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \lambda_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \lambda_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \lambda_{7i}(logRGDP)_{t-i} + \varepsilon_{4t}$$

$$(reg\_prices)_t = \alpha_5 + \sum_{i=1}^{k} \pi_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \pi_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \pi_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \pi_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \pi_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \pi_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \pi_{7i}(logRGDP)_{t-i} + \varepsilon_{5t}$$

$$(interest\_rate)_t = \alpha_6 + \sum_{i=1}^{k} \theta_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \theta_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \theta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \theta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \theta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \theta_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \theta_{7i}(logRGDP)_{t-i} + \varepsilon_{6t}$$

$$(logRGDP)_t = \alpha_7 + \sum_{i=1}^{k} \omega_{1i}(hs\_exp)_{t-i} + \sum_{i=1}^{k} \omega_{2i}(hs\_sensed)_{t-i} \sum_{i=1}^{k} \omega_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \omega_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \omega_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \omega_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \omega_{7i}(logRGDP)_{t-i} + \varepsilon_{7t}$$

Vector Autoregressive Models for Business Entities (Equation - 8)

$$(bs\_exp)_t = \alpha_1 + \sum_{i=1}^{k} \beta_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \beta_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \beta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \beta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \beta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \beta_{6i}(cbu\_policyrate)_{t-i} + \sum_{i=1}^{k} \beta_{7i}(logRGDP)_{t-i} + \varepsilon_{1t}$$

$$(bs\_sensed)_t = \alpha_2 + \sum_{i=1}^{k} \delta_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \delta_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \delta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \delta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \delta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \delta_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \delta_{7i}(logRGDP)_{t-i} + \varepsilon_{2t}$$

$$(inf)_t = \alpha_3 + \sum_{i=1}^{k} \gamma_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \gamma_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \gamma_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \gamma_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \gamma_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \gamma_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \gamma_{7i}(logRGDP)_{t-i} + \varepsilon_{3t}$$

$$(exchrate)_t = \alpha_4 + \sum_{i=1}^{k} \lambda_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \lambda_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \lambda_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \lambda_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \lambda_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \lambda_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \lambda_{7i}(logRGDP)_{t-i} + \varepsilon_{4t}$$

$$(reg\_prices)_t = \alpha_5 + \sum_{i=1}^{k} \pi_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \pi_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \pi_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \pi_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \pi_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \pi_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \pi_{7i}(logRGDP)_{t-i} + \varepsilon_{5t}$$

$$(interest\_rate)_t = \alpha_6 + \sum_{i=1}^{k} \theta_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \theta_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \theta_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \theta_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \theta_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \theta_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \theta_{7i}(logRGDP)_{t-i} + \varepsilon_{6t}$$

$$(logRGDP)_t = \alpha_7 + \sum_{i=1}^{k} \omega_{1i}(bs\_exp)_{t-i} + \sum_{i=1}^{k} \omega_{2i}(bs\_sensed)_{t-i} \sum_{i=1}^{k} \omega_{3i}(inf)_{t-i} + \sum_{i=1}^{k} \omega_{4i}(exchrate)_{t-i} + \sum_{i=1}^{k} \omega_{5i}(reg\_prices)_{t-i} + \sum_{i=1}^{k} \omega_{6i}(interest\_rate)_{t-i} + \sum_{i=1}^{k} \omega_{7i}(logRGDP)_{t-i} + \varepsilon_{7t}$$

The empirical results of Vector Autoregressive (VAR) models for Uzbek households and firms are attached into Appendix 1. Particularly, four lags are found to be the optimal lag lengths for VAR models which is suggested by the AIC selection criteria for choosing optimal lag lengths. Commencing with VAR results for households, the VAR estimates indicate robust results with large R-squares and significant F-statistics. Particularly, the R-squares are equal to 0.71 for inflation expectations, 0.78 for perceived inflation, 0.95 for actual inflation, 0.94 for regulated prices, 0.96 for exchange rate, 0.91 for interest rate and 0.98 for output growth (logRGDP). The Lagrange – Multiplier (LM) test also indicates no autocorrelation in residuals among all lags. Furthermore, the Jarque-Bera test shows that there is no problems with normality in any equations, expect from the equation for output growth which is proxied by the logarithm of RGDP.

Lagrange - Multiplier Test (Households)

Lags	*Chi2*	*Df*	*Prob>chi2*
1	59.1117	49	0.1527
2	49.5966	49	0.4493
3	38.2305	49	0.8667
4	49.1878	49	0.4656

Jarque - Bera Test (Households)

Equation	*Chi2*	*Df*	*Prob>chi2*
hh_exp	2.522	2	0.2834
hh_sensed	0.639	2	0.7266
inf_yoy	2.413	2	0.2992
reg_prices	0.190	2	0.9093
exch_Rate	0.442	2	0.8016
interest_rate	1.970	2	0.3734
logRGDP	9.617	2	0.0082
ALL	17.793	14	0.2164

Moreover, the stability test reveals that the VAR satisfies the stability conditions (stability test results are attached into Appendix 3). Finally, the Granger Causality test is also applied in order to examine whether the lagged values of independent variables help to predict dependent variable (inflation expectations) in the model or not. The results of Granger causality test emphasize that inflation, regulated prices, exchange rate as well as interest rates have acquired Granger impacts on inflation expectations of households whereas, the Granger causes in output growth (proxied by logRGDP) and perceived inflations on expected inflations of households are not found.

