IMPACT OF EXCHANGE RATE REGIME CHANGES ON INFLATION AND ECONOMIC GROWTH: EVIDENCE FROM MEXICO, TURKEY, RUSSIA AND KAZAKHSTAN

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THESIS

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Impact of Exchange Rate Regime Changes on Inflation and Economic Growth: Evidence from Mexico, Turkey, Russia and Kazakhstan

Abstract

The research team used a vector autoregression (VAR) model to evaluate the impact of changes in exchange rate regimes on inflation and economic growth in Mexico, Turkey, Russia and Kazakhstan during the analysis period. The study includes multiple endogenous variables, including exchange rate (Er), consumer price index (CPI), gross domestic product (GDP) and trade balance (TB), as well as exogenous variables such as oil prices (OIL) and the US Federal Reserve interest rate (IFED). The study used impulse response functions (IRFs) and forecast error variance decomposition (FEVD) to analyze the short-term and long-term responses of inflation and economic growth to exchange rate shocks. The results reveal the impact and role of exchange rate changes on GDP, CPI and trade balance. Based on these data analysis results, the study recommends a gradual transition to a floating exchange rate regime; maintaining adequate reserves and intervening when necessary; strengthening regional and international cooperation to achieve export diversification and improve competitiveness.

Key Words: exchange rate regime, inflation, economic growth, emerging economies, macroeconomic stability, VAR model

Introduction

Research Background

Owing to a series of significant historical events and the huge impact of economic theories, the global exchange rate system has moved from a fixed to a floating system. At the beginning, the gold standard and the Bretton Woods system established fixed exchange rates, to put it simply, which is a fixed exchange rate mechanism proposed at the Bretton Woods Conference in the United States in 1944, trying to peg the U.S. dollar to gold and other countries' currencies to the U.S. dollar. In fact, the core is that everyone is dominated by gold, but it is managed indirectly through the U.S. dollar as a "middleman." However, the collapse of the Bretton Woods system signaled this marked shift towards floating exchange rate. This shift really had such a deep impact on monetary policy and the global economy. Countries now use a variety of systems, from fixed to free floats. Some researchers claimed that developing countries focus on the change from fixed or pegged exchange rate systems to more flexible ones. This change is caused by controlling inflation, keeping the economy stable, and being more vulnerable to global trade and capital shocks. (Man-Ching, Stella, Chan, 2015)

Therefore, this paper tries to focus on Mexico, Turkey, Russia and Kazakhstan, these developing countries which have all changed their fixed exchange rate regime to a floating one and try to get some insights from them.

As a close trading partner of Kazakhstan, China was considered to be included in this study. However, China's foreign exchange rate system has maintained a fixed exchange rate.

Although it has changed later, it has always been in a state of controlled floating exchange rate and has not undergone thorough policy reform. The Chinese government has stated that its exchange rate system is still a work in progress and that it plans to gradually move towards a more flexible system (Eichengreen, 2007). China's foreign exchange rate system has not been completely free during the reform process.

Originally, Mexico pegged its peso to the US dollar before 1994 to maintain a stable exchange rate. However, in late 1994, Mexico suffered a serious financial crisis (the "Mexican Peso Crisis"). Because foreign exchange reserves were run out and there was no way to keep a fixed exchange rate, the government was forced to change to a floating regime. (TIMOTHY, KESSLER. 2022)

Similarly, Turkey's Lira depreciated sharply in 2001 due to a severe banking and currency crisis, which caused the fixed exchange rate system to fail. The government then shifted to a floating exchange rate, allowing the market to determine the value of the lira. As for Russia, it implemented a managed floating exchange rate after the economic crisis in 1999, which is to stabilize the value of the Ruble through central bank intervention. However, in 2015, due to the Crimea crisis and international sanctions on Russia's actions in eastern Ukraine, as well as the collapse of oil prices, Russia abandoned its intervention in the Ruble and switched to a floating one. Before 2015, Kazakhstan pegged the Tenge to the US dollar or a basket of currencies. In 2015, due to the fall in oil prices and the devaluation of the Russian Ruble, Kazakhstan's economic pressure increased sharply. Therefore, the government decided to change to a free floating exchange rate.

To add up, all four countries were forced to switch from fixed exchange rate systems to floating exchange rates due to economic or external shocks, such as financial crises, hoping to endure external shocks and strengthen international competitiveness through exchange rate flexibility.

More importantly, their importance in the global economy cannot be underestimated. Their economic scale, specific location and trade characteristics are representative. “Mexico is the world's 15th largest economy (ranked by GDP), and has a developed manufacturing industry, mainly exporting automobiles, electronic products and oil, and it can be said that it has a huge impact on the North American supply chain (By The world bank in Mexico);

Turkey connects the Eurasian continent and is a hub for trade and transportation. It exports textiles, home appliances and agricultural products, and is also an important channel for energy transportation（Gabrielyan, H. 2022)

Russia is an energy giant, rich in oil, natural gas and mineral resources, and has a strong impact on Europe and China; Kazakhstan, as the economic core of Central Asia, also rich in oil, natural gas and metal resources, and is a crucial place of the "Belt and Road" to promote regional economic cooperation. What these countries have in common is that they are resource-dependent economies and are easily affected by external market fluctuations; the background of the reform from fixed to floating exchange rates is similar; the economy is highly open and as emerging market economies, their exchange rate policies and economic performance also have a profound impact on global capital flows and investor confidence. Therefore, such objects are important.

Problem Statement

In existing research, some scholars focus on individual countries' case studies of exchange rate regime reforms, but their research scope is limited and lacks systematic analysis. Other scholars extend their perspective to multiple economies but focus on the common features of these economies, such as geography and production structure. In comparative studies involving multiple countries (Salma Hadj Fraj, Mekki Hamdaoui*, 2018), some researchers choose only those countries that have consistently maintained a single exchange rate regime, which means these countries have not experienced any regime changes. Such research either focuses on individual countries or only considers the common characteristics of economies, indicating that research like this paper, which focuses on comparing pre- and post-reform periods, is an underexplored area.

This paper focuses on representative countries like Mexico, Turkey, Russia, and Kazakhstan. Although they may not be common on the surface, as stated in the previous section, they have all undergone exchange rate regime reforms. Now, Mexico has joined the ranks of the world’s leading economies, and its experience with exchange rate reform is highly instructive for other emerging economies.

By conducting a comparative analysis of data from multiple countries, the goal of this study is to identify the common and unique effects of different exchange rate regime changes on the macroeconomic indicators of these countries. This research will help scholars better understand the effects of historical policy changes, gain deeper insights into the economy of these countries, and provide policy recommendations for other emerging countries. This makes the research question of this study particularly significant.

Research Objectives

This study seeks to answer the following key questions:

- What is the specific impact of exchange rate policy reform on inflation?
- How do exchange rate changes affect GDP growth? Does this effect vary significantly across countries?
- Does exchange rate depreciation improve countries' trade balances?

In a word, this study basically tries to analyze the changes in inflation, GDP and trade balance before and after the exchange rate system reforms in Mexico, Turkey, Russia and Kazakhstan, and the impact of exchange rates on these variables, and also investigates the role of external factors such as IFED and world crude oil price. Comparing the research and analysis of four countries can help to understand the actual impact of exchange rate regime changes on economic performance, and also understand the differences in responses of different countries to exchange rate changes, which might offer some insights for policymakers in managing exchange rate policies and enhancing economic stability.

Literature Review

Theoretical Background

The fixed exchange rate is usually used to stabilize currency and make sustainable transactions, it also means that the domestic currency is fixed. There is another type, a floating exchange rate, which highly depends on supply and demand. It is also called self-correcting (Team, T. I. 2022). The fixed exchange rate is plain and simple to use; however, it can cause sharp economic changes that might lead to a serious economic crisis(CFI Team,2023). A floating exchange rate does not require rigid control, and has the flexibility to internal prices.

Under a fixed exchange rate**,** home currency is pegged to other countries, the government or the central bank cannot independently take monetary policy. But fiscal policy can be implemented. Turning to fiscal policy, an increase in government spending shifts the IS curve upwards, which leads to higher interest rates and income. It also causes a decrease in the exchange rate, hence currency appreciation. To stop the currency appreciation, the government increases the money supply by buying foreign currency in exchange for domestic one. It increases the LM curve.

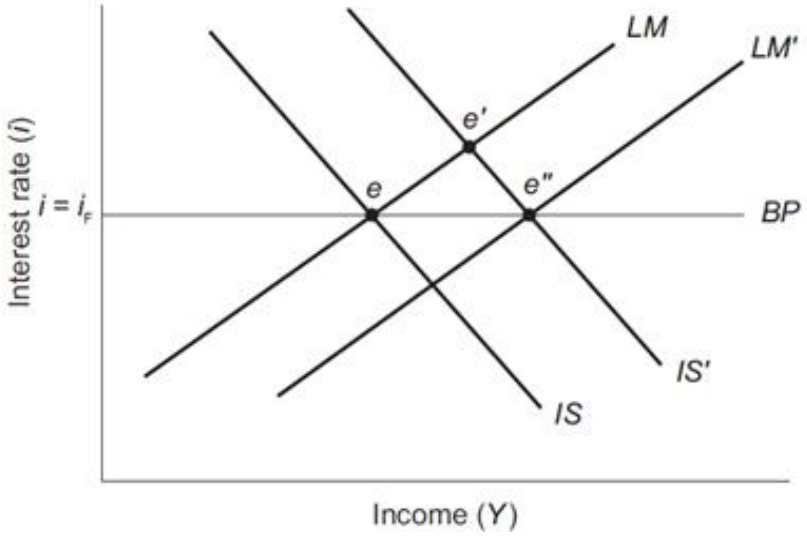

Figure 1

Also, it leads to an increase of income in the case of fiscal policy, which enhances the domestic economy; therefore, fiscal policy is a preferable option under a fixed exchange rate.

In the case of a floating rate, the central bank does not have to intervene and let the market decide. The increase in the money supply under the floating exchange rate shifts the LM curve to the right, which will make the exchange rate higher. If the prices are fixed, depreciation of the domestic currency makes domestic goods cheaper for foreigners, and so export increases. An increase in exports shifts IS to the right and conversely, IS shifts to the left if the money appreciates.

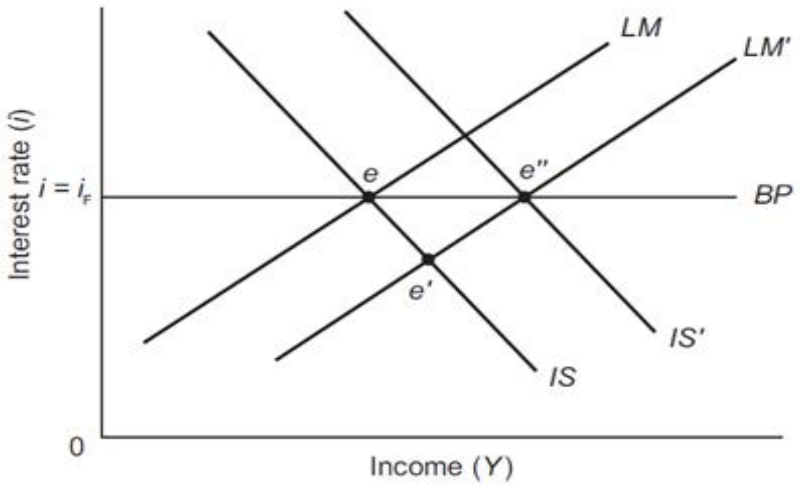

Figure 2

In the case of a fiscal policy under a floating exchange rate, a cut in taxes and increased government spending will shift the IS curve to the right. Then, the money supply surplus will cause home currency to appreciate. This appreciation makes exports fall, hence shifting the IS curve to the left, back to the initial position.

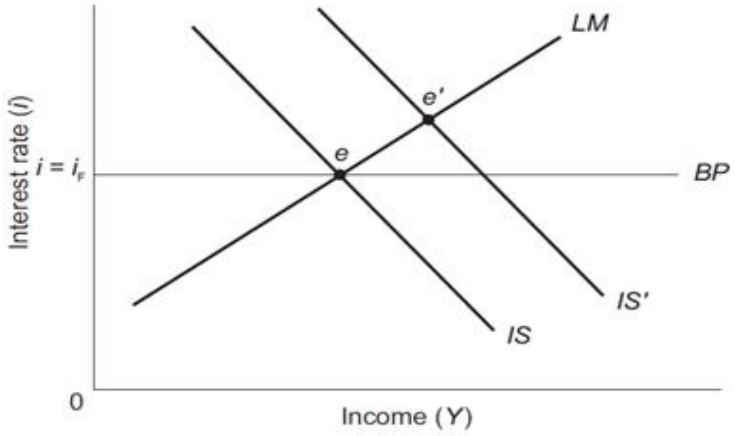

Figure 3

So, compared to the fixed exchange rate, monetary policy in the floating exchange rate can increase the level of domestic income. But unlike the fixed exchange rate, the floating exchange rate is inefficient with fiscal policy because crowding out takes place and at the end the exchange rate goes back to its initial position and domestic output stays the same.

Therefore, different exchange rate systems make some of our policies effective and others ineffective. This is a rather complex issue and changing it will bring about many changes and challenges, so a great deal of researchers have always been keen to study it.

Empirical Studies

It can be said that the impact of exchange rate regime changes on inflation and economic growth has always been a hot topic with considerable concern in the economic field. At the same time, exchange rate fluctuations affect capital flows and investment decisions, so studying them helps international investors understand the impact of these countries' exchange rate policies on risks and returns. So studying how monetary policy works under floating exchange rates can also be said to be an important topic in finance for analyzing capital flows and macro-financial stability.

From an economic perspective, (Domac et. al., 2001) studied the impact of exchange rate regimes on inflation and growth performance in transition economies.Their results showed that no single exchange rate system was better than the others when it came to driving economic growth. (Miles, 2008) also believes that the correct and suitable exchange rate system can significantly affect inflation and economic growth. (Luporini, 2008) found that tight monetary policy can have an immediate impact on the economy, while exchange rates and prices take a bit

more time to be affected. As for one of our research subjects, Russia, other scholars such as (Rasoulinezhad et. al., 2020) focused on Russia's geopolitical risks and energy transition and concluded that the economic growth and inflation rates have a long-term negative impact on energy transition, while the exchange rate actually has a positive effect. (Ybrayev, 2020) studied the impact of real exchange rate management on economic growth in Kazakhstan, aiming to see the impact of real exchange rate management on economic growth in export performance. (Asgharpour et al., 2024) pointed out that smaller differences in exchange rates make monetary policy more effective at controlling inflation. However, if the exchange rate goes too high compared to the monetary base, it leads to more inflation and slower GDP growth, highlighting the importance of keeping the exchange rate stable.

From a financial perspective, (Akash et. al., 2011) studied the relationship between macroeconomic variables and stock returns on the Karachi Stock Exchange and figured out the important factors affecting stock. In addition to this, (Bibi et al., 2014) used a method called dynamic ordinary least squares (DOLS) to estimate how exchange rates and foreign direct investment contribute to economic growth in Pakistan. (Ahmed, 2019) studied the asymmetric impact of exchange rate changes on Egyptian stock returns. Additionally, (Ruslan, 2020) used a VAR model to examine the relationship between Indonesia’s foreign direct investment and economic growth, trade, exchange rate, industrial output, and interest rates.

