The effects of Ukraine-Russian war on Inflation expectations

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Abstract:

This study investigates the impact of the recent Ukraine-Russia conflict on inflation expectations in the United States, emphasising both short-term and long-term effects. Utilising data from the Survey of Consumer Expectations, the Bureau of Labor Statistics, the Federal Reserve Economic Data, and the U.S. Energy Information Administration, the research focuses on the repercussions of this geopolitical event on key economic indicators. The analysis encompasses the effects of oil prices and the Real Broad Effective Exchange Rate (RBEER) on one and three-year-ahead inflation expectations. Our findings indicate that in the short term, U.S. inflation expectations are indirectly influenced by oil price fluctuations rather than directly by the conflict or changes in the RBEER. In the long term, however, these influences do not significantly alter inflation expectations, suggesting the non-persistent nature of such shocks. This research contributes to the understanding of the complex interplay between geopolitical turmoil and economic sentiment in a major economy, offering insights valuable for policymakers and economic analysts.

Keywords: inflation expectations, geopolitical risks, oil prices

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1. Introduction

Historical Background of the Ukrainian-Russian Conflict

The ongoing conflict between Ukraine and Russia, rooted in historical tensions dating back to the 17th century, has evolved significantly over time, marked by key events such as Ukraine's struggle for sovereignty and its declaration of independence in 1991. The recent escalation of hostilities, including Russia's annexation of Crimea in 2014 and the full-scale invasion in 2022, is a manifestation of Vladimir Putin's geopolitical ambitions. The year 2021 set a crucial precedent, characterized by diplomatic challenges and strengthened ties between Russia and China, leading to a crescendo of tensions that culminated in severe global economic sanctions. These sanctions, imposed by the EU, U.S., and other nations, have included cutting off Russian banks from SWIFT, freezing assets of the Russian Central Bank, and suspending major projects like the Nord Stream 2 pipeline. In response to the conflict, several countries, including Canada, South Korea, and Taiwan, have joined in imposing sanctions, targeting Russian defence companies, Duma members, and billionaires associated with Putin. The global response has been diverse, ranging from banning Russian energy imports to specific banking sanctions.

Within this complex geopolitical landscape, our research aims to explore the broader economic repercussions of the Ukraine-Russia conflict, with a specific focus on the United States. We examine how this turmoil has shaped the inflation expectations of the American populace, analysing both short-term and long-term projections for one and three years ahead. This study delves into two critical aspects: the influence of oil prices, considering their intricate relationship with the U.S. economy, and the real exchange rate pass-through mechanism, investigating how fluctuations in exchange rates, prompted by the conflict, might alter expectations of future inflation.

Recognizing the nuanced impact of geopolitical events on economic sentiments, our research investigates how the unfolding Ukraine-Russia conflict affects economic indicators, particularly in the United States. We aim to contribute to the broader economic discourse by providing insights into how such conflicts can echo in the economic sentiments of a major player like the United States. These findings may offer valuable guidance for crafting informed policies and fostering resilience in the face of global uncertainties. This study also adds to the academic and empirical understanding of the intricate relationships between geopolitical

events and economic indicators, emphasizing the need for nuanced analyses and proactive strategies in the evolving landscape of global economics.

Our research occupies a distinctive position in examining the conflict's repercussions on inflation expectations within the United States. By focusing on the interplay between the conflict and inflation expectations, we aim to unravel the implications for the economic sentiments of the American population. The emphasis on oil prices and real exchange rate pass-through mechanisms provides a comprehensive lens through which to analyse the channels of influence, acknowledging the interconnectedness of global events, commodity markets, and currency dynamics.

This research is relevant within the broader context of economic literature, contributing to the fields of macroeconomics, international economics, and the impact of geopolitical events on economic indicators. It aligns with existing literature exploring the connections between geopolitical conflicts and economic variables, adding to the understanding of how major events like the Ukraine-Russia conflict reverberate through economic systems. In particular, our investigation into the psychological and behavioural aspects of economic agents in forming inflation expectations is crucial for understanding decision-making processes in consumption, investment, and overall economic stability.

2. Literature review

Inflation expectations have increasingly become a focal point for policymakers in recent years, particularly in light of the profound impact of geopolitical shocks. The necessity to explore the repercussions of such events on the economic landscape is important, especially in instances where these events create widespread uncertainty and anxiety about the future of the economy. This study is anchored in a thorough review of literature that delves into both inflation expectations and the influence of geopolitical shocks (Kilian & Zhou, 2023).

In conducting our analysis of how inflation expectations were affected by the war, we pay close attention to the factors that shape these expectations. Extensive research has been done on the pivotal role of oil prices and exchange rate pass-through in molding public perception about inflation. The inclusion of a major oil-producing country in the recent geopolitical conflict is expected to significantly sway global oil prices, thereby impacting inflation expectations globally. This effect is magnified when considering the substantial international sanctions imposed on Russia by major entities like the USA, Europe, and other countries, an unprecedented response in recent times (Yotzov et al., 2022).

Understanding inflation expectations is essential for effective economic policymaking. These expectations represent the anticipated rate of inflation by various economic agents, including consumers, businesses, workers, and investors (Istiak & Alam, 2019). Typically, these expectations are measured through surveys that assess household predictions about future inflation rates. While firms also form their own inflation expectations, they often find it more feasible to rely on household expectations due to the complexities and costs associated with independently forecasting inflation (Coibion & Gorodnichenko, 2015). This reliance underscores the interconnectedness of different sectors in the economy when it comes to expectation formation.

The volatility of oil prices has been a subject of intense investigation and concern among economists. The COVID-19 pandemic had already introduced a substantial degree of uncertainty into the global economy, and the subsequent geopolitical conflict has only exacerbated these challenges (Yotzov et al., 2022). The persistent increase in oil and gasoline prices since mid-2020 has raised alarms about the potential for

prolonged high inflation in the United States (Kilian & Zhou, 2023). However, studies indicate that the impact of the pandemic on oil prices, and subsequently on long-term household inflation expectations, may have been overstated (Kilian & Zhou, 2023). This finding is particularly salient for our research, as it suggests that the effects of geopolitical shocks on inflation expectations can vary widely. The economic crisis of 2009-2011, for instance, saw inflation expectations rise due to escalating oil prices, which in turn mitigated the post-crisis decline in inflation (Coibion & Gorodnichenko, 2015). This historical precedent demonstrates the complex nature of how supply and demand dynamics, influenced by geopolitical risks, shape market responses (Zhang et al., 2022).