Hypotheses of the Wald test:

Ho: Independent does not Granger Cause on inflation expectations.

Ha: Independent variable Granger causes on inflation expectations.

Granger Causality Walt Tests (Households)

Equation	Excluded	*Chi2*	*Df*	*Prob>chi2*
hh_exp	hh_sensed	6.1271	4	0.190
hh_exp	inf_yoy	32.98	4	0.000
hh_exp	reg_prices	12.707	4	0.013
hh_exp	exch_rate	24.286	4	0.000
hh_exp	interest_rate	19.818	4	0.001
hh_exp	logRGDP	4.8389	4	0.304
hh_exp	ALL	86.178	24	0.000

Turning to VAR estimates for business entities, the VAR estimates reveal the robust results with large R-squares and significant F-statistics. Particularly, the R-squares equal to 0.89 for inflation expectations, 0.78 for perceived inflation, 0.94 for actual inflation, 0.94 for regulated prices, 0.96 for exchange rate, 0.91 for short-term interest rate and 0.98 for output growth (logRGDP). Essentially, the Lagrange – Multiplier (LM) test indicates that there is no autocorrelation problem in residuals among all lags of models. Additionally, the Jarque-Bera test reveals that the normality assumption is not satisfied for overall VAR models, despite the residuals in equations for inflation expectations, actual inflation,

regulated prices, exchange rate and short-term interest rates are normally distributed; however, residuals in equations for perceived inflation and output growth which is proxied by the logarithm of RGDP are not normally distributed.

Lagrange - Multiplier Test (Firms)

Lags	*Chi2*	*Df*	*Prob>chi2*
1	57.4343	49	0.19106
2	53.3169	49	0.31178
3	60.5836	49	0.12404
4	49.4889	49	0.45360

Jarque - Bera Test (Firms)

Equation	*Chi2*	*Df*	*Prob>chi2*
bs_exp	0.980	2	0.6127
bs_sensed	19.956	2	0.00005
inf_yoy	1.965	2	0.3743
reg_prices	0.277	2	0.8709
exch_Rate	0.549	2	0.7601
interest_rate	0.229	2	0.8919
logRGDP	8.583	2	0.0137
ALL	32.538	14	0.0034

Furthermore, the stability test is also applied and the results of stability test suggest that the VAR estimates satisfies the stability conditions (results of stability test are attached into Appendix 4). Finally, the Granger Causality test is also employed in order to investigate whether the lagged values of selected variables assist to predict dependent variable (inflation expectations) in the model or not. The results of Granger causality test emphasize that perceived rate of inflation, inflation, regulated prices, exchange rate and output growth (proxied by the logRGDP) have Granger causes on inflation expectations of business entities; however, the short-term interest rates does not possess the Granger causes on expected inflations of firms.

Granger Causality Walt Tests (Households)

Equation	Excluded	*Chi2*	*Df*	*Prob>chi2*
bs_exp	bs_sensed	13.837	4	0.008
bs_exp	inf_yoy	37.584	4	0.000
bs_exp	reg_prices	12.859	4	0.012
bs_exp	exch_rate	36.276	4	0.000
bs_exp	interest_rate	6.655	4	0.155
bs_exp	logRGDP	16.046	4	0.003
bs_exp	ALL	122.07	24	0.000