The benchmark study of this article (Thanh Tung Hoang rt.al, 2019) used a model containing 6 endogenous variables (exchange rate, money supply, exports, imports, GDP, CPI) and 2 exogenous variables (international prices, US interest rates) The VAR model studies the impact of Vietnam's exchange rate on inflation and economic growth from 2005 to 2018. The study found that changes in exchange rates impact inflation in several channels, and they also

influence economic growth through factors like total demand and monetary factors. It helps to understand the complex relationship between exchange rate, inflation and economic growth in the case of Vietnam, a developing economy. The four countries studied in this article are like Vietnam. These other developing economies also experience complex interactions between exchange rates, inflation and economic growth. Exchange rate fluctuations affect inflation and GDP growth through various channels. Policymakers in these countries also need to be careful with exchange rate policies in order to control inflation and economic stability.

Overall, these studies help in understanding how exchange rate regimes affect economic factors over time and provide insights into how exchange rate changes influence macroeconomic and macro-financial aspects.

Gaps in the Literature. Existing literature mainly examines the impact of exchange rate changes on inflation or economic growth in a single country or in economies that are similar, lacking systematic multi-country comparative research. In particular, there has been very limited research on Kazakhstan. As an emerging economy, it can derive significant insights from Mexico's experience. Moreover, comparisons with Turkey, which is also located in Asia, and Russia, which experienced similar reforms, help to gain experience, providing valuable insights for Kazakhstan's own economic development.

With the deepening trend of global economic integration, exchange rate fluctuations are becoming more crucial, which is one of the reasons to study in recent years. Central banks worldwide try to address economic stability issues, and will take into account the impact of exchange rate policies. According to the summary by Martin Guzman, Jose Antonio Ocampo, and Joseph E. Stiglitz (2018) Real exchange rate policies for economic development, evidence

from Asian economies such as Japan also shows that historical experience supports the fact that stable and competitive exchange rate policies help economic development (see Rodrik, 2008; Razmi et al., 2012).

Most of the time, Kazakhstan is included in research concerning EMDE (Emerging Market and Developing Economies) countries (Carlos Arteta, Steven Kamin, and Franz Ulrich Ruch, 2022,World Bank Document), emerging economies, or energy-exporting nations in various financial and economic studies. However, such research often considers Kazakhstan as part of a larger group, lacking an in-depth analysis of the specific economic and financial characteristics of Kazakhstan itself. As a result, there is little literature that reveals Kazakhstan's unique development in areas such as economic reform and exchange rate regimes. This paper aims to contribute to the study of Kazakhstan by conducting a focused analysis of its macroeconomic data and policy reforms, comparing it with other experienced countries. This will help address the gap in existing literature while providing useful references for other emerging economies.

By analyzing the impact of exchange rate regime reforms on different countries, this paper not only fills a gap in the current academic field but also provides valuable references for policymakers. The findings of this research will help in understanding the economic functioning of these countries and can also serve as policy recommendations for other countries at a similar stage of development. Exploring this issue has immense potential contributions to both academia and industry.

Methodology

This study implements a multi approach to analyze the effects of exchange rate regime reforms in Mexico, Turkey, Russia, and Kazakhstan. The methodology is Ordinary Least Squares (OLS), Vector Autoregression (VAR), Impulse Response Functions (IRF), and Variance Decomposition to comprehensively assess the impacts.

It is common in research to use the OLS method to estimate the linear relationship between exchange rates and economic indicators such as real GDP, CPI and trade balance. For example, Tran Thi Thanh Huyen (2018) summarized the relevant literature, pointing out that Campa and Goldberg (2005) and Ghosh and Rajan (2009) used ordinary least squares (OLS) to explain the impact of exchange rate changes on the volatility of domestic price indices

At the same time, some scholars directly use the VAR method to study the dynamic relationship between multiple endogenous and exogenous variables (Thanh Tung Hoang, Van Anh Nguyen Thi and Hoang Dinh Minh, 2019; Tran Thi Thanh Huyen, 2018).

The VAR model does not require a pre-set causal relationship and can effectively capture the dynamic interaction between endogenous variables. Its framework can improve prediction accuracy by integrating multiple economic indicators, and has stronger prediction ability than simple models (Chin & Lee, 2024). VAR can also explore the lag effect and feedback mechanism between variables, thereby more comprehensively revealing the dynamic impact of exchange rate reform on the economy. In addition, the impulse response function (IRF) can simulate the dynamic impact of exchange rate shocks on GDP, CPI and trade balance, and

present the short-term and medium-term effects of the reform. Variance decomposition quantifies the contribution of exchange rate changes to the fluctuations of economic variables, and further distinguishes the relative importance of factors.

This paper plans to combine OLS and VAR methods, using data covering about 20 years for each country and dividing it into pre-reform, post-reform and whole periods. Through time series and cross-national comparative analysis, it will more comprehensively explore the impact of exchange rate system reform on the economy.

Research Design

The data used in the OLS and VAR models in this paper are quarterly data because of their higher time resolution and flexibility. Compared with annual data, they can reflect the changing trends of economic variables (such as GDP, CPI and exchange rate) in the short term in more detail. Considering that these economic variables are not suitable for higher data frequencies such as monthly, quarterly data has higher stability and could reduce the possible deviations.

This paper selects Gross Domestic Product (GDP), Consumer Price Index (CPI) and Trade Balance(TB) as dependent variables, which are important indicators of a country's economic performance. The independent variables include Nominal Effective Exchange Rate (ER) and International Foreign Exchange Reserve (IFED), among which International Foreign Exchange Reserve is an exogenous factor in the VAR model. The selection of the variables is inherited from previous studies.

Considering the particularity of Kazakhstan and Russia as energy exporters, this paper further selects World Oil Price as an external shock factor to better capture the impact of energy market fluctuations on their economy. This choice is similar to that of Tran Thi Thanh Huyen, 2018.

In terms of the selection of exchange rate, this paper selects the nominal effective exchange rate (ER). Anh (2015) pointed out that ER can more comprehensively reflect the impact of exchange rate fluctuations on the import price index and the consumer price index (CPI), especially when studying international trade and inflation. It has higher applicability. This article also agrees with this view and believes that ER is a more suitable exchange rate measurement indicator for this study.

This study will use the entire sample period as the "Whole period." The time from the starting year to the year and quarter when policy reforms were implemented in each country will be classified as the "Pre period," while the time from the reform onwards until the end of the sample will be the "Post period." For each country, the analysis will be conducted in three steps: first, examining the overall trends, and then comparing the pre- and post-periods to see if the policy changes had a significant impact on the economy.

Data Collection Method

Data Sources for Variables Used			
No.	Name	Symbol	Source
1	Consumer Price Index	CPI	Bloomberg, IFS
2	Gross Domestic Product	GDP	Bloomberg ECST
3	Trade Balance	TB	Bloomberg ECST
4	Nominal Effective Exchange Rate	ER	IFS
5	FED Interest Rate	Ifed	FRED
6	Crude Oil Prices:Brent - Europe	OIL	FRED

Table1. Data Sources for Variables Used

For all countries studied, most data are in U.S. dollars (USD). GDP data for each country are from official sources and have been seasonally adjusted. Data for Kazakhstan are from the first quarter of 2005 to the first quarter of 2024; data for Russia are from the third quarter of 2005 to the first quarter of 2021. Due to some complex reasons, Russia's trade balance and nominal effective exchange rate (ER) data since March 2022 are missing and incomplete, so the authors decided to use the time range when Russia's data are complete for the study. Mexico's data span from the first quarter of 1985 to the fourth quarter of 2020, and Turkey's data are from the first quarter of 1994 to the fourth quarter of 2022.

Handling Missing Data

Due to data availability issues, specific handling approaches were used. For Russia, due to incomplete exchange rate data after 2022, we exclude GDP and other indicators for 2024 in order to maintain consistency of the dataset. In the case of Kazakhstan, quarterly trade balance data is only available from 2009 onwards, so we converted annual data into quarterly estimates to fill the gap. For Turkey, only up to nine years of pre-reform data were found, hence the pre-period in Turkey's analysis was reduced to nine years instead of ten.

Data Analysis Method

Before carrying out the specific analysis steps, the author first tested the stability of the data and used the ADF (Augmented Dickey-Fuller) test to ensure that the data is stationary when performing VAR modeling.

OLS. The study will first apply the OLS method, and the specific OLS models for Kazakhstan and Russia are listed below (note that for Mexico and Turkey, one of the variables is "IFED" instead of "OIL"):

Analyzing the impact of exchange rate regime changes on GDP;

Analyzing the impact of exchange rate regime changes on CPI;

Analyzing the impact of exchange rate regime changes on trade balance.

VAR. The general k-type VAR model has the following form:

$$Yt = A1\ Yt-1 + A2\ Yt-2 + \cdots + Ap\ Yt-p + BXt + \epsilon t$$

In which the endogenous variables in the VAR model include: GDP (gross domestic product), CPI (consumer price index), ER (nominal effective exchange rate) and TB (trade balance). The exogenous variable is OIL (crude oil price).

After conducting OLS regression analysis, this paper conducted a robustness test to reduce the impact of heteroskedasticity on the estimation results and ensure the robustness of the coefficient estimation.

For the VAR model, this paper conducted a Granger causality test to determine whether there is a causal relationship between different variables and further clarify the mutual influence between variables. At the same time, a variance decomposition (FEVD) was also conducted to identify the source of fluctuations in each variable and understand the contribution of exchange rate shock to the variables.

Data Analysis and Results

In this section, we will present the data results for Mexico, Turkey, Kazakhstan, and Russia, and give some analysis of the data results.

Mexico

For the data dealing part,logs have been taken for GDP, CPI, exchange rate and trade balance. After the ADF test, log_cpi is already stationary in its original form (p-value < 0.05), so no differencing is needed. All other variables required first differencing to achieve stationarity for subsequent analysis.(see appendix A)

Whole Period (1985Q1-2020Q4)

OLS： The analysis aims to examine the relationship between exchange rate changes, GDP, CPI, and trade balance, with IFED included as an additional independent variable. From the results(see in appendix A3), for GDP Change (d_log_gdp), the coefficient of exchange rate change (d_log_exchange_rate) is 0.0902, which is statistically significant (p-value = 0.027). This indicates that exchange rate changes have a positive impact on GDP. However, the impact of CPI, trade balance (d_log_trade_balance), and d_ifed on GDP is not significant. And OLS results for CPI (log_cpi) shows that as the exchange rate rises, CPI falls. However, the impact of GDP, trade balance, and foreign exchange intervention on CPI is not significant. It can be seen that exchange rate changes (d_log_exchange_rate) have a negative impact on trade balance, with a coefficient of -12.3341. But GDP, CPI, and IFED have no significant impact on trade balance.

Although the OLS model provides some information, the fit is not ideal. It can be seen from R-squared of GDP (d_log_gdp):0.0765; CPI (log_cpi)0.1640; Trade balance is 0.0485 that there is a low R-squared value, indicating that the model cannot explain most of the changes in the dependent variable. So in order to improve the reliability of the model, this study added a VAR model for more accurate analysis.

VAR Model: The lag order was determined using multiple criteria. The results show that lag 3 is optimal based on AIC and HQIC, which have the lowest values compared to other lags. The likelihood ratio (LR) test also shows that lag 3 is the most suitable for capturing the dynamic interactions between the variables.

The results of the VAR model for lag 3, showing how the past values of the variables affect their current values: The coefficient of the third lag of d_log_gdp (GDP change)

(`L3.d_log_gdp`) is -0.721, indicating that past GDP growth has a negative impact on current GDP growth. This suggests that there is a reversal effect, i.e., high growth in the past may lead to slower current growth.The third lag of CPI (`L3.log_cpi`) has a positive impact on the current CPI with a coefficient of 0.00392 , which means that higher CPI values in the past may push up the current CPI. The third lag of exchange rate changes (`L3.d_log_exchange_rate`) has significant effects on several variables: It has a positive effect on GDP growth (0.0813,); It has a negative effect on CPI (-7.257,), indicating that exchange rate depreciation can reduce inflation; It has a positive effect on trade balance (0.470,), indicating that exchange rate changes can improve trade balance; The trade balance has a slightly positive effect on GDP growth (0.00150,) and a negative but insignificant effect on CPI (-0.0468,).The US Federal Reserve interest rate (`d_ifed`) has a positive effect on GDP growth (0.0102,), but has no significant effect on CPI or trade balance.

The Granger causality test shows which variables affect other variables over time: The results for GDP change show that past GDP growth significantly affects variables such as CPI, exchange rate, and trade balance.CPI Granger causes exchange rate changes (d_log_exchange_rate) at a very high significance level, indicating that inflation is a driver of exchange rate changes. It also has a marginal effect on trade balance.

In summary, the VAR model results show that exchange rate changes significantly affect GDP growth and trade balance, but the relationship with CPI is more complex. Granger causality tests show that GDP and CPI are the core drivers of other variables, while the exchange rate is more responsive to past economic conditions. The Federal Reserve interest rate (IFED) affects GDP growth, but does not directly affect CPI or trade balance.

IRF Results(See Appendix Figure A1): In this study, we further use the impulse response function (IRF) to analyze the interaction of economic variables such as exchange rate, CPI, GDP and trade balance, mainly by simulating the dynamic impact of exchange rate fluctuations on these variables, trying to understand how they interact in the short and long term.

Short-term impact of exchange rate changes on GDP: The initial impact of exchange rate changes on GDP is significant, which gradually weakens and stabilizes over time. Long-term impact: As time goes by, the impact of exchange rate changes gradually weakens. The impact of exchange rate changes on CPI is that , in the short term, the initial impact of exchange rate changes on CPI is significant, and then gradually weakens. But long-term trend: As time goes by, the impact of exchange rate on CPI gradually weakens.The initial and mid-term impact of exchange rate changes on trade balance is significant, but as time goes by, the impact of exchange rate changes on trade balance gradually weakens.

The overall conclusion is that in the short term, exchange rate changes have a significant impact on GDP, CPI and trade balance, mainly through changes in import and export prices. This short-term shock is most obvious in the early stage. In the long run, as time goes by, the impact of exchange rate changes gradually weakens. Overall, this is consistent with the analysis results of our Benchmark Study on Vietnam.

FEVD: From the FEVD chart for GDP (see Figure A3 in the Appendix), we can see that the contribution of exchange rate changes to GDP is small in the early stage, but increases significantly in the later stage. This shows that exchange rate fluctuations have an important long-term impact on GDP, affecting economic activity by affecting export and import prices.

The trend of GDP's own contribution is the largest in the early stage, and then gradually decreases. This is expected, because GDP's own fluctuations can best explain its future changes, especially in the short term. The trade balance contributes less to GDP in the early stage, but gradually increases over time. This shows that the trade balance has a certain long-term impact on GDP. But overall, the exchange rate and trade balance have a certain short-term impact on GDP, especially through import and export prices and trade activities. The impact of CPI is small and stable. However, GDP's own fluctuations are most significant in explaining its future changes.

Similarly, from the analysis of the IRF CPI chart(Figure A2 FEVD CPI) the direct impact is usually manifested as a significant initial impact response of a variable to the target variable in the IRF chart, and the changes are rapid. The indirect impact is manifested as a small and delayed impact response of a variable to the target variable in the IRF chart, and the changes are relatively gentle. Therefore, it can be concluded that exchange rate fluctuations have a significant impact on CPI, especially in the short term. GDP growth has an indirect impact on CPI. The direct impact of the trade balance on CPI is small and stable, indicating that the trade balance may indirectly affect. CPI itself has the strongest explanatory power for its future fluctuations.