Post-1980, the response of interest rates to oil price shocks in the U.S. has differed from the pre-1980 period, with rates tending to increase rather than decrease (Mehra & Herrington, 2008). This shift highlights the evolving nature of economic policy and market reactions to external shocks. The significant role of oil prices in shaping inflation expectations is partly explained by the frequency hypothesis, which posits that the regular purchase and high visibility of oil prices make them an important influence on public perception (Binder, 2018). This is exemplified by the fact that oil, despite constituting a small percentage of overall consumer spending, exerts a disproportionate influence on inflation expectations due to its widespread impact across various sectors of the economy (Binder, 2018). The pass-through effect of oil prices on inflation expectations can be mitigated by proactive monetary policy measures, currency appreciation, and increased openness in trade (Chen, 2009).

The dynamic relationship between geopolitical risks, oil prices, and inflation is subject to continuous change (Yang et al., 2023). Geopolitical risks tend to affect the industrial demand for oil more significantly than supply disruptions, which often results in temporary rather than sustained increases in oil prices (Yang et al., 2023). This observation is particularly relevant in the context of the recent conflict, as it suggests that the impact on long-term inflation expectations might be limited.

Recent studies have shown that while short-term inflation expectations may spike in response to immediate shocks, they typically return to pre-shock levels within a couple of years (Mehra & Herrington, 2008). The general public tends to adjust their short-term inflation expectations in light of such shocks, but long-term expectations remain relatively stable, implying confidence in the Federal Reserve's ability to manage the economy effectively (Mehra & Herrington, 2008). This phenomenon, known as the anchoring of long-term

expectations, demonstrates the public's trust in monetary policy interventions to stabilize the economy in the face of temporary disruptions (Mehra & Herrington, 2008).

In their daily lives, people constantly observe and react to price changes, particularly in frequently purchased items like groceries, which significantly influence their inflation expectations (D'Acunto et al., 2019). The size and frequency of these price changes, rather than the proportion of their overall spending, are crucial in shaping these expectations (D'Acunto et al., 2019). A geopolitical shock like the one we are studying is expected to cause a sizable and immediate impact in prices of major commodities that will be an observable concern for individuals.

Historical patterns have shown that geopolitical risks often precede periods of high inflation and reduced economic activity (Caldara et al., 2023). The ongoing conflict in Ukraine is no exception, raising concerns among investors, market participants, and policymakers about its potential to hinder global economic growth while accelerating inflation (Caldara et al., 2023). This is evidenced by the frequent references to 'war' in recent economic forecasts and reports, such as the April 2022 edition of the International Monetary Fund's World Economic Outlook, underscoring the significant impact of the conflict on the global economic landscape (Caldara et al., 2023). The conflict has not only dampened global economic activity but has also intensified inflation, further complicating the challenges faced by fiscal and monetary policymakers (Caldara et al., 2023).

The role of exchange rate pass-through in influencing inflation expectations warrants close examination. Countries with higher baseline inflation rates tend to experience a more pronounced effect of exchange rate fluctuations on inflation expectations (Ben Cheikh & Louhichi, 2016). Additionally, the degree of exchange rate pass-through is influenced by a country's monetary policy framework, such as whether it targets inflation or adopts a more flexible approach, as is the case with the United States (Nasir et al., 2020). In countries with explicit inflation-targeting policies, exchange rate pass-through has been found to significantly affect inflation expectations (Nasir et al., 2020). However, the overall impact of exchange rate fluctuations on inflation has been on the decline in recent decades (Gagnon & Ihrig, 2004). This trend is particularly noticeable in scenarios characterized by low actual inflation or when the inflationary impact is driven by demand shocks rather than monetary policy changes (Taylor, 2000).

Governments and monetary authorities are tasked with formulating and implementing comprehensive policies to navigate the complex interactions among geopolitical risks, fluctuations in oil prices, and inflation dynamics (Yang et al., 2023). Recent shifts in monetary policy responses to inflation, particularly in relation to exchange rate changes, are reflective of the decreased impact of these fluctuations (Gagnon & Ihrig, 2004). This shift in policy approach is attributed to the general expectation that monetary authorities will act decisively to stabilize domestic inflation rates, leading to a reduced propensity for businesses to adjust prices in response to exchange rate shocks (Gagnon & Ihrig, 2004). The Federal Reserve's consideration of public inflation expectations in its pursuit of price stability is crucial, as these expectations significantly influence actual inflation (Mehra & Herrington, 2008). Recent research suggests that the variability of expectation shocks on inflation expectations has increased, underscoring the importance of the Fed's role in closely monitoring and responding to public expectations to prevent them from translating into persistent increases in actual inflation (Mehra & Herrington, 2008).

However, studies like those conducted by Sussman and Zohar challenge the belief that monetary authorities can effectively stabilize long-term inflation, suggesting a deterioration in public confidence in this ability (Sussman & Zohar, 2015). Factors contributing to this include a shift in focus towards stabilizing economic activity over inflation, asymmetric responses of central banks to deviations from inflation targets, and public perceptions about the effectiveness of monetary policy, particularly in the context of the zero-lower bound (Sussman & Zohar, 2015). Furthermore, the emphasis of central banks on core inflation, which excludes grocery prices, has led to systematic errors in policy formulation (D'Acunto et al., 2019).

Managing inflation expectations has emerged as a central goal for policymakers, as these expectations significantly influence a wide range of economic decisions (Armantier et al., 2016). The government's response to geopolitical shocks that affect energy prices should aim to stabilize both core and headline inflation, despite potential variances in forecasts between the two (Bodenstein et al., 2008).

The public inflation expectations play a vital role in shaping actual inflation (Mehra & Herrington, 2008). Research on the relationship between current inflation and future expectations varies, depending on the economic context and the time horizon considered (Cerisola & Gelos, 2005). Some studies indicate that past inflation has limited impact on future expectations, especially during periods of economic shocks, where fiscal policies become increasingly influential(Cerisola & Gelos, 2005). A temporary surprise increase in

actual inflation typically leads to a rise in expected inflation (Mehra & Herrington, 2008). Often, future expectations about inflation tend to be higher than official current inflation estimates, signalling public scepticism about the accuracy of official statistics and potentially undermining their credibility (Detmeister et al., 2016).

Inflation expectations are influenced by a constellation of factors, including actual and past inflation, money supply, oil price shocks, and the fiscal stance of the economy (Nasir et al., 2020). Temporary shocks in various economic variables, such as inflation, commodity prices, or expected inflation itself, can cause expected inflation to increase, while a rise in unemployment generally leads to a decrease (Mehra & Herrington, 2008). This complex interplay underscores the multifaceted nature of inflation expectations and their significance in the broader economic landscape.