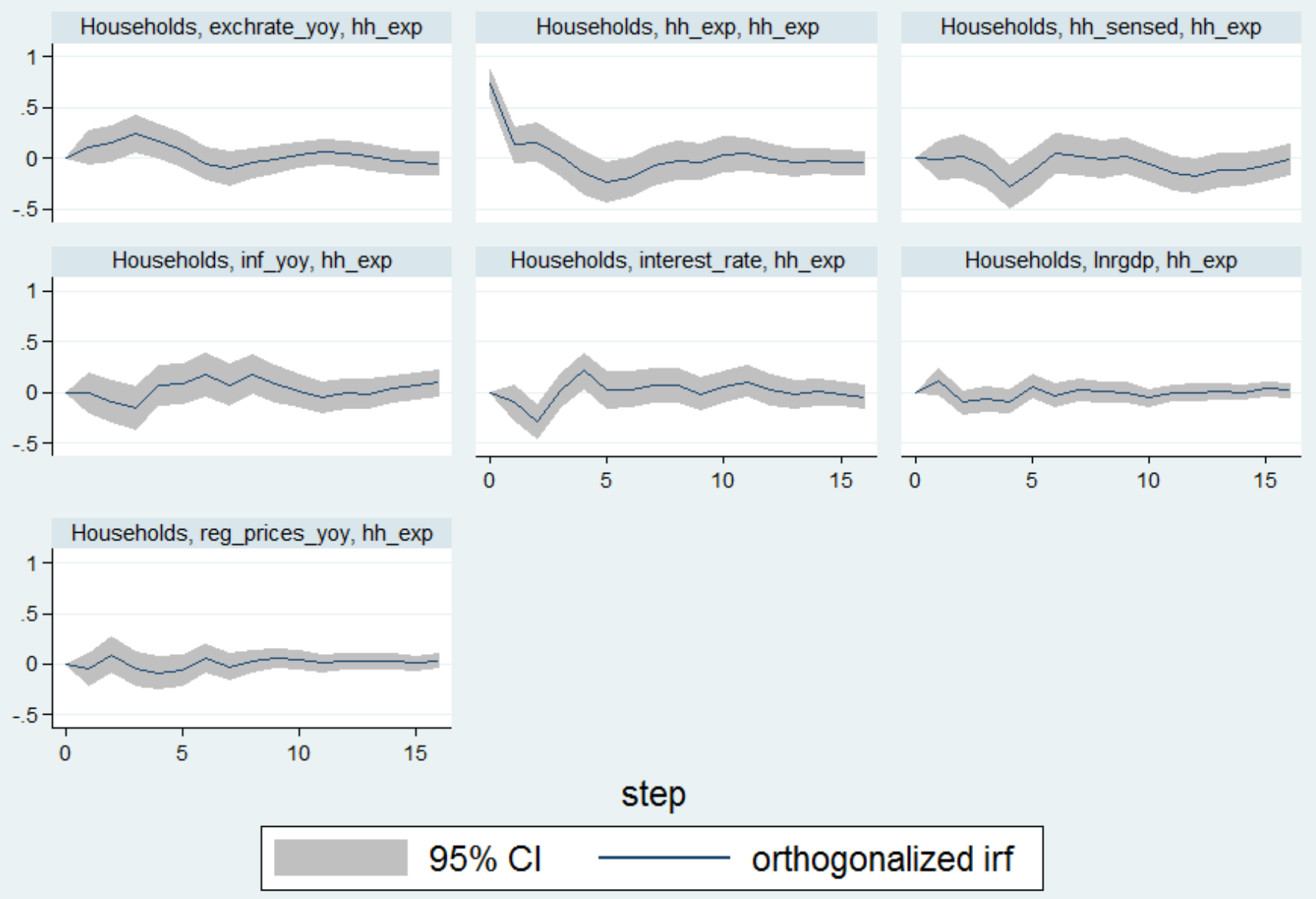
Impulse Response Functions (Households)

The main findings of Impulse Response Analysis for inflation expectations of Uzbek households are reported in *Graph 5*. Through applying impulse response analyses, the responsiveness of households' inflation expectations to the shocks from exchange rate, regulated prices, inflation, interest rate, perceived inflation and output growth (proxied by logRGDP) are analyzed.

Particularly, one standard deviation shock to exchange rate leads inflation expectations of households to increase by 0.25 standard deviation during the first three months. Afterwards, the effect of unexpected shock started to decrease and declined to negative 0.1 standard deviation in the seventh month and the impulse response function further converged into zero in the sixteenth month.

Furthermore, one standard deviation shock to inflation expectations causes Uzbek households' inflation expectations of households to decrease from 0.7 standard deviation to negative 0.1 standard deviation within the first five months. However, the impacts of shock increased until the tenth month and further converged into zero in the thirteenth month after the shock. Also, one standard deviation increase in perceived inflation of households leads expected inflation to decline to negative 0.25 standard deviation in the fourth month; afterwards, the impulse response function converged into zero.

Graph 5. Results of Impulse Response Analysis for Households' Inflation Expectations



Turning into administrated prices, one standard deviation shock to regulated prices will cause inflation expectation of Uzbek households to increase by 0.1 standard deviation in the second month; afterwards, the impulse response function converged to zero in the tenth month after the shock since the effects of shock disappeared eventually.

Moreover, one standard deviation positive shock to inflation leads inflation expectations to decline to negative 0.15 standard deviation within the first three months whereas, the impacts of shock increase to 0.2 standard deviation in the eighth month and the impulse response function converged into zero because the effects of shock eventually disappear.