Figure A4 in the appendix shows that in the short term, the short-term impact of exchange rate and GDP changes on trade balance is significant. The short-term impact of CPI is small and stable. The fluctuation of trade balance itself has the strongest explanatory power in the short term.The long-term trend is that the impact of exchange rate and GDP on trade balance gradually emerges, and the impact of exchange rate fluctuations in the long term is particularly important. Although the direct impact of CPI is still small, its indirect impact may gradually

emerge in the long term. The trade balance itself still has important explanatory power in the long term, but its contribution gradually decreases.

At the time, Mexico was in the fixed exchange rate regime.And for the pre-period and post-period data preprocessing is the same as the whole-time processing. The logarithm is applied and ADF TEST is performed to perform differentiation to ensure that the data is stable and not affected by noise.

OLS (Appendix Table A8):The impact of all independent variables (d_log_exchange_rate, d_log_cpi, dd_log_trade_balance, dd_ifed) is not significant. Similarly, the impact of all independent variables (d_log_exchange_rate, dd_log_gdp, dd_log_trade_balance, dd_ifed) is not significant. It should be noted that the impact of d_log_exchange_rate (exchange rate change) is close to significant (p=0.071), but it has not yet reached the significant level. The Same result for trade balance.These results show that the independent variables selected in the current model do not have a significant impact on the target variable. OLS does not fit well, and so it can be said that the OLS failed.

VAR: The optimal lag-order for the VAR model is 4. This VAR results shows that past values of GDP, CPI, and exchange rates explain themselves the most, the trade balance and the Federal Reserve interest rate appear to have limited direct impacts in this period. From the results of Granger causality tests, it can be seen that the individual and all independent variables (CPI, exchange rate and trade balance changes) on the target variables (GDP changes, CPI, exchange rate and trade balance changes) are not significant. These results show that during the fixed exchange rate period, the dynamic relationship between these economic variables is weak.

IRF and FEVD Results: From the IRF chart, we can get that the exchange rate shock has a small short-term impact on CPI and GDP, but has a greater impact on the fluctuations of the trade balance and exchange rate itself. From the results of FEVD, the exchange rate and trade balance have an impact on GDP in the short term. In the long term GDP's own fluctuations are an important factor in explaining its future changes. CPI's own fluctuations have a significant impact on its future changes in the short term. On the contrary, GDP changes, trade balance and exchange rate have a small short-term impact on CPI. As time goes by, the impact of CPI itself gradually weakens, but still maintains a certain level of impact. As for trade balance, in the short term, exchange rate and GDP changes have a significant impact on trade balance, but the fluctuation of trade balance itself has the strongest explanatory power in the short term, and the impact of GDP and exchange rate gradually emerges over time. The overall impact of CPI on trade balance is small.

Post Period (1994Q1-2020Q4)

OLS results: Overall, the OLS model does not fit well under both exchange rate regimes (fixed and floating). It may not fully explain the relationship between exchange rate, CPI, GDP and trade balance (See AppendixTable A13). Therefore, this study moves to the VAR model.

VAR: GDP has a small and insignificant impact on itself. Changes in the US Federal Reserve interest rate (d_ifed) have a significant positive impact on GDP, indicating that the US monetary policy has a certain impact on Mexico's economy. Exchange rate changes have a significant positive impact on CPI, and changes in the trade balance also have a significant impact on CPI. The changes in the exchange rate itself have a significant self-impact. Changes in

the trade balance have a significant positive impact on changes in the exchange rate and the self-adjustment mechanism of the trade balance is strong. In general, the exchange rate significantly affects the changes in CPI and the exchange rate itself in this model, but the impact on GDP and the trade balance is relatively weak. The trade balance has a significant impact on itself. Changes in the exchange rate affect CPI, indicating that fluctuations in the exchange rate may affect the price level by affecting import and export prices. The US Federal Reserve interest rate has a significant impact on GDP, indicating that the impact of international financial factors on the Mexican economy cannot be ignored.

Judging from the results of the Granger causality test, CPI is the only variable that is significantly affected by the lag of exchange rate and trade balance, and the exchange rate and trade balance have a direct Granger causal relationship with CPI.

IRF and FEVD Results: From the IRF(Figure A9), GDP and trade balance respond weakly to exchange rate shocks and are not significant; CPI responds significantly to exchange rate shock; the dynamic adjustment of the exchange rate itself shows that the shock is short-lived, and the market will gradually restore equilibrium. Overall, the impact of exchange rate shocks is mainly reflected in the short term.

From the perspective of FEVD(Figure A9-A11 in the appendix), the forecast error of GDP growth rate is mainly determined by its own impact, and the impact of other variables (such as trade balance, CPI, exchange rate) can be ignored. The fluctuation of CPI itself has a significant impact on its future changes. The short-term impact of GDP changes, trade balance and exchange rate on CPI is small. Over time, the impact of CPI itself gradually weakens, but still maintains a certain level. The impact of GDP, trade balance and exchange rate increases

slightly in the long term, but is generally small. The fluctuation of trade balance itself has a significant impact on its future changes. GDP changes and exchange rate have a greater short-term impact on trade balance; GDP and exchange rate have a significant impact on trade balance in the long term. The impact of CPI on trade balance is relatively small overall.

Overall, fixed exchange rate regime limits exchange rate flexibility. Exchange rate fluctuations in the short term are more affected by internal mechanisms, and the role of external variables is weaker. Under a floating exchange rate system, the exchange rate has a significant impact on CPI, but a relatively small impact on GDP and trade balance. Changes in the Federal Reserve interest rate have become an important external influencing factor, reflecting the sensitivity of the Mexican economy to global financial conditions.

Turkey

For Turkey, this paper used the same data processing and research as Mexico, and adopted a phased study of the whole time period(1995Q-2022Q4), pre-period(1995Q1-2000Q4) and post period(2001Q1-2022Q4). It was also found that the OLS fit was very low, so the VAR model was adopted. The following mainly discusses the conclusions of the VAR model.

Mexico and Turkey have some similarities and differences in the relationship between economic variables. Both countries' GDP and CPI have strong inertia, that is, past performance will have a significant impact on the future. Their exchange rate fluctuations are mainly affected by external factors, such as changes in the IFED. In addition, the relationship between the economic variables of the two countries is relatively weak, and most of them adjust themselves. For example, the trade balance and exchange rate have a certain recovering ability. Both countries are easily affected by the international financial environment, especially the changes in

the Fed's policies, which have a very obvious impact on the exchange rate. However, they also have differences. Mexico's CPI is more sensitive to exchange rate changes, while Turkey's CPI is more affected by changes in the trade balance. According to the IRF, exchange rate changes have a direct impact on GDP, CPI and trade balance as well as their own changes. From the perspective of FEVD, the fluctuations of each variable itself in the short term have a significant impact on its future changes. In the long run, exchange rate changes and GDP changes gradually show their importance in explaining future changes in the trade balance and GDP. The long-term influence of CPI itself is still large, but the indirect impact of exchange rate and GDP is also increasing.

In the fixed exchange rate stage, that is, the pre-period, the exchange rate shows Turkey's GDP is mainly driven by its own inertia, that is, the past economic performance has a great impact on the present. If economic growth slows down and demand decreases, there will be pressure for prices to fall. Exchange rate changes are closely related to the price level (CPI). If prices rise, it may put pressure on the exchange rate. In addition, changes in the Federal Reserve interest rate also have a great impact on the exchange rate. The exchange rate also shows a certain ability to self-adjust. Changes in the trade balance are mainly related to economic growth, that is, when the economy performs well, the trade balance tends to improve.

The volatility of each variable in the short term has a significant impact on its future changes. GDP and trade balance have the largest short-term volatility, while CPI has a smaller short-term volatility. In the long term, changes in exchange rates and GDP gradually become important in explaining future changes in trade balance and GDP. The long-term influence of CPI itself is still large.

Analyzing the post-period results, we can find that GDP growth mainly relies on its own inertia. In both countries, improvements in trade balance have a significant positive effect on GDP growth. In addition, exchange rate fluctuations in Mexico and Turkey are mainly driven by external factors (IFED). Domestic variables (such as GDP and CPI) have no significant short-term impact on exchange rates. Turkey's CPI is significantly negatively affected by changes in trade balance. In addition, GDP itself has the greatest explanatory power for its future changes, especially in the short term. CPI itself has the greatest explanatory power for its future changes. The same is true for the trade balance. In summary, changes in exchange rates and GDP gradually show their importance in explaining changes in trade balances and GDP. The long-term influence of CPI itself is still large, but the indirect impact of exchange rates and GDP is also increasing. Exchange rate changes have a significant impact on various economic variables by affecting import and export prices.

Kazakhstan

After differential processing (see Table C1. and Table C2), variables such as Kazakhstan's GDP, exchange rate, and international oil prices have all become stable, while CPI and trade balance are already stable under the original data, and the p-values are all less than 0.05.

Whole Period (2005Q1-2024Q1)

OLS: Regression analysis of GDP (Table C3. OLS results) shows that exchange rate (d_log_NEER), oil price (d_log_OIL), CPI (d_CPI) and trade balance (d_TB) do not significantly affect Kazakhstan's GDP growth. The regression coefficient of the nominal effective exchange rate is -0.0279, and the p-value is 0.288, indicating that the impact of

exchange rate changes on GDP is not significant. The impact of changes in oil prices and other factors also did not reach significance.

Exchange rate changes have a significant impact on CPI. The regression coefficient of the nominal effective exchange rate is 3.1956, and the p value is 0.000. The growth of GDP (regression coefficient is 5.7713, p-value is 0.039) also has a positive impact on CPI. Other variables (such as oil prices and trade balance) have smaller or insignificant effects on CPI.

As for impact on trade balance, the regression coefficient of the nominal effective exchange rate is -11.7293 with a p-value of 0.032, indicating that exchange rate depreciation appears to have a negative impact on the trade balance, which is contrary to theoretical expectations. Changes in oil prices and GDP have no significant impact on the trade balance, and changes in CPI have almost no impact on the trade balance.

In all regression models, the R^2 values are relatively low, which can be explained by the poor fit of the model. The study temporarily thinks that the OLS model has a weak ability to explain the exchange rate reform in Kazakhstan on economic variables.

However, the OLS regression provides preliminary insights for the analysis, and the OLS results in the subsequent stages will also be used as a reference and will not be elaborated in detail. This also gives the motivation to use the VAR model.

VAR: First, it is very important to determine the lag term of the VAR model and the choice of the best lag term. Table C4 shows that in this VAR model, the best lag term is lag2, so the results will only show lag2 and description for other terms will not be elaborated.

According to the analysis results of the VAR model (Table C5. VAR results), in terms of the impact on GDP growth (d_log_GDP), the coefficient of GDP lags for two periods is -0.00105 (standard error is 0.121), indicating that the impact on current GDP growth is not significant. The effects of CPI, nominal effective exchange rate, trade balance, and changes in oil prices on GDP growth have not reached significance.

Regarding the impact of CPI, the lagged two-period coefficient of GDP is -4.010 (standard error is 4.387), which has a negative impact on CPI but is not significant. Changes in oil prices have a positive impact on CPI, with a coefficient of 0.336 (standard error of 0.400), but it is also not significant.

In terms of the impact of the nominal effective exchange rate (d_log_NEER), the two-period lag of GDP has a significant negative impact on the nominal effective exchange rate, with a coefficient of -1.250 (standard error is 0.471, P value <0.01). Changes in oil prices have a significant negative impact on the nominal effective exchange rate with a coefficient of -0.0902 (standard error is 0.0429, P value <0.05).

Regarding the impact of trade balance (d_TB), the two-period lag of GDP has a significant positive impact on trade balance, with a coefficient of 61.34 (standard error of 32.32, P value <0.1). The two-period lag of CPI has a significant positive impact on the trade balance, with a coefficient of 1.943 (standard error of 0.898, P value <0.05).

The Granger causality test is similar to the VAR results, showing that GDP and Trade Balance have a significant Granger causality on ER, and GDP and CPI have a significant Granger causality on the trade balance.

IRF: The response of the consumer price index (CPI) to the nominal effective exchange rate shock (Figure C1. IRF) shows that the response of CPI is relatively stable and has a small volatility, indicating that the direct impact of changes in ER on CPI is relatively limited; the trade balance showed a significant increase in the early stage after the ER shock. Fluctuations, then leveling off, with effects gradually weakening and stabilizing over time. For GDP, the response curve has almost no significant change within the time step and remains near zero, indicating that changes in ER have small impact on GDP or almost no significant impact.

FEVD: For GDP, GDP itself makes the largest and most persistent contribution, while ER and trade balance have an impact on GDP, and then gradually weaken and stabilize (Figure C2). Similarly, CPI itself makes a large and lasting contribution to shock, while ER and GDP have an initial impact on CPI, and then gradually weaken and level off (Figure C3). The contribution of the trade balance itself to the forecast error variance is the strongest. The initial impact of the exchange rate and GDP on the trade balance is more significant, and then gradually and stabilizes. (Figure C4)

Pre Period (2005Q1-2015Q2)

VAR results: In this phase of the VAR model, the optimal number of lags is 4. It should be noted here that since there are many unknown factors in the data collection or processing process, some results may have abnormal or extreme values. Although we have tried our best to eliminate or adjust these problems, they may still have a certain impact on the results.

According to the results of the VAR model, the lagged effect of GDP shows a significant negative impact in the first and second periods. This means that changes in GDP growth have a negative effect on other variables (such as exchange rates, price index, etc.) during these two lag

periods. Specifically, in the second period, changes in the exchange rate (ER) had a significant positive impact on other economic variables. Furthermore, CPI shows some positive effect on other variables in lag 3, although its p-value is close to 0.05, which is close to the significance level. On the other hand, the impact of trade balance (TB) on other variables in the model is not significant, which may reflect that the impact of foreign trade has a strong lag and is difficult to be reflected in the short term. The fluctuation of crude oil price (OIL) has a relatively small impact on other economic variables in the model and fails to show significant effects.

Granger causality test shows that GDP has a significant Granger causality on ER, but does not show significant effects on CPI and TB. ER has a significant Granger causality on CPI and has a significant impact on GDP, but its impact on TB is not significant. CPI has a significant Granger causality on GDP but not on ER and TB. TB has significant Granger causality on GDP, ER and CPI.