3. Methodology

3.1 Description of methodology

This section delineates the methodological framework employed for scrutinising the repercussions of the Ukraine-Russia conflict on inflation expectations within the United States of America. Following that, a brief clarification of the essential model variables will follow.

One & three years ahead inflation expectations

The data on inflation expectations is our dependable variable in the model. It is sourced from the Survey of Consumer Expectations, copyrighted from 2013 to 2023 by the Federal Reserve Bank of New York (FRBNY). Figures 1 and 2 visually represent the distributions of these variables.

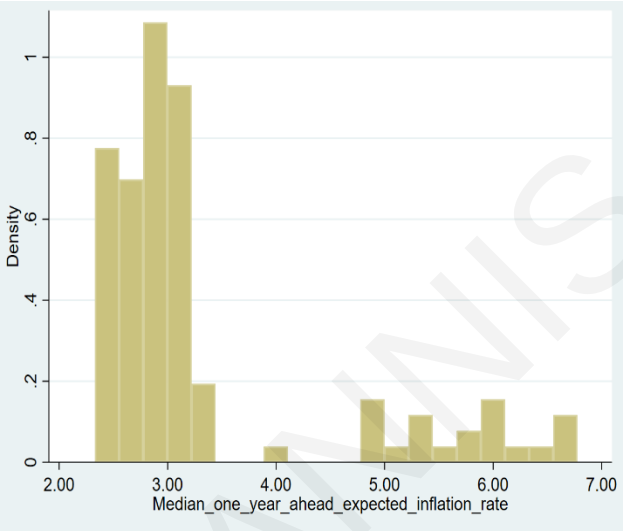

Figure 1

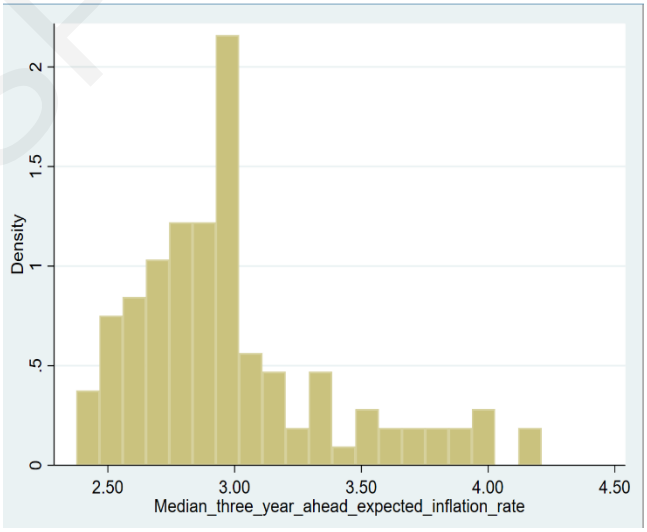

Figure 2

In Figure 3, we observe the percentage change in inflation expectations for one and three years ahead over time. Notably, both variables exhibit fluctuations around the 0% mark, moving in tandem with minimal divergence. Additionally, a red dotted line in Figure 3 indicates the month when the conflict between Russia and Ukraine occurred. Upon visual inspection of the graph, no discernible post-war trend or extreme values in either variable are evident.

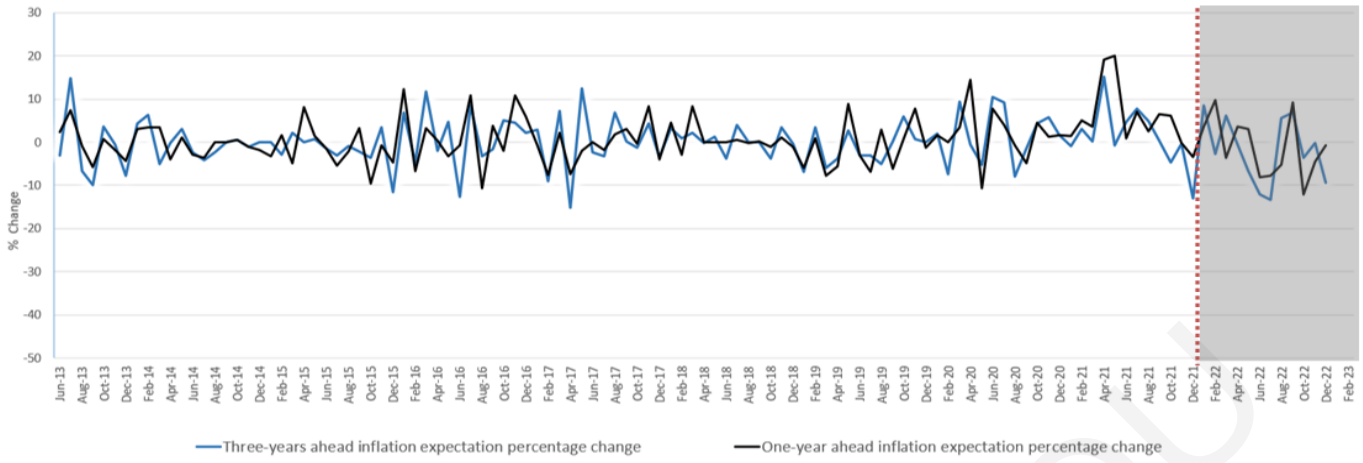

Figure 3

Unemployment Rate:

Data related to the unemployment rate is meticulously sourced from the Bureau of Labor Statistics (BLS), a reputable and authoritative federal agency dedicated to providing comprehensive labor market information. The BLS, as the principal source for national employment and unemployment data in the United States, employs rigorous methodologies in data collection and analysis. This variable, the unemployment rate, signifies the percentage of the labour force actively seeking employment but currently without jobs. Widely regarded as a critical economic indicator, fluctuations in the unemployment rate offer valuable insights into the overall health of the job market, influencing policy decisions and shaping our understanding of economic trends.

3-Month Treasury Bill Secondary Market Rate:

The 3-Month Treasury Bill Secondary Market Rate, a pivotal economic indicator, is meticulously acquired from the Federal Reserve Economic Data (FRED), facilitated by the Economic Research Division of the Federal Reserve Bank of St. Louis. This invaluable metric, denoting the yield investors receive from investing in government-issued treasury securities with a 3-month maturity (T-bill), offers critical insights into short-term interest rate movements. As a key component of the broader financial landscape, this rate influences borrowing costs, investment decisions, and monetary policy considerations.