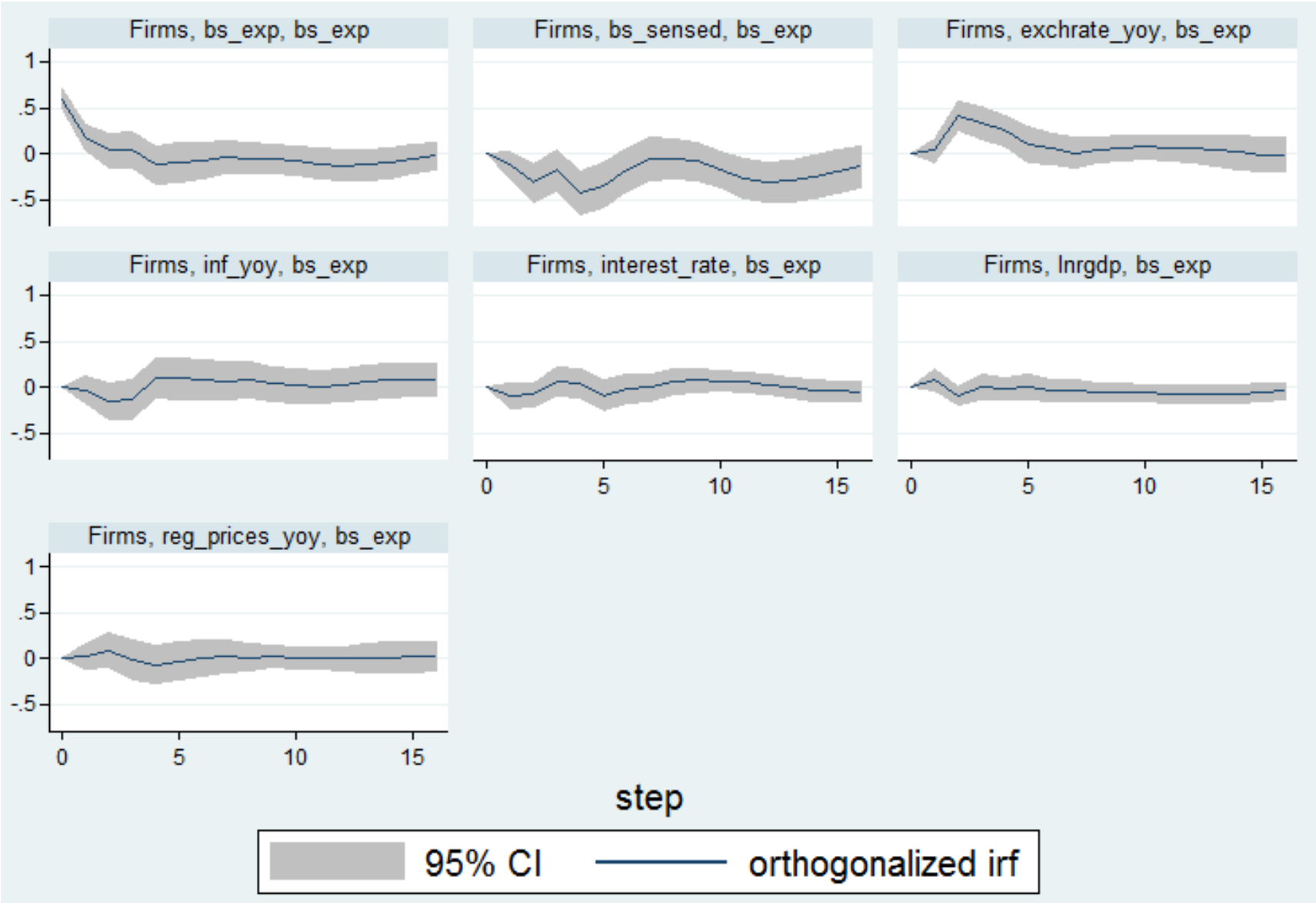
Finally, one standard deviation shock to interest rate leads expected inflation to decrease by 0.3 standard deviation during the first two months but the effects of shock increase significantly to 0.2 standard deviation in the fourth month from negative 0.3 standard deviation in the second month. Afterwards, the impacts of shock eventually disappeared and the impulse response function converged into zero after the fifth month.

Impulse Response Analysis for Business Entities

The main findings of Impulse Response Analysis for inflation expectations of Uzbek business entities are illustrated in *Graph 6*. The principal reason for applying impulse response analyses is to investigate the elasticity of firms' inflation expectations to shocks from exchange rate, regulated prices, inflation, interest rate, perceived rate of inflation and output growth.

Commencing with the shock to exchange rate, one standard deviation shock to exchange rate caused inflation expectations of Uzbek business entities to increase by 0.4 standard deviation within the first two months; however, the effects of shock gradually declined and the impulse response function converged into zero in the sixth month. Additionally, similar to households, one standard shock to inflation expectations leads inflation expectations of firms to decrease to negative 0.1 standard deviation in the fourth months from 0.6 standard deviation in the first month. Afterwards, the impacts of shock gradually increased and converged into zero in the seventh months.

Graph 6. Results of Impulse Response Analysis for Firms' Inflation Expectations



Turning to administrated prices, one standard deviation positive shock to regulated prices causes inflation expectations of firms to increase by 0.1 standard deviation during the first two months after the shock. However, the effects of shock started declining after the second month and reach to zero level in the sixth month; therefore, the impulse response function converged into zero after the sixth period.

Moreover, one standard deviation increase in inflation due to shock leads to decrease inflation expectations by 0.2 standard deviation during the first three months after the shock. Afterwards, the impacts of shock increased considerably to 0.1 standard deviation in the fourth month. However, the effects of shock gradually declined and converged into zero after one year from the shock.

Furthermore, one standard deviation positive shock to output growth (proxied by the logRGDP) leads inflation expectations of Uzbek firms to increase by 0.5 standard deviation in the first month after the shock. Afterwards, the effects of shock declined gradually and disappear eventually; therefore, impulse response function converges to zero in the third month.

Conclusion

Undoubtedly, inflation expectations play an important role in conducting effective monetary policy by monetary authorities such as the Central banks. Essentially, modern economic theory emphasizes that inflation expectations is an essential determinant in the formulation of current inflation because households and firms, definitely consider the expected rate of inflation for future period while making economic decisions. Thus, the Central banks have to anchor the long-term inflation expectations of economic agents to achieve stable and low inflation in economy. Essentially, there are typically two principal measures to gauge inflation expectations of households and business entities, specifically, survey-based and market-based measures.