IRF

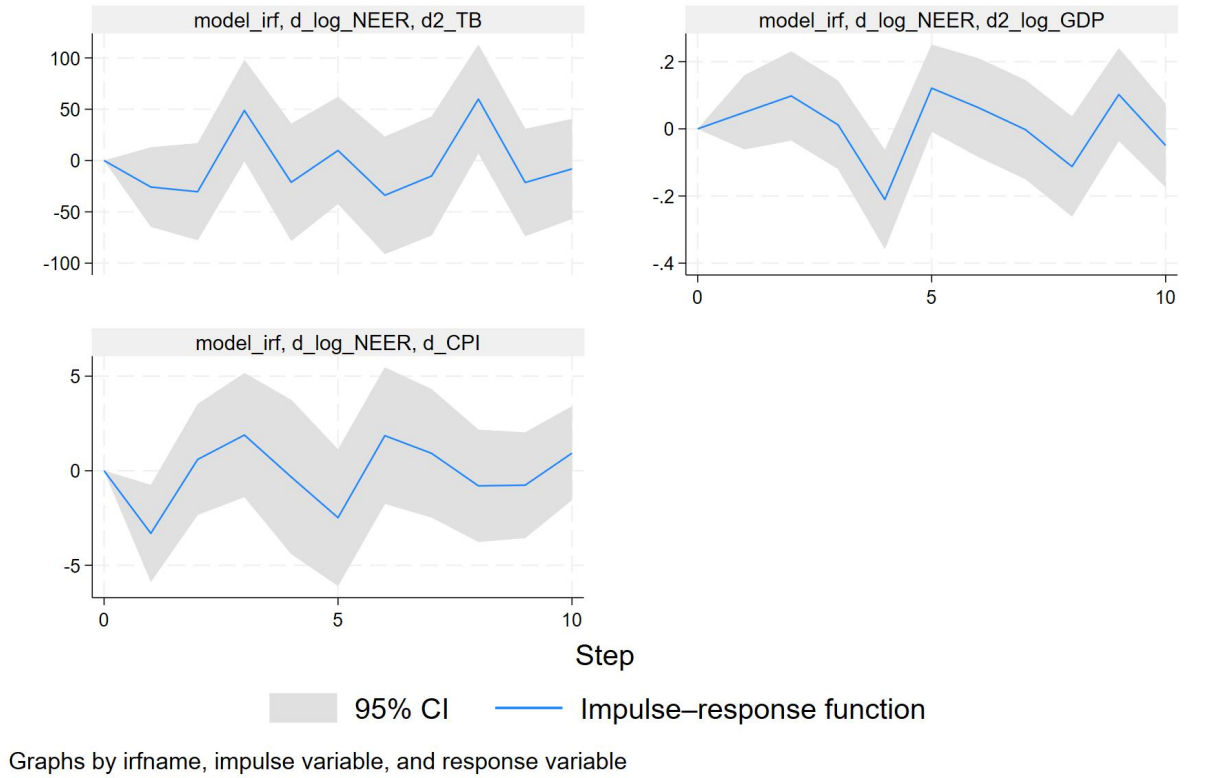

Figure C9. IRF

Based on the analysis of the impulse response function (Figure C9. IRF), we can rank the responses of different economic variables after the exchange rate (ER) shock, sorted from high to low according to the significance of the response as follows:

Trade balance (TB): The response to the ER shock is the most significant, showing a significant negative response initially, and then gradually recovering and stabilizing.

Consumer Price Index (CPI): The response to the ER shock is relatively small and stable. Although there are some fluctuations, the overall change is not large and gradually approaches zero.

Gross Domestic Product (GDP): The magnitude of the response to ER shocks is minimal, and the curve fluctuates almost around zero, indicating that changes in ER have little direct impact on GDP.

FEVD: Based on the forecast error variance decomposition (FEVD) analysis of different economic variables for GDP, CPI and trade balance (TB), the following conclusions can be drawn (Figure C6. -C8).

On GDP: CPI and ER are the same, the contribution is small in the early stage, but increases slightly over time. The contribution of trade balance to GDP is small, but the impact gradually increases and stabilizes over time.

On CPI: GDP, ER and TB are the same, the contribution is small in the early stage, but increases slightly over time. In comparison, GDP has a greater impact, followed by ER.

On TB: GDP has a more significant impact on the trade balance from the beginning , but the impact gradually weakens and stabilizes over time. CPI and ER have a more significant medium- and long-term impact on the trade balance.

Post Period (2015Q3-2024Q1)

VAR results: First, the analysis of the GDP shows that the lags of GDP (1 to 4 periods) do not have a significant impact on the current GDP growth rate. The effect of ER (Exchange Rate) is significant in the previous period, where changes in the exchange rate positively affect GDP growth (coefficient = 0.146, p-value = 0.034). Meanwhile, the lag 4 effect of the exchange rate shows a negative impact (coefficient = -0.125). The effect of CPI growth rate on GDP growth is more pronounced, especially in lags 1, 2, and 3, where CPI changes significantly negatively affect GDP. The effect of TB (Trade Balance) on GDP is volatile. Oil price changes have a significant negative impact on GDP growth, with a coefficient of -0.00060 and a p-value of 0.013.

For ER, the lag of CPI does not significantly affect the exchange rate, possibly because the pass-through effect of exchange rates on inflation is slow or delayed. The changes in TB have a significant effect on ER, with the fluctuations in trade balance having an immediate impact on the exchange rate, and the direction of this effect varies over time. Oil price changes show a significant negative impact in lag 2, suggesting that oil price fluctuations might have a negative effect on the exchange rate over time.

For CPI, the lag 3 of ER significantly shows a negative effect, indicating that exchange rate fluctuations may exert substantial pressure on inflation after a period of time.

In the TB equation, GDP growth rate has a very significant impact on the trade balance, with lags 1 to 4 all showing a positive and significant relationship, suggesting that economic growth significantly improves the trade balance. The lag 2 and lag 3 of ER have a strong effect on TB, showing both positive and negative impacts, reflecting the complex relationship between

exchange rate fluctuations and the trade balance. The volatility of CPI also influences TB, especially in lag 3, suggesting that CPI changes might affect trade balance through production costs or import prices.

Finally, oil price changes (OIL) as an exogenous variable have a significant impact across all equations. Particularly, it has a substantial negative effect on GDP growth, ER, and CPI.

IRF

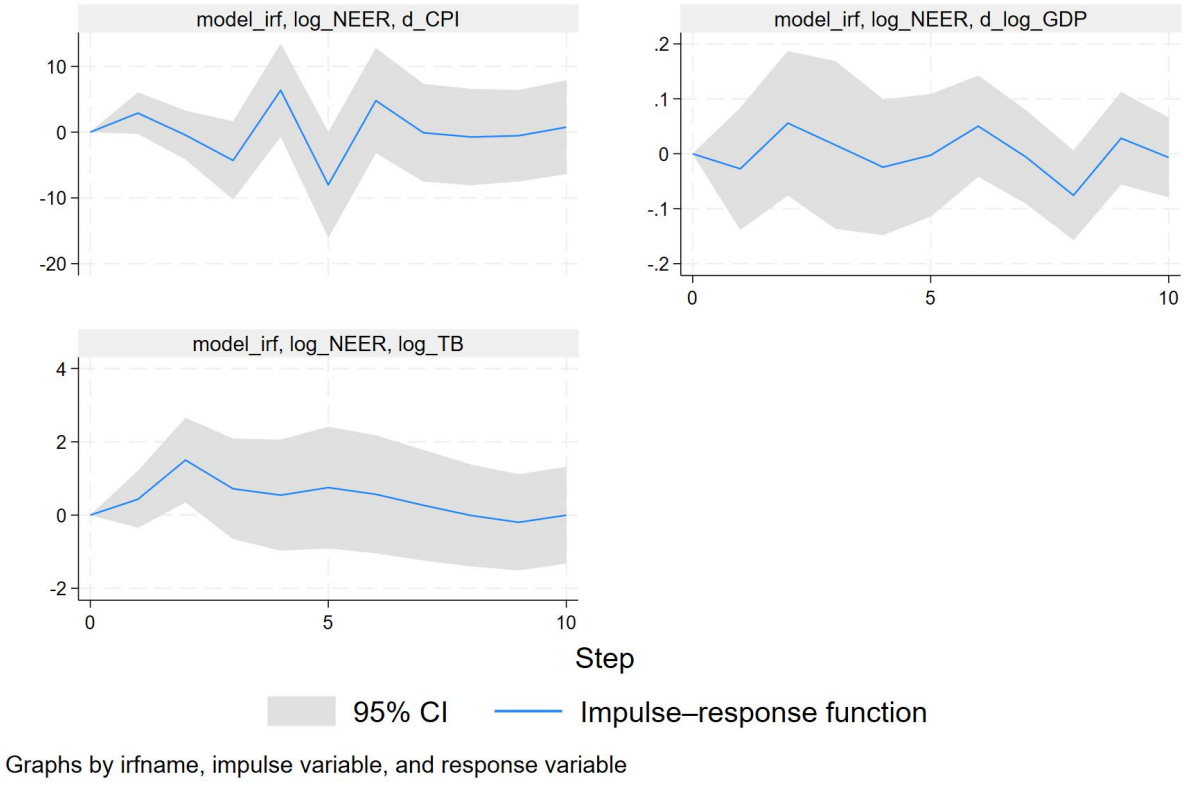

Figure C9. IRF

ER's impact on CPI: CPI shows an upward trend in the first few periods, and then gradually falls back to the level before the impact. This indicates that exchange rate appreciation may lead to higher prices of imported goods, thereby pushing up domestic inflation.

ER's impact on GDP growth: GDP growth rate shows a trend of first falling and then rising. This may reflect that exchange rate appreciation has an indirect impact on GDP

ER's impact on trade balance: the trade balance shows a direct effect. This indicates that exchange rate appreciation may lead to a wider trade deficit in the short term, but in the long run, it may improve the trade balance.

FEVD: GDP is mainly affected by shocks to the effective exchange rate (ER), consumer price index (CPI) and trade balance (TB). Among them, the impact of ER on GDP has a lag, that is, the impact of exchange rate changes on GDP will not appear immediately, but will gradually appear over time. The impact of CPI and TB on GDP is relatively stable, and high inflation and trade deficit usually have a negative impact on economic growth.

CPI is mainly affected by shocks to GDP and effective exchange rate (ER). Exchange rate depreciation may lead to an increase in the price of imported goods, thereby pushing up domestic inflation.

The trade balance is mainly affected by shocks to GDP and effective exchange rate (ER). GDP growth usually leads to an increase in imports, which has a certain impact on the trade balance. ER has the most direct impact on the trade balance. Exchange rate changes will significantly affect exports and imports, thereby affecting the trade balance.

Russia

For Russia, this section will not expand the data analysis, but directly compare the differences between the exchange rate and oil price (external shock) on various economic indicators in the pre-period and post-period.

VARIABLES	d3_log_GDP	d2_CPI	log_NEER	log_TB
L.d3_log_GDP	-1.502***	-0.54	-0.0391	0.320***
	-0.128	-1.092	-0.139	-0.0979
L2.d3_log_GDP	-1.523***	-0.925	0.0399	0.273***
	-0.133	-1.137	-0.145	-0.102
L3.d3_log_GDP	-1.508***	-0.453	0.00454	0.249**
	-0.133	-1.141	-0.145	-0.102
L4.d3_log_GDP	-0.535***	-0.327	0.0226	0.307***
	-0.128	-1.093	-0.139	-0.098
L.d2_CPI	0.0217	-1.141***	0.00079	0.00936
	-0.0172	-0.147	-0.0187	-0.0132
L2.d2_CPI	0.0278	-0.687***	0.0324	-0.0207
	-0.0245	-0.209	-0.0266	-0.0188
L3.d2_CPI	0.00823	-0.363**	0.0179	-0.0289*
	-0.0205	-0.175	-0.0223	-0.0157
L4.d2_CPI	-0.0112	-0.0619	0.00532	-0.00075
	-0.0146	-0.124	-0.0158	-0.0112
L.log_NEER	0.11	2.779**	1.119***	0.117
	-0.133	-1.134	-0.144	-0.102
L2.log_NEER	-0.145	-0.718	-0.0775	-0.215
	-0.199	-1.701	-0.216	-0.152
L3.log_NEER	-0.176	-2.076	-0.0942	0.228*
	-0.18	-1.543	-0.196	-0.138
L4.log_NEER	0.215	0.0262	0.042	-0.0824
	-0.14	-1.196	-0.152	-0.107
L.log_TB	0.193	-2.206	0.338*	2.292***
	-0.159	-1.358	-0.173	-0.122
L2.log_TB	0.024	6.692**	-1.078***	-2.298***
	-0.357	-3.057	-0.389	-0.274
L3.log_TB	-0.849**	-7.869**	1.097***	1.303***
	-0.362	-3.097	-0.394	-0.278
L4.log_TB	0.662***	3.587***	-0.415**	-0.389***
	-0.16	-1.369	-0.174	-0.123
d3_log_OIL	-0.0134	0.123	-0.0764***	-0.0538***
	-0.0171	-0.146	-0.0186	-0.0131
Constant	-0.167	-1.031	0.335	0.262*
	-0.193	-1.653	-0.21	-0.148
Observations	56	56	56	56

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

Table D14. VAR results

GDP in Pre Period. The lagged period of the exchange rate (NEER) has a significant negative impact on GDP, especially in lags 1 and 2. The depreciation (or fluctuation) of the exchange rate directly affects the growth of GDP.

The impact of oil prices on GDP is weak and almost insignificant, which may indicate that during this period, oil price fluctuations did not have a direct impact on GDP.

GDP in Post Period. Similar to the "Pre" period, the lagged period of the exchange rate has a strong negative impact on GDP, especially in lags 1 to 3 ($p < 0.05$). This persistent negative effect may be due to geopolitics, and the fluctuation of the exchange rate has a stronger inhibitory effect on economic growth. The impact of the exchange rate is stronger and more persistent, and the impact of oil prices increases in some lags.

CPI in Pre Period. The exchange rate has a positive impact on CPI in lag period 2 and lag period 3. The depreciation of the exchange rate may have driven the rise in inflation. The impact of oil prices on CPI is small and statistically insignificant.

CPI in Post Period. Similar to the "Pre" period, the impact of the exchange rate is more obvious, and exchange rate fluctuations may have a greater driving effect on CPI after a period of time.

Impact of oil prices on CPI: Oil prices have a strong impact on CPI in the "Post" period, with a significant positive impact. Oil price fluctuations may have a greater impact on the price level, reflecting the greater impact of global oil price fluctuations on Russian economic prices.

Trade Balance in Pre Period. The exchange rate has a small impact on the trade balance, and the impact does not change much in the lag period, and it is not significant. The impact of oil prices is also small.

Trade Balance in Post Period. The impact of the exchange rate is not as weak as in the "Pre" period. Some lags (such as lag 1 and lag 3) show positive effects. Exchange rate changes may have a greater impact on trade balance, especially after the Russian crisis, where exchange rate fluctuations may lead to changes in trade balance.

The impact of oil prices on trade balance becomes significant in the "Post" period, especially in lags 3 and 4, which may be closely related to global oil price fluctuations and energy-related trade flows.

Discussion

First, let's look at Mexico and Turkey. During the floating exchange rate period, exchange rate fluctuations in both countries were mainly driven by external factors (changes in the Federal Reserve interest rate). The floating exchange rate system provides greater independence for monetary policy, enabling both countries to respond more effectively to external shocks. The performance of the two countries after the exchange rate system reform has both similarities and some subtle differences, so it is an ideal research object to put them together. Based on the above data analysis, we can answer the research questions of this article.

The first aspect is the impact of exchange rate policy reform on inflation. Mexico’s whole time changes in inflation (CPI) show high sensitivity to exchange rate fluctuations. The VAR model shows that the lagged changes in exchange rates have a significant positive impact on CPI,

indicating that exchange rate fluctuations are quickly transmitted to the price level. The FEVD results show that the inertia of CPI itself dominates its changes in the short term, but the long-term impact of exchange rates gradually increases. In the fixed exchange rate stage, CPI is mainly driven by its own fluctuations, and exchange rate changes and external shocks (such as changes in the Fed's interest rate) have little impact on inflation. In the floating exchange rate stage, the sensitivity of inflation to exchange rate fluctuations has increased significantly. The IRF results show that exchange rate shocks will quickly push up the price level, but its impact is short-term, and CPI gradually returns to stability; For Turkey, the changes in CPI in the whole time stage are more directly affected by the trade balance, and the direct effect of exchange rate fluctuations on CPI is weak. FEVD shows that the long-term fluctuations of CPI are still dominated by its own inertia, but the role of trade balance is gradually emerging. In the fixed exchange rate stage, inflation is mainly driven by GDP changes, and the direct impact of exchange rate fluctuations on CPI is not significant. In the floating exchange rate stage, inflation is significantly affected by the trade balance. IRF results show that positive changes in trade balance help ease inflationary pressure.