Consumer Price Index (CPI) for All Urban Consumers (CPI-U):

The Consumer Price Index for All Urban Consumers (CPI-U) data, a fundamental measure of inflation, is diligently procured from the Bureau of Labor Statistics (BLS). Serving as a cornerstone in economic analysis, the CPI-U encapsulates the fluctuations in consumers' prices, gauging the change in the cost of a representative basket of goods and services essential for the average household's sustenance. This comprehensive index encompasses a diverse array of items, ranging from groceries and housing to healthcare and transportation.

Inflation Rate:

The inflation rate is calculated using the formula:

[(CPI-U at the ending period - CPI-U at the starting period) / CPI-U at the starting period)] x 100.

This formula captures the percentage change in the Consumer Price Index for All Urban Consumers (CPI-U) between two specified periods, facilitating a quantitative measure of inflation. This formula provides a standardised method for expressing the relative increase or decrease in consumer prices over the designated time frame. It quantifies the rate at which the general price level of goods and services is rising, influencing purchasing power and overall economic stability. Moderate inflation is often considered a normal aspect of a growing economy, stimulating spending and investment. For policymakers, monitoring inflation is crucial in making informed decisions about monetary and fiscal policies. Central banks, for instance, may adjust interest rates to control inflation and stabilise the economy. Additionally, businesses and investors rely on inflation data to anticipate future trends, adjust pricing strategies, and make sound financial decisions. On an individual level, understanding inflation is essential for household budgeting and financial planning, as it directly impacts the cost of living.

In Figure 4, an insightful examination of the inflation variable's distribution is presented. Notably, a discernible pattern emerges, indicating that the variable predominantly clusters around values near zero. This concentration of values in the proximity of zero underscores a noteworthy characteristic of the inflation

variable, suggesting a prevalence of stability or minimal fluctuations in certain segments of the observed data.

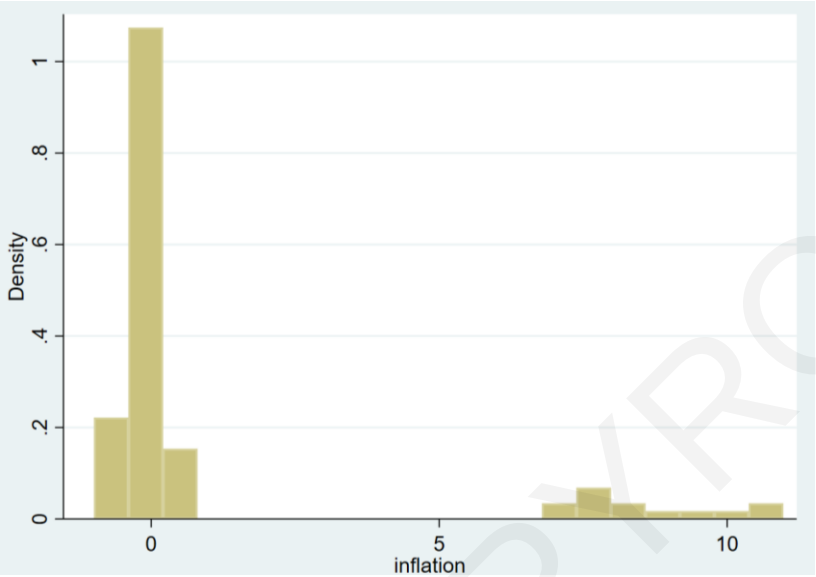

Figure 4

Oil prices:

Oil prices are a key indicator of economic activity, as they influence transportation costs, industrial production, and consumer spending. Accurate data on oil prices is essential for economic analysis and forecasting. The U.S. Energy Information Administration (EIA) provides a comprehensive dataset of oil prices, including spot prices for crude oil and refined products

Real Broad Effective Exchange Rate

The Real Broad Effective Exchange Rate (RBEER) serves as a pivotal metric in our economic analysis, offering a comprehensive evaluation of a country's currency strength in relation to its diverse trading partners. Computed as an average of bilateral Real Exchange Rates, with weights assigned based on respective trade shares, the RBEER captures the collective impact of multiple trade interactions, providing insights into the overall competitiveness of a nation's currency. This non-seasonally adjusted index, benchmarked against the base year 2020, facilitates consistent comparisons over time. Crucially, our utilisation of the RBEER in our econometric model is driven by the need to comprehensively investigate an event outside the USA, where

understanding the intricacies of exchange rate dynamics becomes essential. By drawing on data meticulously obtained from the Federal Reserve Bank of St. Louis, we integrate the RBEER into our model, recognizing its significance in assessing economic performance, trade dynamics, and the broader implications for policy and forecasting associated with the Ukraine-Russia conflict.

3.2 Descriptive statistics

Following will be presented a table which summarises the main characteristics of the variables that will be used in the study and may give a first picture of the variables. The period of this analysis starts from January 2013 and ends up to June 2023. Furthermore, the dummy variables that are used correspond to the periods of conflict. More specifically war dummy 1 starts from February 2022 and ends with our data on January 2023 which is the recent conflict that occurred. War dummy 2 accounts for the recent conflict that occurred, but also includes the previous conflict period that started in February 2014 and ended March 2015.

Table 1 presents a comprehensive overview of the descriptive statistics for the main characteristics of the variables under consideration. Notably, the dataset comprises a maximum of 116 observations, providing a robust foundation for analysis. Examining the independent variables, both oil prices and RBEER exhibit significant dispersion from their respective means, highlighting the variability in these crucial factors. Moreover, a closer inspection of Table 1 reveals that the variable RBEER boasts the highest mean value among the variables, underscoring its importance in the dataset. Conversely, the variable inflation registers the lowest mean value. It's noteworthy that the variable RBEER also demonstrates the widest range, as evidenced by its highest minimum and maximum values. In contrast, inflation exhibits the lowest minimum value, and the change in three years ahead inflation expectation stands out with the lowest maximum value. These nuanced insights gleaned from the descriptive statistics set the stage for a more in-depth examination of the relationships and dynamics within the dataset.