The inflation expectations of Uzbek households and firms which is collected by the Central bank of Uzbekistan through conducting monthly surveys with individuals and business entities among regions in Uzbekistan. Particularly, almost 50 percent of participants from both households and firms indicate changes in exchange rate and energy resources as the largest factors in the formulation of 12-month ahead inflation expectations. Considering the aforementioned statement, the main purpose of thesis is to empirically investigate whether exchange rate and energy resources have statistically significant impacts on inflation expectation or not.

Additionally, the primary objectives of thesis is to empirically investigate the impact of changes in exchange rate, regulated prices of goods and services by government, and selected macroeconomic variables on volatilities of Uzbek households and firms' inflation expectations through applying the OLS method to examine the significance of coefficients in regression model, employing the ARDL technique to investigate the short-run and long-run relationship between inflation expectations of economic agents and selected macroeconomic variables, implementing the impulse response analyses based on VAR models in order to examine the elasticity of inflation expectations to shocks from exchange rate, administrated prices as well as selected macroeconomic variables with using monthly data throughout the period from January 2018 until December 2022. Particularly, in empirical analyses, survey-based inflation expectations of households

and firms are applied as dependent variables whereas, exchange rate, regulated prices, inflation (cpi), perceived inflation (survey-based), short-term interest rate, logarithm of real gross domestic product are utilized as primary independent variables.

Summarizing the main findings from empirical analyses, commencing with the OLS estimations, perceived inflation, exchange rate, inflation and regulated prices acquire statistically significant and positive impact on expected inflation of households and legal entities in Uzbekistan which correspond and are in line with the findings of previously investigated empirical research analyses. Furthermore, the OLS estimates suggest that short-term nominal interest rates and the logarithm form of external debt possess negative and statistically insignificant impact on inflation expectations in Uzbekistan.

Moreover, the Augmented Dickey-Fuller and Phillips-Perron tests are applied to determine the order of integration in variables. Particularly, the ADF and PP tests indicate that several variables are stationary at the level; however, all variables are stationary at the first difference level. In addition, existence of cointegration, the long-run relationship between inflation expectations and selected macroeconomic variables is proved by the results of the Bound test results. More specifically, statistically significant and positive relationship between inflation expectations and perceived inflation, exchange rate, regulated prices, inflation and inflation expectations is identified whereas, statistically insignificant and negative impact in interest rate and the Central bank policy rate on expected inflation is found.

Finally, the underlying study investigates the impulse response analyses based on VAR models to analyze the responsiveness of inflation expectations to shocks from inflation expectations itself, exchange rate, administered prices, inflation, perceived inflation, interest rates and output growth (proxied by the logRGDP). Essentially, the empirical findings underline that the impacts of inflation expectations, exchange rate, inflation, perceived inflation shocks last longer on inflation expectations of Uzbek households whereas, the effects of output growth, administrated prices and interest rates on expected inflation of Uzbek individuals converge into zero within short period of time. In fact, one

standard deviation shock to exchange rate causes 0.25 standard deviation increase in inflation expectations of households within the first three months.

Furthermore, empirical findings from impulse response analyses suggest that perceived inflation and interest rate shocks are longer-lasting impacts on inflation expectations of Uzbek firms whereas, the effects of inflation expectations, exchange rate, regulated prices, inflation and output growth shocks are shorter-lasting on expected rate of inflation. In particular, one standard deviation shock to exchange rate causes inflation expectations of firms to increase by 0.4 standard deviation within the first two months; however, the effects of exchange rate shock gradually declined and the impulse response function converged into zero in the sixth month after the shock.

To sum up, hypothetically a positive relationship between movements in exchange rate and administrated prices and volatilities in inflation expectation is expected; indeed, empirical results emphasized that exchange rate and regulated prices acquire statistically significant and positive impacts on inflation expectations of households and business entities in Uzbekistan. In fact, the effects of exchange rate and regulated prices on expected inflation are statistically significant at 1 percent level which is indicated by the results of OLS regression analysis. Additionally, statistically significant and positive relationship between aforementioned variables in short-run and long-run is also exist which are proved by the findings from the ARDL results. Finally, the impulse response analyses based on VAR models indicated that inflation expectations are positively responded to the shocks of exchange rate and admintrated prices.

Taking into account aforementioned findings, discussions and statements, the Central bank of Uzbekistan should concentrate on the stability of exchange rate and continuously observe the share and contribution of regulated price inflation into headline inflation. Furthermore, enhancing partnership and cooperating with local government, especially with the Ministry of Economy and Finance in order to effectively implement monetary and fiscal policies are essential to achieve price stability and anchor inflation expectations of market participants in Uzbekistan.