The second aspect is the impact of exchange rate changes on GDP growth. Mexico: GDP changes in Whole Time show strong inertia, and the VAR model shows that the lagged value of GDP has a significant positive impact on its own changes. The direct effect of exchange rate and trade balance on GDP is limited. In the fixed exchange rate stage, GDP growth is mainly driven by internal factors, and the change of exchange rate has a weak transmission effect on economic growth. In the floating exchange rate stage, the exchange rate is no longer fixed, but GDP growth still depends more on domestic demand. The role of exchange rate is still small. Turkey's GDP growth in the whole period shows similar inertial characteristics. At the same time, FEVD results

show that changes in GDP itself dominate future trends in the short term. In the fixed exchange rate stage, GDP growth is mainly driven by inertia. In the floating exchange rate stage, GDP growth is significantly driven by foreign trade conditions. The IRF results show that the improvement of trade balance has a significant positive effect on GDP growth, while the exchange rate indirectly affects economic growth by affecting the trade balance.

The third aspect is the impact of exchange rate changes on trade balance. From the perspective of Whole Time analysis, the changes in Mexico's trade balance are more dependent on itself. The FEVD results show that the short-term fluctuations in trade balance are mainly driven by its own inertia. In the fixed exchange rate stage, the adjustment ability of trade balance is weak. Since the exchange rate is fixed, the direct impact of the exchange rate is weak. In the floating exchange rate stage, the IRF results show that the positive impact of exchange rate shocks on trade balance is strong in the short term. From the perspective of Turkey Whole Time, the FEVD results show that the fluctuations in trade balance are dominated by its own inertia in the short term, but are significantly affected by GDP and exchange rates in the long term. In the fixed exchange rate stage, the impact of exchange rate on trade balance is not significant. In the floating exchange rate stage, the IRF results show that exchange rate depreciation has an improving effect on trade balance.

Above all, we can find that the direct impact of the change in the exchange rate system on GDP is not significant. Because the GDP of both countries shows inertia, the exchange rate has a small direct effect on GDP, but it can indirectly affect GDP through the trade balance. We know that the GDP formula is: GDP=C+I+G+(X−M). The limited impact of the exchange rate on GDP is that the exchange rate here mainly affects GDP through net exports (X−M), rather than directly acting on GDP. As for the impact on the trade balance, the impact is not strong when the

exchange rate is fixed, while both countries show a positive effect of exchange rate depreciation on the trade balance during the floating stage. It can be seen that the impact of the change in the exchange rate system on the trade balance is significant and positive.

In addition, in terms of the impact on CPI, the two countries show completely different paths: Mexico shows that the exchange rate reform has a greater direct impact on CPI, while Turkey shows an indirect impact, and the direction is opposite (i.e., suppressing inflation). If a country is dependent on imported goods (such as Mexico), exchange rate fluctuations will significantly affect CPI, which is manifested as rising inflation. If a country's trade is mainly export-oriented and can significantly improve trade conditions (such as Turkey), exchange rate reform may suppress CPI through indirect paths. Therefore, there is uncertainty in the impact of exchange rate reform on CPI, and the specific performance depends on national characteristics, transmission paths, etc. Importantly, we can see that under the floating exchange rate system, the improvement in trade balance has a significantly stronger impact on GDP growth and CPI, and forth it is also a key variable.

Next is the exchange rate changes on GDP in Kazakhstan. First is the Whole Period (2005Q1-2024Q1), OLS Regression tells us the exchange rate does not have a significant impact on GDP. This suggests that exchange rate fluctuations may not have a direct and immediate impact on economic growth. After looking at the lagged effect of the exchange rate on GDP is not significant, indicating an indirect impact. IRF and FEVD also suggest a minimal response of GDP to exchange rate shocks, suggesting that exchange rate changes have a negligible direct impact on GDP. The contribution of the exchange rate to the forecast error variance of GDP is relatively small, indicating that other factors may have a more significant impact on GDP.

When the exchange regime is fixed, in the pre period, the lagged effect of the exchange rate on GDP is significant in the second period, suggesting a positive impact. The overall impact of exchange rate changes on GDP is relatively small. The response of GDP to exchange rate shocks is minimal and the contribution of the exchange rate to GDP is relatively small, suggesting that other factors may play a more significant role in driving GDP growth.

After the reform, the lagged effect of the exchange rate on GDP is mixed in both directions. This suggests a more complicated relationship between exchange rate changes and GDP growth. The response of GDP to exchange rate shocks is relatively small and shows a slight downward trend. The contribution of the exchange rate to the forecast error variance of GDP is relatively small, suggesting that other factors, such as domestic demand and oil prices, may play a more significant role in driving GDP growth.

In general, the impact of exchange rate changes on GDP in Kazakhstan appears to be relatively limited. While exchange rate depreciation may have a positive impact on exports and economic growth in the short term, it can also lead to increased import costs and inflationary pressures in the long term.

Then, regarding the relationship between exchange rate and CPI in Kazakhstan, this study found that under a fixed exchange rate, it can be found that the impact response of the exchange rate to CPI in the early period (2005Q1-2015Q2) is similar to that of the overall period, that is, it is relatively stable and has a small movement. The exchange rate's contribution to the forecast error variance of CPI is also small, which also shows that the fixed exchange rate may be relatively stable at this time and will not have a big impact on inflation.

When focusing on the post-reform stage, under a floating exchange rate system, the lagged effect of the exchange rate has a significant negative impact on CPI, that is, exchange rate depreciation may lead to a decrease in CPI. Kazakhstan's domestic monetary policy adjustments can explain this phenomenon. The CPI's response to exchange rate shocks shows a trend of first rising and then falling, that is, exchange rate depreciation may push up inflation in the short term. Whether this means that inflationary pressure will gradually reduce in the long term needs to be seen together with more internal and external conditions.

Overall, the impact of the exchange rate on CPI is relatively limited but stable. Of course, the influencing factors of CPI are inherently complex, and there are many other factors, such as domestic monetary policy and global commodity prices, which may have a greater impact on inflation.

The impact of the exchange rate on the Kazakhstan trade balance during this period of fixed exchange rate system was not significant, but its impact on the trade balance responded significantly, showing a rising and later stable trend. This may indicate that exchange rate depreciation will improve the trade balance in the long term. The contribution to shock is relatively small.

In the later period (2015Q3-2024Q1), the impact of exchange rate on trade balance is more complex, with positive and negative impacts. This may reflect differences in the short- and long-term effects of exchange rate changes on the trade balance. There may also be a series of chain reactions after changing the policy, because there is a certain lag in the transmission mechanism of exchange rate changes to the trade balance.

The response of exchange rate shocks to trade balance is showing a trend of first falling and then rising. However, the contribution to the forecast error variance of the trade balance is relatively large, indicating that exchange rate changes have a significant impact on the trade balance. This may be due to the fact that Kazakhstan has changed to a floating exchange rate system, and trade has become more frequent, promoting exports and improving the trade balance.

For Russia, the depreciation of the exchange rate in the early period (2005Q1-2015Q2) had a short-term stimulating effect on GDP, but the impact was relatively small. The short-term impact on CPI is small, but there may be some impact in the medium term. The impact of exchange rate on trade balance is small and relatively stable.

Under the floating exchange rate policy in the later period (2015Q3-2024Q1), the short-term impact of exchange rate depreciation on GDP is more significant, but the long-term impact is uncertain. The short-term impact on CPI is more obvious and may lead to an increase in inflation. The impact on the trade balance is more significant, especially in the short term, as exchange rate depreciation may lead to a trade deficit.

Overall, the impact of Russia's exchange rate policy on economic variables differs in different periods. In the early period, the impact of exchange rate on economic variables is relatively small, while in the later period, the impact of exchange rate on economic variables is more significant, especially the impact on CPI and trade balance.

Conclusion

This study investigates the impact of exchange rate regime reforms on key economic variables—CPI, GDP, and trade balance—by analyzing the experiences of Mexico, Turkey,

Kazakhstan, and Russia. The findings reveal distinct patterns in exchange rate changes, with country-specific characteristics playing a crucial role in determining the effects.

For Mexico and Turkey, the floating exchange rate system allows for greater policy independence, enabling more effective responses to external shocks. However, while Mexico's inflation is highly sensitive to exchange rate fluctuations, Turkey's inflation is more influenced by trade balance conditions. The exchange rate reforms have also had limited direct effects on GDP growth in both countries.

In the case of Kazakhstan, the impact of exchange rate fluctuations on GDP and CPI appears relatively modest. Under the floating exchange rate system, the lagged effects of exchange rate changes show a complex relationship with GDP and CPI, suggesting that other internal factors, such as domestic demand and monetary policy, play a more significant role. Kazakhstan's trade balance responds more strongly to exchange rate fluctuations in the floating exchange rate period, reflecting the increased frequency of trade and export activity.

For Russia, the floating exchange rate system has led to more significant short-term impacts on both GDP and CPI, especially through trade balance adjustments. However, the long-term effects remain uncertain, highlighting the need for further study of the broader economic context.

Research Limitations

Although this study reveals the dynamic impact of exchange rate system reform on economic variables, it still has the following limitations:

Insufficient control of external shocks.This study captures external shocks through changes in the Federal Reserve interest rate and international oil prices, but fails to fully consider the impact of other external variables (such as geopolitical risks and international capital flows) on the economy. For example, the geopolitical tensions in Turkey in the later period, the Russo-Ukrainian war, and the sanctions on Russia may have had additional shocks on the exchange rate and terms of trade.

Insufficient model complexity.The VAR model captures the dynamic relationship of economic variables, but fails to refine the specific impact of the type of external shocks (such as financial crises and energy price fluctuations) on the results.

Limitations in the scope of the study.Only these four countries were selected for analysis. Although they are representative, the universality of the research results needs to be further verified by data from other emerging market countries.

Future Research Directions

Deepen the analysis of external shocks: introduce more external variables (such as international capital flows, geopolitical risk index), and add event analysis methods to study the specific impact of major economic events on the effect of exchange rate system reform.

Expand the scope of research Expand the scope of research to more emerging market countries (such as Brazil, India, and South Africa). Perhaps AI machine learning can be used to explore the commonalities and differences of exchange rate reforms in different economic contexts.In addition, more complex models can be used to analyze the specific role of exchange rate reforms in different scenarios.

Policy Recommendations

For emerging market countries like Kazakhstan, the following policy recommendations can be drawn from this analysis.

Gradually transition to a floating exchange rate system to strengthen monetary policy independence. The study shows that countries undergoing exchange rate reforms have seen positive outcomes, such as improved trade balances and better inflation control. The floating exchange rate system helps absorb external shocks and supports domestic price stability. This highlights the importance of exchange rate reforms for enhancing a country's economic resilience, with monetary policy independence playing a key role.

Emerging market countries should work more closely with each other to address challenges from exchange rate fluctuations and maintain regional financial stability. For example, Kazakhstan has joined the Eurasian Economic Union (EAEU), and Turkey is part of the Organization of Turkic States. Strengthening these regional partnerships can help countries share resources, exchange ideas, and coordinate strategies to tackle common economic issues.

At the same time, these countries should actively engage in dialogue and cooperation with international organizations like the International Monetary Fund (IMF). By learning from the experiences of other nations, they can improve their own exchange rate reform policies and better handle global economic changes.

Emerging markets need to diversify their exports and reduce their reliance on any single market. Exploring new export destinations can help reduce risks from economic changes in specific regions. Governments can support this by signing trade agreements, offering export

credits, and encouraging businesses to explore a variety of export markets. For Kazakhstan, it's important to strengthen industries such as agriculture, renewable energy, and metallurgy, reducing dependence on oil, gas exports and commodities.

Improving the quality and competitiveness of exports is also essential. Governments should invest in research and development, help businesses adopt advanced production technologies, and encourage innovation to produce higher-quality goods. Building strong brands and increasing the global recognition of domestic products can further boost export potential. This not only increases revenue but also strengthens the country's position in global markets.

Foreign exchange reserves are crucial for mitigating risks, especially for emerging markets. Kazakhstan, with its reliance on oil exports, uses reserves to stabilize the exchange rate and shield the economy from oil price fluctuations. Increase reserves through trade surpluses and foreign direct investment. Kazakhstan can leverage its mineral resources and agricultural potential to boost non-energy exports and earn more foreign exchange. Use reserves to manage excessive exchange rate fluctuations, balancing short-term volatility and long-term stability. Adjust reserve compositions based on market trends, increasing holdings in non-dollar assets like Euros or Yuan to diversify risks. Ensure clear policies and effective communication to stabilize market expectations and reduce speculative capital flows.

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Appendix

Appendix A Mexico

Whole Time Period (1985Q1-2020Q4)

Table A1. ADF Test （first-time）

Variable	ADF Statistic	p-value
log_GDP	-1.374	0.5948
log_CPI	-3.056	0.03
log_exchange_rate	-2.852	0.0513
log_trade_balance	-2.338	0.16
ifed	-2.02	0.2778

Table A2. ADF Test After Taking First Difference

Variable	ADF Statistic	p-value
d_log_GDP	-5.615	0
d_log_exchange_rate	-4.057	0.0011
d_log_trade_balance	-4.823	0
d_ifed	-4.739	0.0001

Table A3 OLS Results

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
d_log_gdp (GDP change)	d_log_exchange_rate (Exchange Rate Change)	0.0902	0.0405	2.23	0.027	[0.0102, 0.1702]
	log_cpi (CPI)	-0.00066	0.00195	-0.34	0.736	[-0.0045, 0.0032]
	d_log_trade_balance (Trade Balance Change)	-0.00032	0.00037	-0.87	0.388	[-0.0011, 0.00041]
	d_ifed (Foreign Exchange Intervention)	0.00784	0.00631	1.24	0.216	[-0.00464, 0.02032]
log_cpi (CPI)	d_log_exchange_rate (Exchange Rate Change)	-7.051	1.1961	-5.9	0	[-9.4160, -4.6860]
	d_log_gdp (GDP Change)	-1.1282	3.1746	-0.36	0.723	[-7.4054, 5.1490]
	d_log_trade_balance (Trade Balance Change)	-0.036	0.0376	-0.96	0.34	[-0.1104, 0.0384]
	d_ifed (Foreign Exchange Intervention)	-0.1829	0.1841	-0.99	0.322	[-0.5469, 0.1812]
d_log_trade_balance (Trade Balance Change)	d_log_exchange_rate (Exchange Rate Change)	-12.3341	6.3817	-1.93	0.055	[-24.9527, 0.2845]
	d_log_gdp (GDP Change)	-6.3299	7.3854	-0.86	0.393	[-20.9330, 8.2732]
	log_cpi (CPI)	-0.4159	0.4393	-0.95	0.345	[-1.2846, 0.4528]
	d_ifed (Foreign Exchange Intervention)	-0.2061	0.8363	-0.25	0.806	[-1.8596, 1.4475]