Table 1

Descriptive statistics of variables

Variable	Observations	Mean	Standard deviation	min	max
$\pi_{t,1}^{e}$	116	3.3410	1.1466	2.3301	6.7758
$\pi_{t,3}^{e}$	116	2.9911	0.4036	2.3747	4.2111
$\boldsymbol{\pi_t}$	116	-0.0055	.8521	-5.7211	4.4757
$\mathbf{RBEER_t}$	116	96.7607	7.2673	81.7	112.98
$\mathbf{U_t}$	116	5.1508	1.8261	3.4	14.7
$\mathbf{T\text{-}bill_t}$	116	0.8452	1.0563	0.02	4.54
P_t^{Oil}	116	64.5575	22.3681	16.55	114.84
$\mathbf{Log(\pi_t)}$	116	-0.0011	1.2028	-4.5359	7.6629
$\Delta\pi_{t,1}^{e}$	115	0.0109	.3245	-1.076	1.294
$\Delta\pi_{t,3}^{e}$	115	-.0139	.28462	-0.8057	0.8161

In Table 2, we examine the correlation coefficients among our main variables to discern potential relationships and patterns within the dataset. Notably, the inflation expectation variables reveal intriguing insights. The correlation of 0.7341 between inflation expectations one year ahead and those three years ahead suggests a strong positive association, indicating a certain level of continuity in expected inflation over time. On the other hand, the correlation of 0.0142 between the first-period inflation expectation and

contemporaneous inflation is comparatively low, indicating that short-term expectations may not closely align with the immediate inflation outcomes.

Turning our attention to the broader correlations, the Real Broad Effective Exchange Rate exhibits diverse connections. It demonstrates a positive correlation of 0.4342 with inflation implying a potential relationship between currency strength and inflation. Additionally, the negative correlation of -0.2087 with the unemployment rate hints at an inverse connection, suggesting that a stronger currency might be associated with lower unemployment. The lowest observed correlation coefficient of -0.5445 between the variables Unemployment and $RBEER_t$ and suggests a negative correlation, implying an inverse relationship between unemployment and currency strength. Such a phenomenon may be attributed to economic dynamics where a stronger currency, as reflected by a higher $RBEER_t$, might influence export competitiveness negatively, potentially leading to a decline in economic activity and a subsequent rise in unemployment rates.

Table 2

Correlation coefficients among variables of interest

Variable	$\pi^e_{t,1}$	$\pi^e_{t,3}$	$\boldsymbol{\pi_t}$	$\mathbf{RBEER_t}$	$\mathbf{U_t}$	$\mathbf{T\text{-}bill_t}$	P_t^{Oil}
$\pi^e_{t,1}$	**1.0000**						
$\pi^e_{t,3}$	**0.7341**	**1.0000**					
$\boldsymbol{\pi_t}$	**0.0142**	**-0.0226**	**1.0000**				
$\mathbf{RBEER_t}$	**0.4342**	**-0.0226**	**0.0654**	**1.0000**			
$\mathbf{U_t}$	**-0.2087**	**0.0008**	**0.1933**	**-0.2831**	**1.0000**		
$\mathbf{T\text{-}bill_t}$	**0.1684**	**-0.2623**	**-0.0052**	**0.5358**	**-0.5445**	**1.0000**	
P_t^{Oil}	**0.5889**	**0.6625**	**-0.0417**	**-0.3001**	**-0.1361**	**0.0721**	**1.0000**

Following table 3 and 4 project the comparison of our dependent variables, one and three years ahead inflation expectations, before the war and after. According to the results, inflation expectations before the war on average were lower than after the war in both one and three years ahead. This is a signal that there might be an increase due to the war as our study examines.

TABLE 3					
Before war					
	Observations	**Mean**	**Standard deviation**	**Min**	**max**
$\pi^{e}_{t,1}$	**104**	**3.0456**	**0.7572**	**2.3301**	**6.0010**
$\pi^{e}_{t,3}$	**104**	**2.9564**	**0.3857**	**2.3747**	**4.2112**

TABLE 4					
After war					
	Observations	**Mean**	**Standard deviation**	**Min**	**max**
$\pi^{e}_{t,1}$	**12**	**5.9010**	**0.6329**	**4.9549**	**6.7758**
$\pi^{e}_{t,3}$	**12**	**3.2925**	**0.4467**	**2.7119**	**3.9024**

Dickey-Fuller test for unit root

To check for stationarity, we perform the Dickey-fuller test for unit root on the original variables and on the first differences of our variables that are used on our econometric model. the dickey-fuller test exhibits the following results:

TABLE 5		
Dickey-Fuller test		
Variable	**t-statistic**	**first difference t-statistic**
$\pi^{e}_{t,1}$	-0.459	-10.047***
$\pi^{e}_{t,3}$	-2.489	-12.992 ***
P^{oil}_{t}	-1.759	-7858***
$RBEER_t$	-1.107	-6537 ***
π_t	-10.383 ***	-15.732***
U_t	-3.211 **	-10.42***
t_bill_t	2.073	-5.745 ***

Results suggest that existence of a unit root in all our main variables first differences when we test with dickey fuller. this implies that all these variables are stationary which is a desirable property in time series.

Joint Significance Test:

Subsequently, we conduct a joint significance test of the independent variables with respect to the dependent variable to ascertain their combined impact. Table 6 presents the results of the F-test, assessing whether the variables in the model collectively exert a significant influence on inflation expectations. The rejection of the null hypothesis in this test signifies a statistically significant joint impact of the explanatory variables on the dependent variable only for the difference in one year ahead inflation expectations. The outcomes from Table 6 indicate the rejection of the null hypothesis at all significance levels, as the p-value of the test is 0. This implies that the explanatory variables collectively possess a statistically significant effect on inflation expectations one year ahead. However, the results for three years ahead are not the same. testing for joint significance for the same variables on three years ahead inflation expectations we observe a p-value result equal to 0.3647 which suggest that our variables are not jointly significant at any significance level.

Table 6		
Joint significance test		
	$\Delta\pi^{e}_{t,1}$	$\Delta\pi^{e}_{t,3}$
$\Delta\pi_t$= 0		
ΔU_t= 0		
Δt_bill_t= 0		
$\Delta RBEER_t$ =0		
ΔP_t^{Oil} **= 0**		
	F(5, 108) = 7.20	**F(5, 108) = 1.10**
	Prob > F = 0.0000	**Prob > F =0.3647**

Following the joint significance test of all variables in our model that includes the dummy 1 variable one one year ahead inflation expectations, the results reveal their collective statistical significance (F(6, 107) = 5.99, Prob > F = 0.0000). Furthermore, we extending this analysis to Model (3), where we assess the joint significance of *RBEER*×*dummy*1 and *RBEER*, as well as oil prices and *oil_prices*×*dummy*1.The tests show that for *RBEER*×*dummy*1 and *RBEE*R (F(2,106) =1.65, Prob > F = 0.1967) the variables are not jointly significant, but in contrast for oil prices and *oil_prices*×*dummy*1 (F(2,106) =24.28,Prob > F =0.0000) are.