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Appendix

Appendix 1. Vector Autoregressive Analysis Results for Households

VARIABLES	hh_expectation	hh_perceived	inflation	admin_prices	exchange_rate	interest_rate	logRGDP
L. hh_expectation	0.0247	-0.0255	-0.0263	0.433	0.493	0.433**	-0.00507
	(0.240)	(0.297)	(0.156)	(0.427)	(0.406)	(0.168)	(0.0115)
L2.hh_expectation	-0.291	-0.131	-0.0736	1.460***	0.464	0.00807	-0.00259
	(0.252)	(0.312)	(0.164)	(0.447)	(0.426)	(0.176)	(0.0121)
L3.hh_expectation	0.153	0.214	0.212	0.872**	-0.103	0.290*	-0.00703
	(0.231)	(0.286)	(0.150)	(0.410)	(0.390)	(0.162)	(0.0111)
L4.hh_expectation	-0.0436	0.292	-0.119	0.231	-0.596	0.365**	-0.0282***
	(0.225)	(0.278)	(0.146)	(0.399)	(0.380)	(0.158)	(0.0108)
L.hh_perceived	0.00809	0.340	-0.179	-0.525	-0.355	-0.262**	0.00536
	(0.190)	(0.235)	(0.123)	(0.337)	(0.321)	(0.133)	(0.00911)
L2.hh_perceived	0.195	0.258	0.101	-0.851**	-0.576*	-0.194	-0.00210
	(0.196)	(0.242)	(0.127)	(0.347)	(0.331)	(0.137)	(0.00939)
L3.hh_perceived	-0.101	-0.306	-0.151	-0.418	0.0836	-0.135	0.00278
	(0.177)	(0.219)	(0.115)	(0.314)	(0.299)	(0.124)	(0.00849)
L4.hh_perceived	-0.357**	-0.472**	-0.143	-0.556*	0.0199	-0.296**	0.0118
	(0.166)	(0.205)	(0.108)	(0.294)	(0.280)	(0.116)	(0.00795)
L.inflation	-0.148	0.0996	1.259***	1.107**	-0.137	-0.162	0.0189
	(0.269)	(0.333)	(0.175)	(0.477)	(0.454)	(0.188)	(0.0129)

L2.inflation	-0.454	-0.597	-0.619**	-1.383*	-0.725	0.369	-0.00547
	(0.416)	(0.515)	(0.271)	(0.739)	(0.703)	(0.291)	(0.0200)
L3.inflation	-0.0593	0.200	0.0430	0.0494	1.054	-0.149	0.000716
	(0.413)	(0.511)	(0.268)	(0.733)	(0.698)	(0.289)	(0.0198)
L4.inflation	1.110***	1.030***	0.488**	1.418***	-0.276	0.206	-0.0178
	(0.305)	(0.377)	(0.198)	(0.541)	(0.515)	(0.213)	(0.0146)
L.admin_prices	-0.0164	-0.0576	-0.197***	-0.00807	0.135	0.0239	-0.00152
	(0.100)	(0.124)	(0.0652)	(0.178)	(0.169)	(0.0702)	(0.00481)
L2.admin_prices	0.167	0.0149	0.189**	0.464**	-0.0591	-0.0319	0.00373
	(0.113)	(0.140)	(0.0734)	(0.200)	(0.191)	(0.0791)	(0.00542)
L3.admin_prices	-0.116	-0.104	-0.137*	-0.141	-0.197	0.0325	-9.63e-05
	(0.115)	(0.142)	(0.0745)	(0.203)	(0.194)	(0.0802)	(0.00550)
L4.admin_prices	-0.197**	-0.269**	-0.0311	-0.463***	0.172	-0.0951	0.00204
	(0.0944)	(0.117)	(0.0614)	(0.168)	(0.159)	(0.0661)	(0.00453)
L.exchange_rate	0.170**	-0.0486	-0.0616	-0.153	0.926***	0.0968*	-3.32e-05
	(0.0807)	(0.0998)	(0.0524)	(0.143)	(0.136)	(0.0565)	(0.00387)
L2.exchange_rate	0.0158	0.211	0.0934	-0.0465	-0.105	-0.225***	-0.00370
	(0.122)	(0.151)	(0.0792)	(0.216)	(0.206)	(0.0853)	(0.00584)
L3.exchange_rate	0.204*	0.0684	0.0445	-0.154	-0.241	-0.0414	0.00472
	(0.120)	(0.148)	(0.0779)	(0.213)	(0.203)	(0.0839)	(0.00575)
L4.exchange_rate	-0.283***	-0.246***	-0.114**	-0.0435	0.260**	0.0879*	0.000716
	(0.0730)	(0.0903)	(0.0474)	(0.130)	(0.123)	(0.0511)	(0.00350)

L.interest_rate	-0.0724	-0.171	0.0861	0.674*	0.256	0.583***	-0.0149
	(0.203)	(0.252)	(0.132)	(0.361)	(0.344)	(0.142)	(0.00976)
L2.interest_rate	-0.693***	-0.363	-0.120	0.299	-0.452	0.268*	-0.0153
	(0.222)	(0.274)	(0.144)	(0.394)	(0.375)	(0.155)	(0.0106)
L3.interest_rate	0.433**	0.252	0.167	0.591*	0.138	0.0258	0.0264***
	(0.188)	(0.233)	(0.122)	(0.334)	(0.318)	(0.132)	(0.00904)
L4.interest_rate	0.208	0.451**	0.0431	-0.346	0.256	-0.209	-0.00130
	(0.185)	(0.229)	(0.120)	(0.328)	(0.312)	(0.129)	(0.00887)
L.logRGDP	4.460*	0.308	0.464	3.917	-7.735*	1.870	1.144***
	(2.608)	(3.228)	(1.696)	(4.629)	(4.406)	(1.826)	(0.125)
L2.logRGDP	-7.521*	-4.395	-1.543	-6.818	6.098	-2.879	-0.292
	(4.036)	(4.996)	(2.624)	(7.164)	(6.820)	(2.826)	(0.194)
L3.logRGDP	5.272	1.861	0.729	-1.860	1.338	-1.894	-0.309
	(3.925)	(4.859)	(2.552)	(6.967)	(6.632)	(2.748)	(0.188)
L4.logRGDP	-2.984	-0.317	-1.199	-4.262	-2.310	2.754*	0.412***
	(2.297)	(2.843)	(1.493)	(4.076)	(3.880)	(1.608)	(0.110)
Constant	30.83***	37.45***	21.44***	74.96***	37.81**	4.439	1.057**
	(11.07)	(13.71)	(7.200)	(19.65)	(18.71)	(7.753)	(0.531)
Observations	56	56	56	56	56	56	56