Table A4 Lag-order Selection Criteria for VAR Model

Lag	Log Likelihood (LL)	LR Statistic	df	p-Value	FPE	AIC	HQIC	SBIC
0	-193.685	-	-	-	0.000214	2.90194	2.97058	3.07083
1	-124.999	137.37	16	0	0.0001	2.14386	2.34976	2.65054*
2	-98.5484	52.9	16	0	0.000086	1.9935	2.33667	2.83796
3	-60.4975	76.102	16	0	0.000063*	1.67622	2.15665*	2.85846
4	-44.3266	32.342*	16	0.009	0.000063	1.67376*	2.29146	3.19378

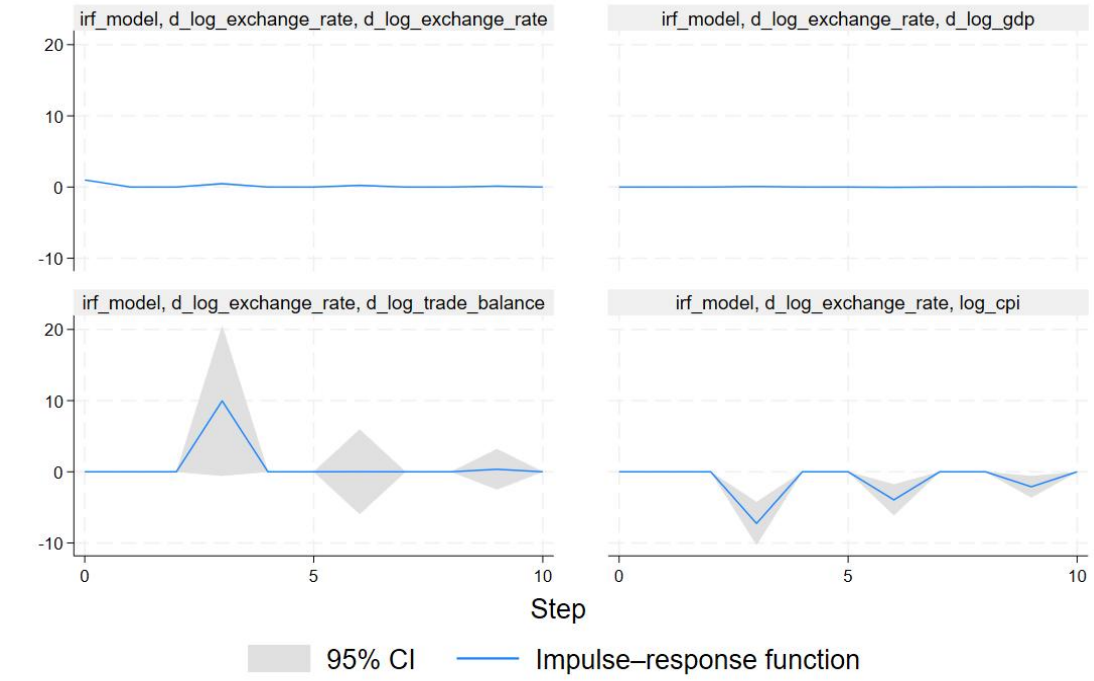
Table A5 Results for the VAR model with lag 3 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	d_log_gdp	log_cpi	d_log_exchange_rate	d_log_trade_balance
L3.d_log_gdp	-0.721***	4.666	-0.131	-7.775
	(0.0778)	(4.051)	(0.210)	(14.19)
L3.log_cpi	0.00392**	0.0606	-0.00233	0.570*
	(0.00160)	(0.0832)	(0.00431)	(0.291)
L3.d_log_exchange_rate	0.0813***	-7.257***	0.470***	9.963*
	(0.0295)	(1.534)	(0.0795)	(5.371)
L3.d_log_trade_balance	0.00150***	-0.0468*	0.000808	0.0103
	(0.000468)	(0.0243)	(0.00126)	(0.0852)
d_ifed	0.0102**	-0.346	0.0187	-0.289
	(0.00440)	(0.229)	(0.0119)	(0.803)
Constant	0.00868***	0.559***	-0.00911	-0.164
	(0.00256)	(0.133)	(0.00690)	(0.466)
Observations	140	140	140	140

Table A6 Granger Causality Test Results

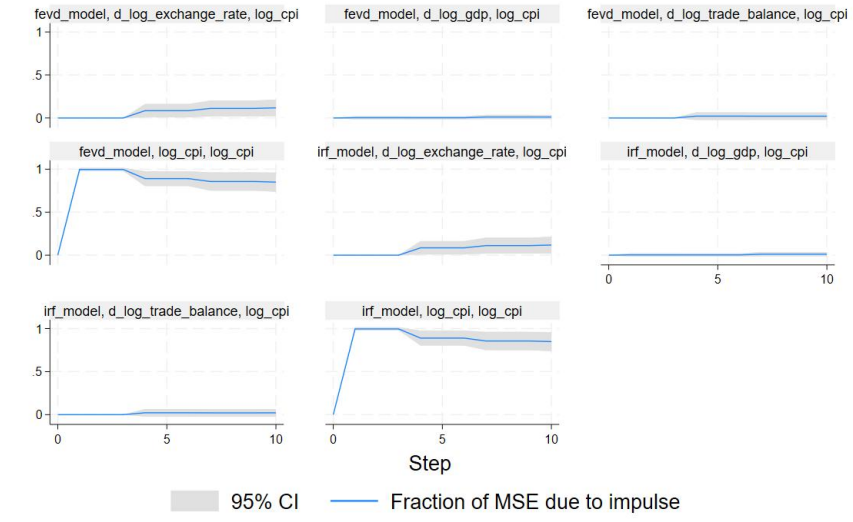
Equation	Excluded	chi2	df	Prob > chi2
d_log_gdp	log_cpi	6.0123	1	0.014
	d_log_exchange_rate	7.617	1	0.006
	d_log_trade_balance	10.347	1	0.001
	ALL	16.863	3	0.001
log_cpi	d_log_gdp	1.3262	1	0.249
	d_log_exchange_rate	22.389	1	0
	d_log_trade_balance	3.6964	1	0.055
	ALL	23.546	3	0
d_log_exchange_rate	d_log_gdp	0.3902	1	0.532
	log_cpi	0.2907	1	0.59
	d_log_trade_balance	0.4098	1	0.522
	ALL	1.2838	3	0.733
d_log_trade_balance	d_log_gdp	0.3004	1	0.584
	log_cpi	3.8319	1	0.05
	d_log_exchange_rate	3.4416	1	0.064
	ALL	5.335	3	0.149

Figure A1 IRF



Graphs by irfname, impulse variable, and response variable

Figure A2 FEVD CPI



Graphs by irfname, impulse variable, and response variable

Figure A3 FEVD GDP

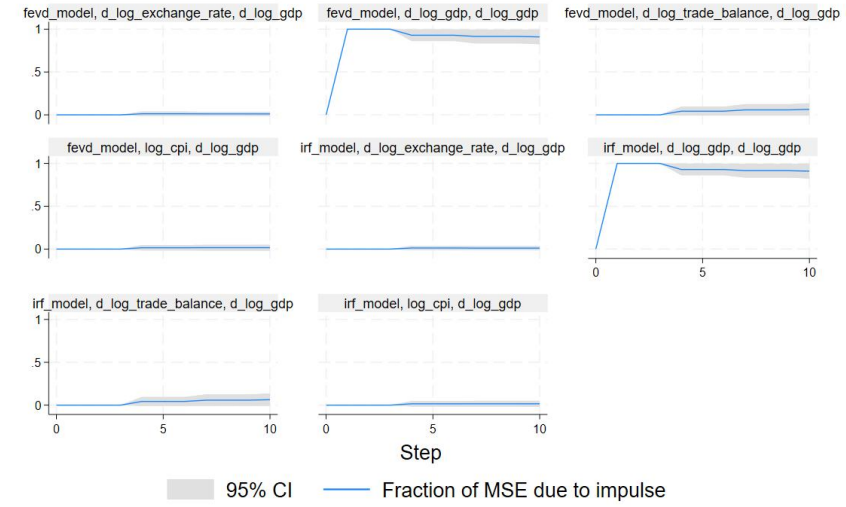
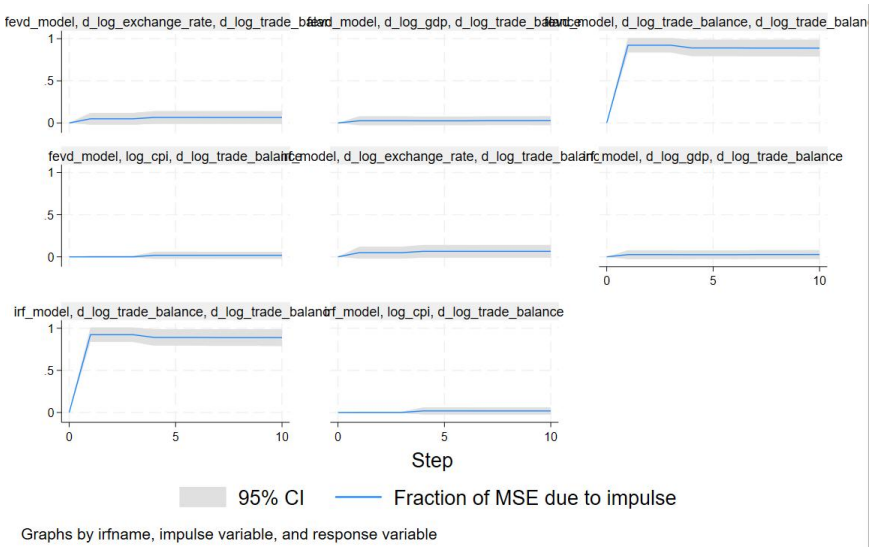


Figure A4 FEVD Trade Balance



Pre-Period (1985Q1-1993Q4)

Table A7 ADF Test

Variable	ADF Statistic (Z(t))	p-value
log_gdp	0.167	0.9703
log_cpi	-1.376	0.5936
log_exchange_rate	-3.198	0.0201
log_trade_balance	-1.232	0.6595
ifed	-1.01	0.7494
d_log_gdp	-1.921	0.3223
d_log_cpi	-3.156	0.0227
d_log_trade_balance	-2.368	0.1509
d_ifed	-1.805	0.3782
dd_log_gdp	-3.729	0.0037
dd_ifed	-3.747	0.0035
dd_log_trade_balance	-3.677	0.0044

Table A8 OLS Results

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
d_log_gdp (GDP change)	d_log_exchange_rate (Exchange Rate Change)	0.0028788	0.0245713	0.12	0.908	[-0.0474, 0.0531]
	d_log_cpi (CPI)	-0.0417216	0.0407183	-1.02	0.314	[-0.1250, 0.0416]
	dd_log_trade_balance (Trade Balance Change)	-0.0010235	0.0078425	-0.13	0.897	[-0.0171, 0.0150]
	dd_ifed (Foreign Exchange Intervention)	0.013993	0.0202779	0.69	0.496	[-0.0275, 0.0555]
d_log_cpi (CPI)	d_log_exchange_rate (Exchange Rate Change)	0.145268	0.0773938	1.88	0.071	[-0.0130, 0.3036]
	dd_log_gdp (GDP Change)	-0.7614934	0.8163769	-0.93	0.359	[-2.4312, 0.9082]
	dd_log_trade_balance (Trade Balance Change)	0.0255091	0.0297216	0.86	0.398	[-0.0353, 0.0863]
	dd_ifed (Foreign Exchange Intervention)	-0.0844674	0.0896664	-0.94	0.354	[-0.2679, 0.0989]
d_log_trade_balance (Trade Balance Change)	d_log_exchange_rate (Exchange Rate Change)	0.1294753	0.7649024	0.17	0.867	[-1.4349, 1.6939]
	dd_log_gdp (GDP Change)	-1.036369	7.601533	-0.14	0.892	[-16.5833, 14.5105]
	d_log_cpi (CPI)	1.415158	1.519468	0.93	0.359	[-1.6925, 4.5228]
	dd_ifed (Foreign Exchange Intervention)	0.7233516	0.5438913	1.33	0.194	[-0.3890, 1.8357]

Table A9 Lag-order Selection Criteria for VAR Model

Lag	Log-Likelihood (LL)	LR Statistic	p-value	FPE	AIC	HQIC	SBIC
0	-76.9953	-	-	0.003399	5.66635	5.78589	6.04001
1	40.0115	234.01	0	4.10E-06	-1.06744	-0.708832	0.053522
2	69.8611	59.699	0	1.80E-06	-1.99074	-1.39307	-0.122478
3	107.346	74.969	0	5.20E-07	-3.42304	-2.5863	-0.807472
4	147.051	79.411*	0	1.7e-07*	-5.0034*	-3.92758*	-1.64052*

Table A10 Results for the VAR model with lag 4 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	dd_log_gdp	d_log_cpi	log_exchange_rate	dd_log_trade_balance
L4.dd_log_gdp	0.881***	-0.311	-0.0609	1.337
	(0.0688)	(0.684)	(0.185)	(5.602)
L4.d_log_cpi	-0.00584	0.509***	-0.0410	1.023
	(0.0163)	(0.162)	(0.0438)	(1.325)
L4.log_exchange_rate	-0.000886	-0.00871	0.486***	-0.288
	(0.0105)	(0.104)	(0.0281)	(0.851)
L4.dd_log_trade_balance	-0.00274	0.0106	0.00352	0.0744
	(0.00212)	(0.0210)	(0.00569)	(0.172)
dd_ifed	0.00944	-0.0862	-0.00541	0.132
	(0.00921)	(0.0915)	(0.0248)	(0.750)
Constant	0.00310	0.00244	3.050***	1.893
	(0.0677)	(0.673)	(0.182)	(5.510)
Observations	30	30	30	30

Table A11 Granger Test Results

Equation	Excluded	Chi-squared	df	Prob > chi-squared
dd_log_gdp	d_log_cpi	0.12859	1	0.72
	log_exchange_rate	0.00719	1	0.932
	dd_log_trade_balance	1.6747	1	0.196
	ALL	2.0996	3	0.552
d_log_cpi	dd_log_gdp	0.20732	1	0.649
	log_exchange_rate	0.00703	1	0.933
	dd_log_trade_balance	0.25431	1	0.614
	ALL	0.47068	3	0.925
log_exchange_rate	dd_log_gdp	0.1083	1	0.742
	d_log_cpi	0.8788	1	0.349
	dd_log_trade_balance	0.38316	1	0.536
	ALL	1.1289	3	0.77
dd_log_trade_balance	dd_log_gdp	0.05698	1	0.811
	d_log_cpi	0.59598	1	0.44
	log_exchange_rate	0.11467	1	0.735
	ALL	0.64225	3	0.887