3.3 Econometric model

First, we regress a simplified form of our econometric model that only includes the variables oil prices and RBEER.

$$\Delta\pi^{e}_{t,j} = b_0 + b_1\Delta RBEER_t + b_2\Delta P_t^{Oil} + e_t \qquad (0)$$

The following econometric model is employed to estimate the effects of the conflict on inflation expectations. The model specification is presented as follows:

$$\Delta\pi^{e}_{t,j} = b_0 + b_1\Delta\pi_t + b_2\Delta U_t + b_3\Delta t\_bill + b_4\Delta RBEER_t + b_5\Delta P_t^{Oil} + e_t \quad (1)$$

Where,

$\Delta\pi^{e}_{t,j}$ =inflation expectations for t years ahead

$\Delta\pi_t$ =logarithm inflation rate

ΔU_t = unemployment rate

Δt_bill_t = 3-Month Treasury Bill Secondary Market Rate

$\Delta RBEER_t$ = Real broad effective exchange rate

ΔP_t^{Oil} = oil prices

We proceed to analyse the impact of the conflict on inflation expectations by introducing the following two variations to the model that include firstly the dummy variable, and secondly the multiplication of the the dummy variable with the variables RBEER and Oil prices:

$$\Delta\pi^{e}_{t,j} = b_0 + b_1\Delta\pi_t + b_2\Delta U_t + b_3\Delta t\_bill + b_4\Delta RBEER_t + b_5\Delta P_t^{Oil} + b_6 Dummy_i + e_t \quad (2)$$

$$\Delta\pi^{e}_{t,j} = b_0 + b_1\Delta\pi_t + b_2\Delta U_t + b_3\Delta t\_bill + b_4\Delta RBEER_t + b_5\Delta P_t^{Oil} + b_6\Delta RBEER*Dummy_i + b_7\Delta P_t^{Oil} *Dummy_i + e_t \quad (3)$$

We run the same regressions for one year ahead inflation expectations and for three years ahead inflation expectations.

We also run the regressions for each one with dummy 1 and dummy 2.

4. Empirical results

4.1 Changes in inflation expectations

From the regressions we perform we can derive tables 7 to 10. In all these tables, column (0) shows the results for variables ΔP_t^{Oil} and ΔRBEER on inflation expectations changes which is the representation of model 0. Column (1) shows the results for the regression on our main econometric model(model 1). Column (2) presents the results of our regression on model (2) that includes the main variables and also the war dummy variable. Column (3) projects the results of model (3) which relapses the dummy variable with variables (ΔRBEER)*Dummy_i and (ΔP_t^{Oil})*Dummy_i .

Table 7				
	(0) $\Delta\pi_{t,1}^{e}$	(1) $\Delta\pi_{t,1}^{e}$	(2) $\Delta\pi_{t,1}^{e}$	(3) $\Delta\pi_{t,1}^{e}$
ΔP_t^{Oil}	.0138 (.0036)***	.0153 (.0034)***	.0151 (.0036)***	0.0411 (.0152)**
ΔRBEER_t	.0290 (.0149)**	.0302 (.0149)**	.0304 (.0148)**	.0080 (.0034)**
$\Delta\pi_t$		-.0291 (.0113)***	-.0293 (.0113)***	-.0319 (.0093)***
ΔU_t		.0094 (.0088)	.0097 (.0089)	.0015 (.0087)
Δt_bill_t		-.2601 (.1203)**	-.2269 (.0988)**	-.0854 (.0815)
Dummy_1			-.0325 (.0948)	
(ΔP_t^{Oil})*Dummy_1				.0319 (.0058)***
(ΔRBEER)*Dummy_1				-.0343 (.0349)
Constant	.0127 (.0178)	.0234 (.0169)	.0251 (.0171)	.0201 (.0166)
Robust R^2	0.1626	0.2501	0.2513	0.3665

*Note: in brackets are the standard errors. * Indicates the statistical significance at 10% level, ** indicates the statistical significane at 5% level and *** indicates the statistical significance at 1% level.*

In line with the results of Killian and Zhou(2023), we observe that fears of rising inflation expectations have been overstated because of the increase in oil prices. This overstatement is particularly evident when considering the broader economic context and the multifaceted factors influencing inflation. When examining changes in one-year-ahead inflation expectations, the impact of oil prices is significant; however, for projections three years ahead, this influence diminishes, as highlighted by tables 7 to 10. Our analysis underscores the long-term significance of oil price shocks, challenging some prevailing assumptions in the field. Despite prevailing concerns, there is no substantial evidence suggesting that long-run inflation expectations have experienced a fundamental shift or that the inflationary effects of oil price fluctuations are enduring (Kilian & Zhou, 2023). The impacts observed in the one-year-ahead inflation expectations are notable but represent only a minor portion of the overall changes in inflation expectations (Kilian & Zhou, 2023).

The role of geopolitical shocks in influencing oil prices is complex(Zhang et al., 2022). These shocks can drive oil prices, but their significance and impact vary considerably over time(Zhang et al., 2022). The relationship between geopolitical shocks and oil prices is not static but evolves dynamically, reflecting the changing global economic and political landscape (Yang et al., 2023). This dynamic nature complicates the prediction and management of oil price-related inflationary pressures. Geopolitical risks, such as those associated with oil supply disruption, exert a substantial influence on the industrial demand for oil, overshadowing the effects on supply (Yang et al., 2023). Consequently, the resultant fluctuations in oil prices tend to be transient rather than persistent (Yang et al., 2023). This transience explains why significant influences on inflation expectations extending three years ahead are not observed (Yang et al., 2023).

In a broader context, even though exogenous shocks to expected inflation remain a significant source of fluctuation, public confidence in the Federal Reserve Bank's ability to influence actual inflation and maintain price stability leads to adjustments in long-run inflation expectations(Mehra & Herrington, 2008). This confidence suggests a belief in the effectiveness of monetary policy in mitigating the impact of such shocks. Therefore, we do not observe a persistent increase in inflation expectations, and consequently, in actual inflation (Mehra & Herrington, 2008). Contemporary economic theory and empirical evidence from recent sample years support this view; they indicate that surprise increases in inflation expectations tend to be short-lived, with both expected and actual inflation returning to pre-shock levels within approximately two years (Mehra & Herrington, 2008).