Appendix 2. Vector Autoregressive Analysis Results for Firms

VARIABLES	bs_expectation	bs_perceived	inflation	admin_prices	exchange_rate	cbu_policyrate	logRGDP
L.bs_expectation	0.616***	0.521**	0.0849	0.263	0.803***	0.0344	0.00194
	(0.160)	(0.236)	(0.104)	(0.326)	(0.261)	(0.104)	(0.00988)
L2.bs_expectation	0.294*	0.0712	0.0759	1.210***	1.136***	-0.0554	-0.00921
	(0.176)	(0.259)	(0.114)	(0.359)	(0.287)	(0.114)	(0.0109)
L3.bs_ expectation	-0.0920	-0.286	0.209*	1.243***	0.0197	0.119	-0.0373***
	(0.194)	(0.287)	(0.126)	(0.397)	(0.318)	(0.126)	(0.0120)
L4.bs_ expectation	-0.184	-0.359	-0.0107	0.989***	-0.549**	0.163	-0.0270***
	(0.168)	(0.247)	(0.109)	(0.343)	(0.274)	(0.109)	(0.0104)
L.bs_perceived	-0.217	0.0719	-0.194**	-0.473	-0.695***	-0.0543	0.00403
	(0.142)	(0.209)	(0.0920)	(0.290)	(0.232)	(0.0920)	(0.00877)
L2.bs_ perceived	-0.337**	-0.0469	-0.125	-1.095***	-1.261***	0.0375	0.00468
	(0.159)	(0.234)	(0.103)	(0.324)	(0.260)	(0.103)	(0.00982)
L3.bs_ perceived	0.277*	0.332	-0.164	-1.075***	0.303	-0.0932	0.0256**
	(0.167)	(0.246)	(0.108)	(0.341)	(0.273)	(0.108)	(0.0103)
L4.bs_ perceived	-0.0688	0.0499	-0.203**	-1.066***	-0.0178	-0.180**	0.0194**
	(0.139)	(0.205)	(0.0904)	(0.285)	(0.228)	(0.0904)	(0.00862)
Inflation	-0.338	-0.324	1.020***	1.093**	-0.486	0.107	-0.00913
	(0.256)	(0.377)	(0.166)	(0.523)	(0.418)	(0.166)	(0.0158)
L2.inflation	-0.492	-0.453	-0.417*	-0.851	0.136	0.217	0.00954

	(0.366)	(0.540)	(0.238)	(0.748)	(0.599)	(0.238)	(0.0226)
L3.inflation	0.535	0.604	-0.0156	-0.323	0.194	-0.189	-0.00346
	(0.341)	(0.503)	(0.221)	(0.697)	(0.558)	(0.221)	(0.0211)
L4.inflation	0.441*	0.298	0.486***	1.751***	0.144	0.0351	-0.0279*
	(0.257)	(0.380)	(0.167)	(0.526)	(0.421)	(0.167)	(0.0159)
L.admin_prices	0.00658	-0.0157	-0.248***	-0.128	0.00435	0.00180	0.00422
	(0.0747)	(0.110)	(0.0485)	(0.153)	(0.122)	(0.0485)	(0.00462)
L2.admin_prices	0.0367	0.0361	0.122**	0.457**	-0.354**	-0.136**	-0.00183
	(0.0913)	(0.135)	(0.0593)	(0.186)	(0.149)	(0.0592)	(0.00565)
L3.admin_prices	-0.233**	-0.255*	-0.0423	-0.0384	0.0577	0.0360	0.00460
	(0.0920)	(0.136)	(0.0597)	(0.188)	(0.150)	(0.0597)	(0.00569)
L4.admin_prices	0.0303	0.0605	-0.105**	-0.596***	0.0482	0.0573	0.00304
	(0.0755)	(0.111)	(0.0490)	(0.154)	(0.123)	(0.0490)	(0.00467)
L.exchange_rate	0.105	0.0421	-0.0336	-0.184	0.948***	-0.0590	0.00465
	(0.0711)	(0.105)	(0.0462)	(0.145)	(0.116)	(0.0462)	(0.00440)
L2.exchange_rate	0.224**	0.170	0.110*	0.140	-0.0134	0.0644	-0.00373
	(0.0992)	(0.146)	(0.0644)	(0.203)	(0.162)	(0.0644)	(0.00614)
L3.exchange_rate	-0.0946	0.0663	0.0244	-0.0184	-0.345**	-0.0242	0.000707
	(0.0863)	(0.127)	(0.0560)	(0.176)	(0.141)	(0.0560)	(0.00534)
L4.exchange_rate	-0.0726	-0.104	-0.108***	-0.348***	0.224**	-0.0527	0.00680*
	(0.0593)	(0.0875)	(0.0385)	(0.121)	(0.0971)	(0.0385)	(0.00367)
L.cbu_policyrate	-0.290	-0.383	-0.0275	-0.560	-0.324	0.682***	0.0194