Figure A5 IRF pre-time

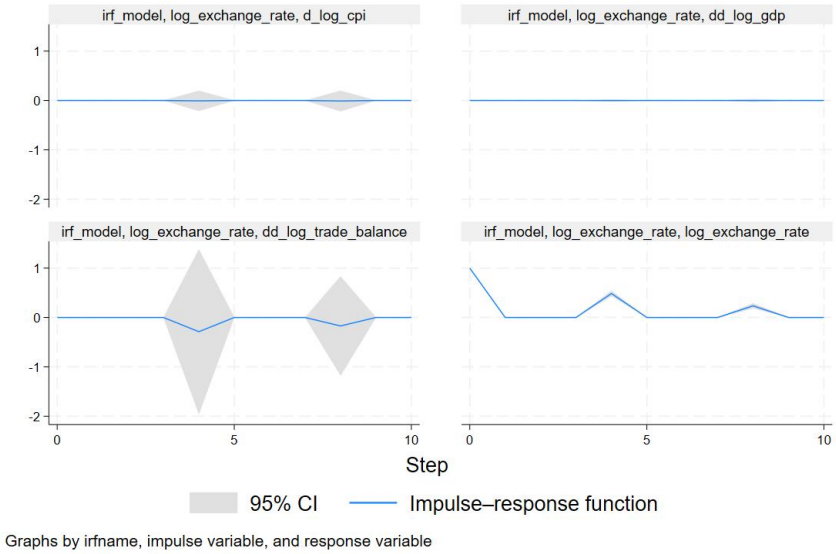
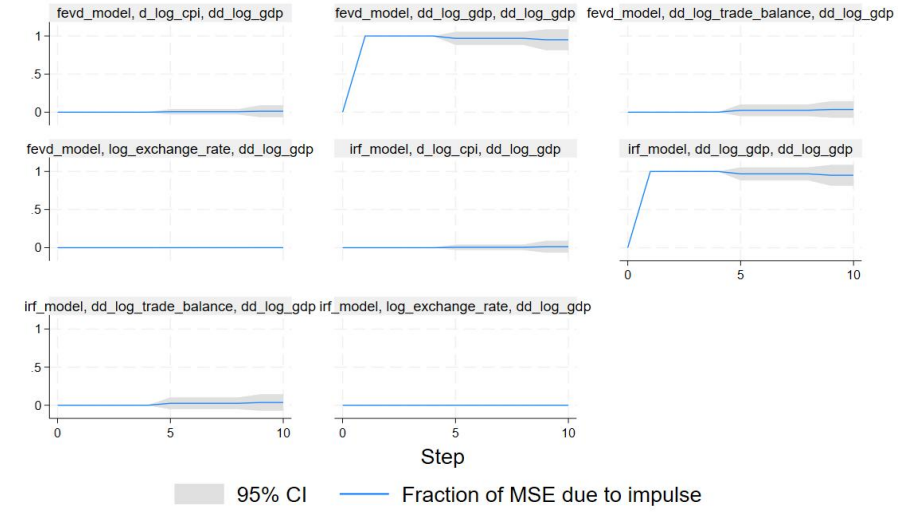
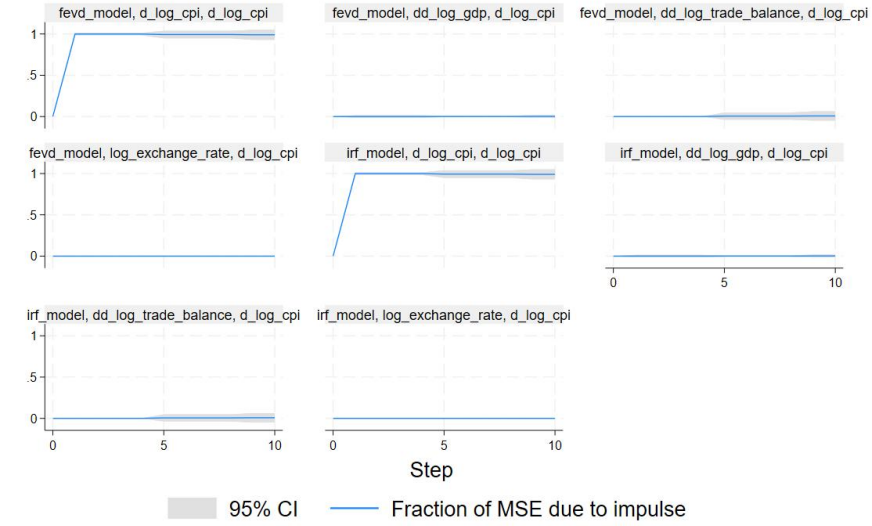


Figure A6 FEVD GDP pre-time



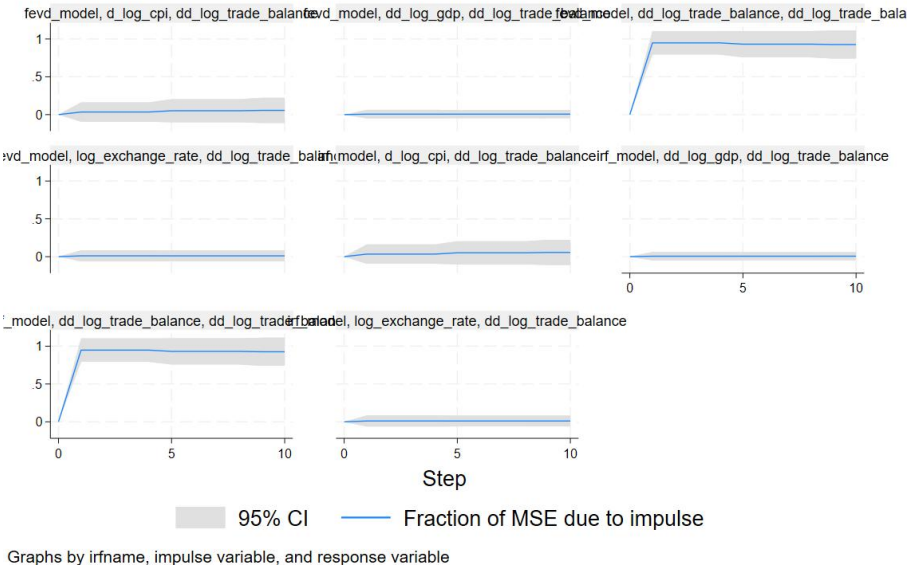
Graphs by irfname, impulse variable, and response variable

Figure A7 FEVD CPI pre-time



Graphs by irfname, impulse variable, and response variable

Figure A8 FEVD Trade Balance pre-time



Post-Period (1994Q1-2020Q4)

Table A12 ADF Test post-time

Variable	ADF Statistic (Z(t))	p-value
log_gdp (GDP)	-1.475	0.5458
log_cpi (CPI)	-3.352	0.0127
log_exchange_rate (Exchange Rate)	-3.198	0.0201
log_trade_balance (Trade Balance)	-1.232	0.6595
ifed (Foreign Exchange Intervention)	-1.01	0.7494
d_log_gdp (First Diff. of GDP)	-4.827	0
d_ifed (First Diff. of Foreign Exchange Intervention)	-4.601	0.0001
d_log_trade_balance (First Diff. of Trade Balance)	-4.367	0.0003

Table A13 OLS Results post-time

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
d_log_gdp (GDP Change)	log_exchange_rate	0.0055414	0.0103631	0.53	0.594	[-0.0150, 0.0261]
	log_cpi	-0.0033246	0.0033145	-1	0.318	[-0.0099, 0.0032]
	d_log_trade_balance	-0.0006253	0.0003989	-1.57	0.12	[-0.0014, 0.0002]
	d_ifed	0.0093995	0.003929	2.39	0.019	[0.0016, 0.0172]
	_cons	-0.0191061	0.0494696	-0.39	0.7	[-0.1172, 0.0790]
log_cpi (CPI)	log_exchange_rate	0.6503254	0.3086327	2.11	0.038	[0.0382, 1.2624]
	d_log_gdp	-10.85481	6.218252	-1.75	0.084	[-23.1872, 1.4776]
	d_log_trade_balance	-0.0145842	0.0382869	-0.38	0.704	[-0.0905, 0.0613]
	d_ifed	-0.2051009	0.2176228	-0.94	0.348	[-0.6367, 0.2265]
	_cons	-2.445301	1.541642	-1.59	0.116	[-5.5028, 0.6122]
d_log_trade_balance (Trade Balance Change)	log_exchange_rate	-0.0036572	1.32921	0	0.998	[-2.6398, 2.6325]
	d_log_gdp	-27.79812	20.98354	-1.32	0.188	[-69.4140, 13.8178]
	log_cpi	-0.198589	0.5110476	-0.39	0.698	[-1.2121, 0.8150]
	d_ifed	-0.2310538	1.347824	-0.17	0.864	[-2.9041, 2.4420]
	_cons	0.4121393	6.560151	0.06	0.95	[-12.5984, 13.4226]

Table A14 Lag-order Selection Criteria for VAR Model

Lag	Log-Likelihood (LL)	LR Statistic	df	p-value	FPE	AIC	HQIC	SBIC
0	-287.763	-	-	-	0.003469	5.68774	5.77015	5.89116
1	-92.5204	390.48	16	0	0.000111	2.24078	2.48801*	2.85102*
2	-69.2768	46.487	16	0	0.000096	2.10148*	2.51352	3.11855
3	-54.7639	29.026	16	0.024	0.0001	2.13008	2.70694	3.55398
4	-39.2925	30.943	16	0.014	0.000101	2.14024	2.88192	3.97097

Table A15 Results for the VAR model with lag 1 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	d_log_gdp	log_cpi	log_exchange_rate	d_log_trade_balance
L.d_log_gdp	-0.117	0.374	0.0723	-8.608
	(0.0965)	(5.455)	(0.240)	(19.94)
L.log_cpi	0.00277	0.0414	0.000453	-0.290
	(0.00169)	(0.0955)	(0.00420)	(0.349)
L.log_exchange_rate	-0.00205	0.698**	0.943***	0.433
	(0.00616)	(0.348)	(0.0153)	(1.273)
L.d_log_trade_balance	-0.000466	0.0595**	0.00209*	-0.230**
	(0.000460)	(0.0260)	(0.00114)	(0.0950)
d_ifed	0.0127**	-0.349	0.00639	-0.358
	(0.00546)	(0.309)	(0.0136)	(1.128)
Constant	0.0140	-2.770*	0.252***	-1.673
	(0.0292)	(1.651)	(0.0726)	(6.036)
Observations	107	107	107	107

Table A16 Granger Test Results

Equation	Excluded	Chi-squared	df	Prob > chi-square
d_log_gdp	log_cpi	2.678	1	0.102
	log_exchange_rate	0.11107	1	0.739
	d_log_trade_balance	1.0262	1	0.311
	ALL	3.8842	3	0.274
log_cpi	d_log_gdp	0.0047	1	0.945
	log_exchange_rate	4.0089	1	0.045
	d_log_trade_balance	5.2446	1	0.022
	ALL	9.179	3	0.027
log_exchange_rate	d_log_gdp	0.09096	1	0.763
	log_cpi	0.01165	1	0.914
	d_log_trade_balance	3.3303	1	0.068
	ALL	3.332	3	0.343
d_log_trade_balance	d_log_gdp	0.18638	1	0.666
	log_cpi	0.69022	1	0.406
	log_exchange_rate	0.11547	1	0.734
	ALL	0.7943	3	0.851

Figure A9 IRF post-time

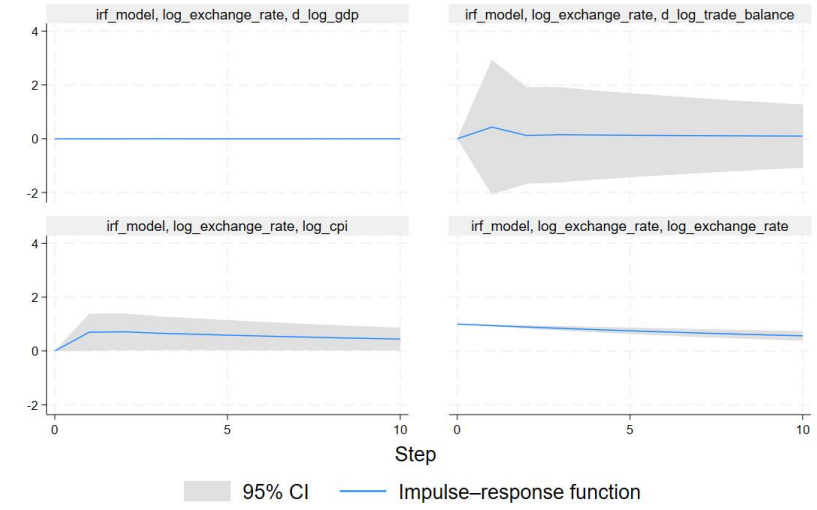


Figure A10 FEVD GDP post-time

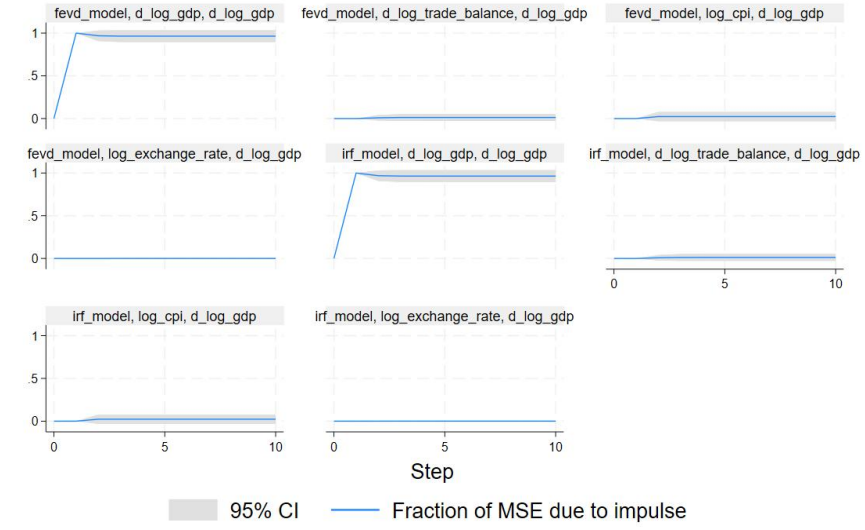


Figure A11 FEVD CPI post-time

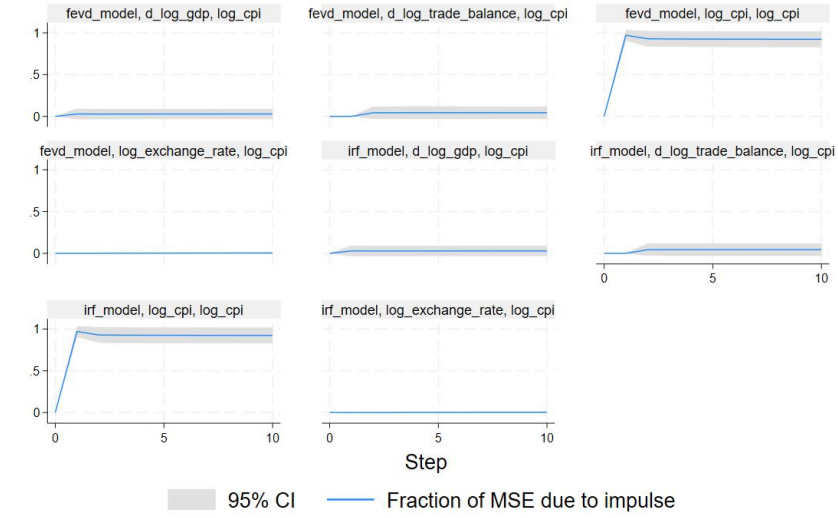
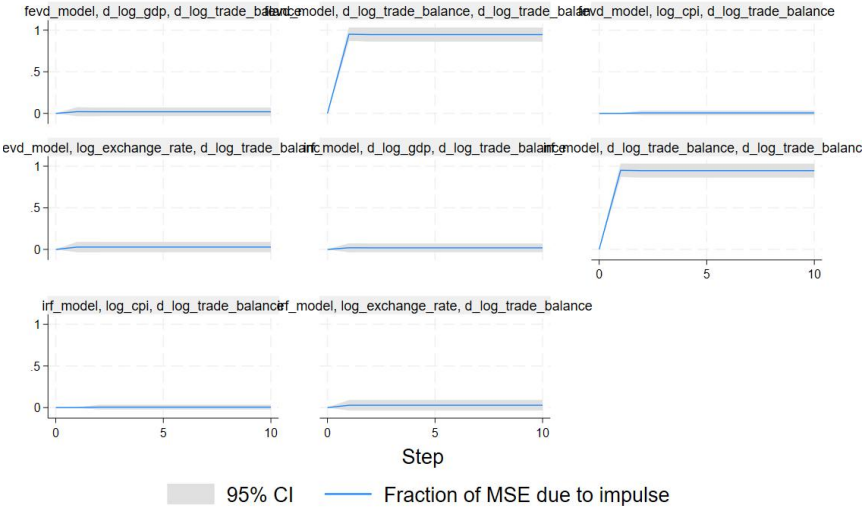