Table 8				
	(0) $\Delta\pi^{e}_{t,1}$	(1) $\Delta\pi^{e}_{t,1}$	(2) $\Delta\pi^{e}_{t,1}$	(3) $\Delta\pi^{e}_{t,1}$
ΔP_t^{Oil}	.0138 (.0036)***	.0153 (.0034)***	.0149 (.0037)***	.0101 (.0042)**
$\Delta RBEER_t$	.0290 (.0149)**	.0302 (.0149)**	.0314 (.0143)**	.0377 (.0151)**
$\Delta\pi_t$		-.0291 (.0113)***	-.0290 (.0113)***	-.0307 (.0105)***
ΔU_t		.0094 (.0088)	.0086 (.0092)	.0004 (.0097)
Δt_bill_t		-.2601 (.1203)**	-.2381 (.1142)**	-.1796 (.1089)*
$Dummy_2$			-.0255 (.0448)	
(ΔP_t^{Oil})*$Dummy_2$				.0122 (.0072)*
$(\Delta RBEER)$*$Dummy_2$				-.0291 (.0352)
Constant	.0127 (.0178)	.0234 (.0169)	.0277 (.0183)	.0276 (.0162)*
Robust R^2	0.1626	0.2501	0.2521	0.2802

*Note: in brackets are the standard errors. * Indicates the statistical significance at 10% level, ** indicates the statistical significane at 5% level and *** indicates the statistical significance at 1% level.*

Higher geopolitical risks, such as those stemming from international conflicts or political instability, invariably lead to an increase in oil prices (Mignon & Saadaoui, 2023). These risks, by fuelling fears of potential supply disruptions, play a pivotal role in shaping people's inflation expectations (Mignon &

Saadaoui, 2023). Our research has led to the development of Model 3, which establishes a connection between oil prices and the war conflict between Ukraine and Russia. This model provides valuable insights into the mechanisms through which geopolitical events influence economic variables. Our findings indicate that in the United States, changes in inflation expectations are not directly affected by the mere existence of a new geopolitical event, such as the war in Ukraine. Instead, these changes are influenced more significantly by the oil price shocks that such geopolitical events trigger. Inflation expectations are particularly sensitive to oil price shocks, especially to positive shocks, rather than to negative ones (Istiak & Alam, 2019).

Oil-related products, while constituting a small fraction of the Consumer Price Index (CPI) in the USA, have far-reaching implications due to their influence on the production costs of a wide array of goods (Sussman & Zohar, 2015). This influence leads to a swift and substantial pass-through from oil prices to the overall price level in the economy (Sussman & Zohar, 2015). This phenomenon underscores the interconnectedness of various economic sectors and the ripple effects that changes in a single commodity can have. Moreover, our research indicates that oil price shocks, to some extent, invariably pass through into inflation (Chen, 2009). This partial pass-through highlights the critical importance of understanding the complex linkages between oil prices and inflation, which is a central concern for central banks globally as they strive to maintain control over inflation rates (Chen, 2009).

The impact of real board exchange rate (RBEER) on inflation varies across countries, influenced by their respective inflation rates and economic structures (Ben Cheikh & Louhichi, 2016). Countries with higher inflation rates typically experience a greater degree of RBEER, while those with lower inflation rates exhibit a diminished pass-through, particularly in response to demand shocks rather than monetary policy shocks (Taylor, 2000). This variation suggests that the nature and intensity of economic shocks, as well as the responsiveness of monetary policy, play crucial roles in determining the extent of RBEER. Given the Federal Reserve's flexible approach to inflation, which does not adhere to a strict inflation-targeting monetary policy, it becomes increasingly important to investigate whether geopolitical shocks, such as the ongoing conflict between Ukraine and Russia, have significantly impacted inflation expectations in the US. However, our comparative analysis of the effects of RBEER in various countries reveals a notable decline in its impact since the 1980s (Gagnon & Ihrig, 2004). This decline, akin to the trends observed in oil prices, can be attributed to the proactive and decisive actions taken by authorities to stabilize domestic inflation rates following exchange rate shocks (Gagnon & Ihrig, 2004).

Table 9				
	(0) $\Delta\pi^{e}_{t,3}$	(1) $\Delta\pi^{e}_{t,3}$	(2) $\Delta\pi^{e}_{t,3}$	(3) $\Delta\pi^{e}_{t,3}$
ΔP_t^{Oil}	.0036 (.0030)	.0047 (.0033)	.0041 (.0031)	.0053 (.0035)
$\Delta RBEER_t$	.0065 (.0148)	.0035 (.0140)	.0041 (.0137)	.0082 (.0146)
$\Delta\pi_t$		-.0141 (.0075)*	-.0148 (.0074)**	-.0140 (.0078)*
ΔU_t		.0177 (.0100)*	.0188 (.0093)**	.0174 (.0098)*
Δt_bill_t		-.0947 (.1267)	.0090 (.1063)	-.0898 (.1288)
$Dummy_1$			-.1018 (.0704)	
(ΔP_t^{Oil})*$Dummy_1$				-.0024 (.0087)
$(\Delta RBEER)$*$Dummy_1$				-.0158 (.0417)
Constant	-.0057 (.0169)	-.0005 (.0168)	.0049 (.0172)	-.0010 (.0171)
Robust R^2	0.0155	0.0485	0.0657	0.0516

*Note: in brackets are the standard errors. * Indicates the statistical significance at 10% level, ** indicates the statistical significane at 5% level and *** indicates the statistical significance at 1% level.*

Changes in RBEER are also significant determinants of short-term inflation expectations, though their influence wanes in the long run (Nasir et al., 2020) (Koç et al., 2021). The literature suggests that inflation expectations are directly affected by exchange rate movements, highlighting the interconnectedness of international trade, currency markets, and domestic inflation. However, unlike other inflation-targeting countries, such as Brazil, there is no substantial evidence in the US that changes in RBEER persistently affect

long-term changes in inflation expectations (Nogueira, 2007). This distinction may be attributed to the differing monetary policy frameworks and economic structures between the US and other inflation-targeting nations.

Table 10				
	(0) $\Delta\pi^{e}_{t,3}$	(1) $\Delta\pi^{e}_{t,3}$	(2) $\Delta\pi^{e}_{t,3}$	(3) $\Delta\pi^{e}_{t,3}$
ΔP_t^{Oil}	.0036 (.0030)	.0047 (.0033)	.0041 (.0033)	.0053 (.0046)
$\Delta RBEER_t$	.0065 (.0148)	.0035 (.0140)	.0054 (.0139)	.0063 (.0139)
$\Delta\pi_t$		-.0141 (.0075)*	-.0140 (.0074)*	-.0135 (.0077)*
ΔU_t		.0177 (.0100)*	.0166 (.0099)*	.0182 (.0105)*
Δt_bill_t		-.0947 (.1267)	-.0631 (.1257)	-.0634 (.1224)
$Dummy_2$			-.0368 (.0360)	
(ΔP_t^{Oil})*$Dummy_2$				-.0032 (.0059)
$(\Delta RBEER)$*$Dummy_2$				-.0004 (.0003)
Constant	-.0057 (.0169)	-.0005 (.0168)	.0056 (.0191)	.0060 (.0192)
Robust R^2	0.0155	0.0485	0.0542	0.0587

*Note: in brackets are the standard errors. * Indicates the statistical significance at 10% level, ** indicates the statistical significane at 5% level and *** indicates the statistical significance at 1% level.*

Changes in actual inflation lead to significant but negative adjustments in inflation expectations, which are more pronounced in the short term than in the long term (Mehra & Herrington, 2008). This observation suggests that when people witness changes in actual inflation, they often interpret them as corrective movements resulting from monetary policy actions by the Federal Reserve. Consequently, they adjust their future inflation expectations downward, anticipating further corrective actions by the Fed. This phenomenon underscores the public's perception of the Federal Reserve's role in managing inflation and stabilizing the economy.