	(0.213)	(0.315)	(0.138)	(0.436)	(0.349)	(0.138)	(0.0132)
L2.cbu_policyrate	0.582**	0.750*	-0.391**	-0.472	-0.370	0.0224	-0.00778
	(0.275)	(0.406)	(0.179)	(0.563)	(0.451)	(0.179)	(0.0170)
L3.cbu_policyrate	-0.520*	-0.363	0.346*	0.976*	-0.288	-0.197	-0.0124
	(0.288)	(0.425)	(0.187)	(0.589)	(0.471)	(0.187)	(0.0178)
L4.cbu_policyrate	0.325	0.0831	0.481***	0.483	1.479***	0.134	0.0229
	(0.245)	(0.362)	(0.159)	(0.501)	(0.401)	(0.159)	(0.0152)
L.logRGDP	2.177	1.456	0.512	-0.680	-3.851	-1.114	1.287***
	(1.930)	(2.849)	(1.254)	(3.945)	(3.158)	(1.253)	(0.119)
L2.logRGDP	-4.789	-6.339	-3.115	-3.963	5.613	-1.275	-0.298
	(3.205)	(4.729)	(2.081)	(6.549)	(5.243)	(2.080)	(0.198)
L3.logRGDP	3.464	4.403	0.709	0.172	-9.044*	3.091	-0.558***
	(3.214)	(4.742)	(2.087)	(6.567)	(5.258)	(2.086)	(0.199)
L4.logRGDP	-2.626	-1.454	-2.080	-10.09**	-0.0114	-1.484	0.578***
	(1.967)	(2.903)	(1.278)	(4.020)	(3.218)	(1.277)	(0.122)
Constant	30.27**	31.66*	49.42***	167.7***	88.45***	14.24*	0.0381
	(11.84)	(17.47)	(7.688)	(24.19)	(19.37)	(7.685)	(0.732)
Observations	56	56	56	56	56	56	56

Appendix 3. VAR Stability Test Results for Households

```
. varstable
```

Eigenvalue stability condition

Eigenvalue	Modulus
.9673095	.96731
.9590594	.959059
.9227574 + .1778955*i*	.939749
.9227574 - .1778955*i*	.939749
.806034 + .4788581*i*	.937548
.806034 - .4788581*i*	.937548
-.1526582 + .8625893*i*	.875994
-.1526582 - .8625893*i*	.875994
.6477917 + .587054*i*	.874223
.6477917 - .587054*i*	.874223
-.5724689 + .6209026*i*	.844536
-.5724689 - .6209026*i*	.844536
.2235579 + .801424*i*	.832021
.2235579 - .801424*i*	.832021
.3543529 + .7443626*i*	.824404
.3543529 - .7443626*i*	.824404
-.8192262	.819226
-.6679043 + .2839385*i*	.725753
-.6679043 - .2839385*i*	.725753
.6368273 + .3397878*i*	.721807
.6368273 - .3397878*i*	.721807
.421748 + .5777*i*	.715268
.421748 - .5777*i*	.715268
-.5032024 + .4952741*i*	.706052
-.5032024 - .4952741*i*	.706052
-.6727419	.672742
-.5313592	.531359
.1318269	.131827

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Appendix 4. VAR Stability Test Results for Business Entities

```
. varstable

   Eigenvalue stability condition
```

Eigenvalue	Modulus
.9463531 + .07176526*i*	.94907
.9463531 - .07176526*i*	.94907
.6956356 + .5424343*i*	.882125
.6956356 - .5424343*i*	.882125
.857493 + .1939177*i*	.879146
.857493 - .1939177*i*	.879146
.489575 + .7022043*i*	.856023
.489575 - .7022043*i*	.856023
.8351702	.83517
.6981318 + .4392218*i*	.824805
.6981318 - .4392218*i*	.824805
.2224885 + .7848984*i*	.815823
.2224885 - .7848984*i*	.815823
-.805048	.805048
-.3512746 + .6849528*i*	.769775
-.3512746 - .6849528*i*	.769775
.115228 + .7445575*i*	.753421
.115228 - .7445575*i*	.753421
-.6796455 + .1535149*i*	.696767
-.6796455 - .1535149*i*	.696767
.5814601 + .376763*i*	.692854
.5814601 - .376763*i*	.692854
-.4300521 + .4945513*i*	.655382
-.4300521 - .4945513*i*	.655382
-.5576879	.557688
-.3903071 + .3066627*i*	.496368
-.3903071 - .3066627*i*	.496368
-.4868349	.486835

```
All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.
```