Geopolitical risks are inherently associated with increased uncertainty and heightened inflation risks (Caldara et al., 2023). The ongoing war in Ukraine has led to a substantial rise in inflation and a decline in economic activity, exacerbating the trade-offs confronting fiscal and monetary policymakers(Caldara et al., 2023). This situation highlights the challenges faced by policymakers in balancing the need for economic stability with the imperative to respond effectively to external shocks.

4.2 Changes in Inflation Expectation interpreted through inflation of oil inflation

To extend our analysis, we seek to investigate the impact of changes in oil price inflation on the alteration in inflation expectations, drawing inspiration from the methodology outlined in the article "Inflation Expectations and the Price at the Pump" by Carola Conces Binder(2018). While inflation expectation survey data is commonly utilized, gas price expectation data is infrequently incorporated. In contrast to many studies that compare expected inflation to actual oil or gas prices, Coibion & Gorodnichenko (2015) employ a regression model represented as:

$$\Delta\pi^{e}_{t,h} = \beta_0 + \beta_1\pi^{oil}_{t-j} + \varepsilon_t$$

Where $\Delta\pi^{e}_{t,h}$ is the change in the median inflation expectations for h year ahead and π^{oil}_{t-j} is the inflation on gas price imports in the U.S. for j months prior. $\pi^{oil}_{t-j} = log\left(\frac{P^{oil}_{t}}{P^{oil}_{t-j}}\right) \times 100$. P^{oil}_{t} is the price of oil at time t.

Where h=1,3 for one year ahead inflation expectations and three years ahead inflation expectations respectively.

Where j=1,3,6 for one, three and six months prior oil price inflation.

Table 11

Correlation between inflation expectations and oil price inflation

	$\pi^{e}_{it,1}$		$\pi^{e}_{it,3}$	
	Before	After	Before	After
π^{oil}_{t-1}	1.9808***	11.7731***	0.7628	3.8027
π^{oil}_{t-3}	0.3490	2.4282	0.3606	0.4469
π^{oil}_{t-6}	0.3882*	-1.2906	0.2167	-0.5373

In Table 11, we examine the correlation between changes in inflation expectations and oil price inflation, distinguishing periods before and after the war between Ukraine and Russia. The table presents coefficients for variables reflecting oil price inflation one,three and six months prior. Importantly, the positive coefficient on inflation of oil prices aligns with findings in Carola Conces Binder's article, which suggests that households, perceiving oil prices as highly visible, tend to consider them when shaping expectations for other prices (Binder, 2018). The results suggest a positive correlation between oil price inflation and changes in inflation expectations for various lag periods before the war, highlighting the potential influence of oil prices on expected inflation levels.

We observe a substantial increase in the change in inflation expectations for one lag period on oil prices inflation both before and after the war. Specifically, a 1% rise in oil price inflation before the war corresponds to a 1.98% change in inflation expectations one year ahead, while post-war, this effect significantly magnifies to 11.77%. This underscores a heightened sensitivity to recent changes in oil prices, consistent with the notion that individuals formulate their inflation expectations based on the most recently observed prices.

Additionally, the observations support the concept that individuals, especially small businesses, rely on more frequent observations, such as routine crude oil purchases, to shape their expectations. This aligns with economic theory, emphasising the importance of frequent transactions in shaping inflation predictions. Small businesses, constituting a substantial portion of the economy, are deemed reliable predictors of inflation

expectations due to their observational habits and limited resources for extensive research compared to larger corporations.

5. Conclusions

The conflict in Ukraine has profoundly influenced inflation expectations globally, with a particular emphasis on the United States, our primary focus in this study. Our observations reveal that short-term changes in inflation expectations in the U.S. are not directly impacted by the conflict itself. Rather, these changes are indirectly affected through the fluctuations in oil prices, which act as a significant intermediary. This indirect influence underscores the intricate link between geopolitical events and economic variables, where the effects are often not straightforward but mediated through other market factors.

Furthermore, our analysis indicates that the war in Ukraine did not directly contribute to short-run changes in inflation expectations through shifts in the real broad effective exchange rate (RBEER). This finding is particularly noteworthy as it challenges some common assumptions about the immediate economic impact of geopolitical conflicts. It suggests that while geopolitical events can have profound and far-reaching effects, their direct impact on certain economic indicators might be more limited or nuanced than initially perceived.

Another critical aspect highlighted by our research is the variation in the impact of the war on inflation expectations over different time horizons. In the short run, we observe significant effects on inflation expectations. However, these effects show considerable variation when we extend our analysis to the long run. Intriguingly, in the context of long-term changes, the war conflict does not appear to influence inflation expectations significantly. Furthermore, the changes in oil prices and RBEER, while impactful in the short term, lose their significance in the long run. These findings suggest that the shocks induced by the conflict are not persistent and tend to dissipate over time.

In the latter part of our research, which delves deeper into the effects of oil price changes, we have made an intriguing discovery. We found that one month prior to the escalation of the conflict in Ukraine, the influence of oil price inflation on one-year-ahead inflation expectations dramatically increased. This observation highlights the heightened sensitivity of inflation expectations to recent price changes in the aftermath of the conflict. It suggests that the frequency with which people encounter price changes in their daily transactions has become more crucial in shaping their inflation expectations. This heightened sensitivity to recent price

trends is a critical factor for policymakers to consider, as it indicates a more immediate and tangible impact of current events on public perception and economic outlook.

In conclusion, our comprehensive study on the effects of the Ukraine conflict on inflation expectations reveals a complex interplay of factors. While short-term impacts are evident and significant, they do not translate directly into long-term inflationary trends. This distinction between short-term reactions and long-term expectations is crucial for understanding the dynamics of inflation in response to geopolitical conflicts. It also underscores the need for a nuanced approach to monetary policy, one that considers the immediate impacts of such events but also remains cognizant of their transient nature over extended periods.

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