Figure A12 FEVD Trade Balance post-time



Appendix B Turkey

Whole Time Period (1994Q1-2022Q4)

Table B1 ADF Test

Variable	ADF Statistic (Z(t))	p-value
log_gdp (GDP)	-1.082	0.722
log_cpi (CPI)	-2.231	0.1951
log_exchange_rate (Exchange Rate)	-2.138	0.2296
log_trade_balance (Trade Balance)	-2.423	0.1352
ifed (Foreign Exchange Intervention)	-2.232	0.195
d_log_gdp (GDP Change)	-4.406	0.0003
d_log_cpi (CPI Change)	-6.689	0
d_log_exchange_rate (Exchange Rate Change)	-3.33	0.0136
d_log_trade_balance (Trade Balance Change)	-6.276	0
d_ifed (Foreign Exchange Intervention)	-3.689	0.0043

Table B2 OLS Results

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
d_log_gdp (GDP Change)	d_log_exchange_rate (Exchange Rate Change)	-0.0235	0.1405	-0.17	0.868	[-0.3019, 0.2550]
	d_log_cpi (CPI Change)	-0.0032	0.0124	-0.25	0.8	[-0.0278, 0.0215]
	d_log_trade_balance (Trade Balance Change)	-0.0268	0.0372	-0.72	0.473	[-0.1006, 0.0469]
	d_ifed (Foreign Exchange Intervention)	0.0305	0.0287	1.07	0.289	[-0.0263, 0.0873]
d_log_cpi (CPI Change)	d_log_exchange_rate (Exchange Rate Change)	-1.2817	1.0706	-1.2	0.234	[-3.4033, 0.83997]
	d_log_gdp (GDP Change)	-0.1855	0.7307	-0.25	0.8	[-1.6337, 1.2626]
	d_log_trade_balance (Trade Balance Change)	-0.5254	0.2816	-1.87	0.065	[-1.0834, 0.0326]
	d_ifed (Foreign Exchange Intervention)	-0.1272	0.2205	-0.58	0.565	[-0.5641, 0.3098]
d_log_trade_balance (Trade Balance Change)	d_log_exchange_rate (Exchange Rate Change)	-0.5765	0.355	-1.62	0.107	[-1.2800, 0.1270]
	d_log_gdp (GDP Change)	-0.1752	0.2431	-0.72	0.473	[-0.6570, 0.3066]
	d_log_cpi (CPI Change)	-0.0584	0.0313	-1.87	0.065	[-0.1204, 0.0036]
	d_ifed (Foreign Exchange Intervention)	-0.0487	0.0735	-0.66	0.509	[-0.1943, 0.0969]

Table B3 Lag-order Selection Criteria for VAR Model

Lag	Log-Likelihood (LL)	LR Statistic	df	p-value	FPE	AIC	HQIC	SBIC
0	-26.7544	-	-	-	0.000022	0.626205	0.705425	0.821487
1	5.58559	64.68	16	0	0.000016	0.331791	0.569451	0.917636
2	62.5918	114.01	16	0	7.80E-06	-0.40706	-0.01096	0.569347
3	103.021	80.857	16	0	5.10E-06	-0.847217	-0.292678	0.519753
4	133.97	61.9*	16	0	3.9e-06*	-1.11658*	-0.403604*	0.64095

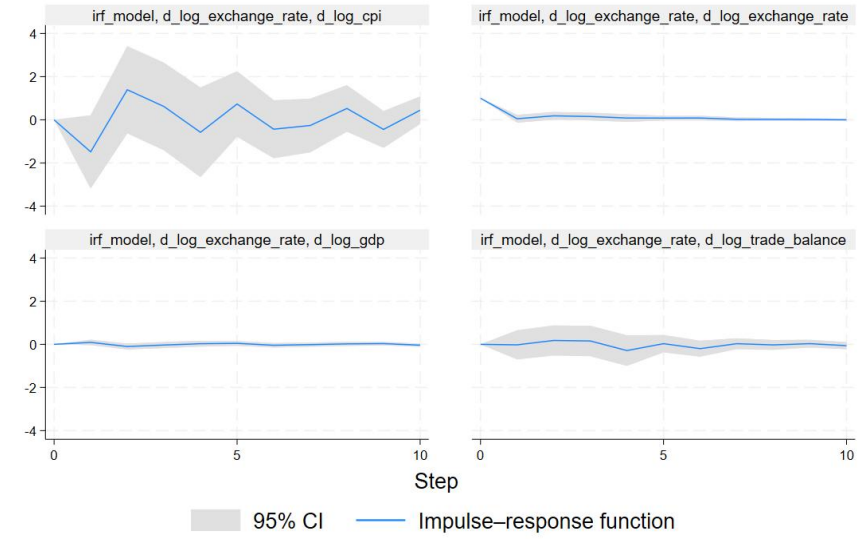
Table B4 Results for the VAR model with lag 4 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	d_log_gdp	d_log_cpi	d_log_exchange_rate	d_log_trade_balance
L4.d_log_gdp	0.810***	0.0859	0.00199	-0.0251
	(0.0460)	(0.690)	(0.0596)	(0.232)
L4.d_log_cpi	0.00726	-0.334***	0.00385	-0.0392
	(0.00597)	(0.0895)	(0.00773)	(0.0302)
L4.d_log_exchange_rate	0.0121	-0.627	0.0730	-0.268
	(0.0679)	(1.018)	(0.0879)	(0.343)
L4.d_log_trade_balance	0.0359**	-0.697***	0.0325	0.129
	(0.0178)	(0.266)	(0.0230)	(0.0898)
d_ifed	0.0101	-0.120	0.0393**	-0.0541
	(0.0145)	(0.217)	(0.0187)	(0.0731)
Constant	0.00537	-0.0622	-0.0465***	-0.0354
	(0.00762)	(0.114)	(0.00987)	(0.0385)
Observations	111	111	111	111

Table B5 Granger Test Results

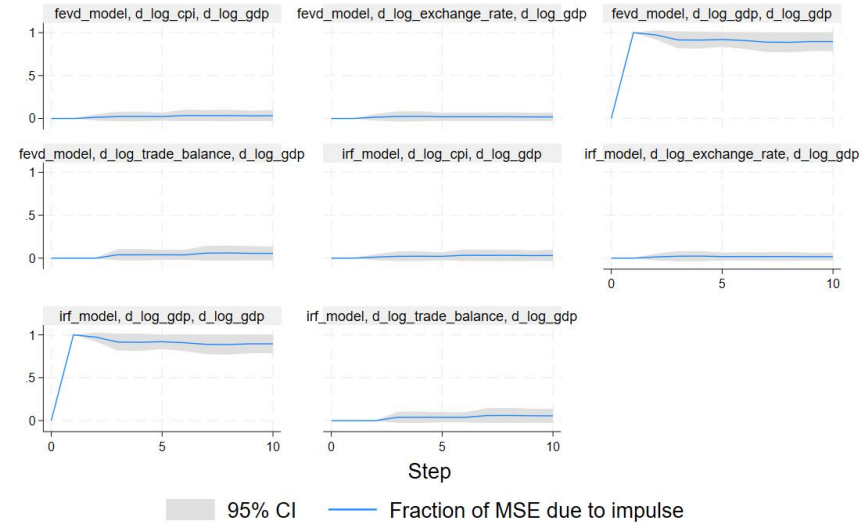
Equation	Excluded	Chi-squared	df	Prob > chi-square
d_log_gdp	d_log_cpi	1.476	1	0.224
	d_log_exchange_rate	0.03179	1	0.858
	d_log_trade_balance	4.072	1	0.044
	ALL	4.9142	3	0.178
d_log_cpi	d_log_gdp	0.01551	1	0.901
	d_log_exchange_rate	0.37973	1	0.538
	d_log_trade_balance	6.8378	1	0.009
	ALL	6.9736	3	0.073
d_log_exchange_rate	d_log_gdp	0.00112	1	0.973
	d_log_cpi	0.24787	1	0.619
	d_log_trade_balance	1.9929	1	0.158
	ALL	2.0692	3	0.558
d_log_trade_balance	d_log_gdp	0.01164	1	0.914
	d_log_cpi	1.6904	1	0.194
	d_log_exchange_rate	0.61149	1	0.434
	ALL	2.1214	3	0.548

Figure B1 IRF



Graphs by irfname, impulse variable, and response variable

Figure B2 FEVD GDP



Graphs by irfname, impulse variable, and response variable

Figure B3 FEVD CPI

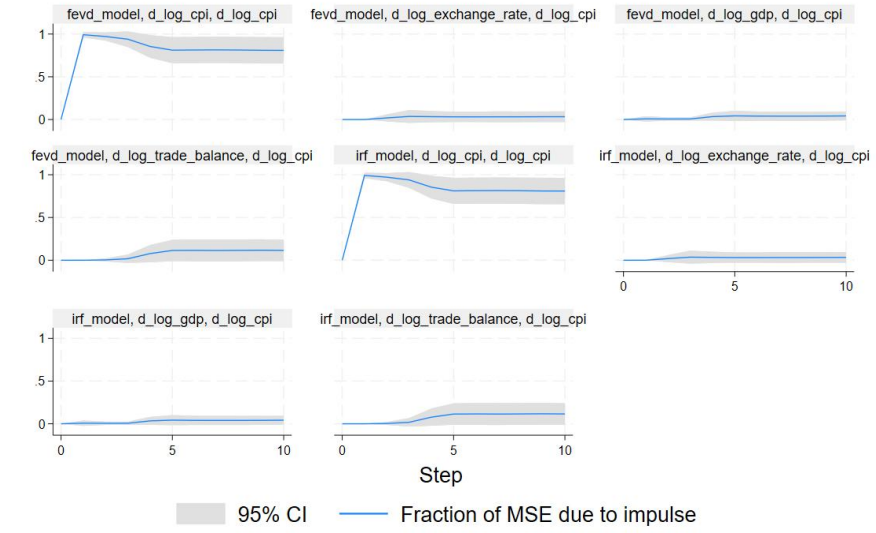
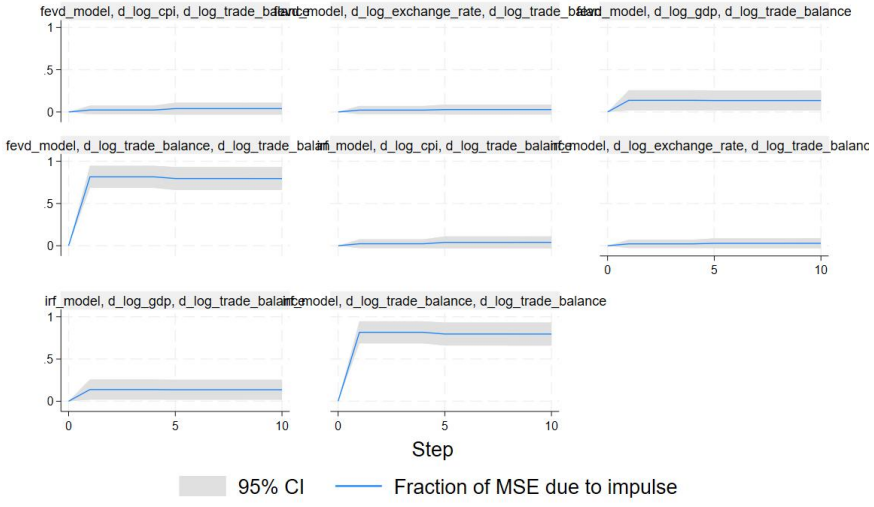


Figure B4 FEVD Trade Balance



Pre-Time Period (1994Q1-2000Q4)

Table B6 ADF Test

Variable	ADF Statistic (Z(t))	p-value
log_gdp (GDP)	-0.825	0.8118
log_cpi (CPI)	-0.431	0.9048
log_exchange_rate (Exchange Rate)	-2.479	0.1206
log_trade_balance (Trade Balance)	-3.183	0.021
ifed (Foreign Exchange Intervention)	-2.018	0.2786
d_log_gdp (GDP change)	-4.406	0.0003
d_log_cpi (CPI change)	-6.689	0
d_log_exchange_rate (Exchange Rate change)	-3.33	0.0136
d_log_trade_balance (Trade Balance change)	-6.276	0
d_ifed (Foreign Exchange Intervention)	-3.689	0.0043
dd_log_gdp (Second difference of GDP)	-3.57	0.0064
dd_log_exchange_rate (Second difference of Exchange Rate)	-3.878	0.0022

Table B7 OLS Results pre-time

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
dd_log_gdp	dd_log_exchange_rate	-0.7589992	1.089773	-0.7	0.494	[-3.0253, 1.5073]
	d_log_cpi	-0.7900199	0.2002579	-3.95	0.001	[-1.2065, -0.3736]
	log_trade_balance	-0.0578938	0.1142933	-0.51	0.618	[-0.2956, 0.1798]
	d_ifed	-0.1640635	0.1703893	-0.96	0.347	[-0.5184, 0.1903]
	_cons	-0.4411785	0.8438908	-0.52	0.607	[-2.1961, 1.3138]
d_log_cpi	dd_log_exchange_rate	-2.579035	0.7154775	-3.6	0.002	[-4.0669, -1.0911]
	dd_log_gdp	-0.5387849	0.1365737	-3.95	0.001	[-0.8228, -0.2548]
	log_trade_balance	0.0269124	0.0947795	0.28	0.779	[-0.1702, 0.2240]
	d_ifed	-0.1741685	0.1386704	-1.26	0.223	[-0.4625, 0.1142]
	_cons	0.1952533	0.7001323	0.28	0.783	[-1.2608, 1.6513]
log_trade_balance	dd_log_exchange_rate	4.564665	1.839451	2.48	0.022	[0.7393, 8.3900]
	dd_log_gdp	-0.2084958	0.4116101	-0.51	0.618	[-1.0645, 0.6475]
	d_log_cpi	0.1421149	0.5004979	0.28	0.779	[-0.8987, 1.1830]
	d_ifed	0.3831336	0.3196595	1.2	0.244	[-0.2816, 1.0479]
	_cons	-7.372767	0.098108	-75.15	0	[-7.5768, -7.1687]

Table B8 Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	43.6378	-	-	-	4.60E-07	-3.2398	-3.1463	-2.8431
1	52.9816	18.688	16	0.285	8.90E-07	-2.6347	-2.3543	-1.4445
2	70.6341	35.305	16	0.004	9.70E-07	-2.7849	-2.3176	-0.8012
3	118.791	96.314	16	0	9.80E-08	-5.7083	-5.0541	-2.9311
4	169.777	101.97	16	0	2.30E-08	-8.8888	-8.0476	-5.3181

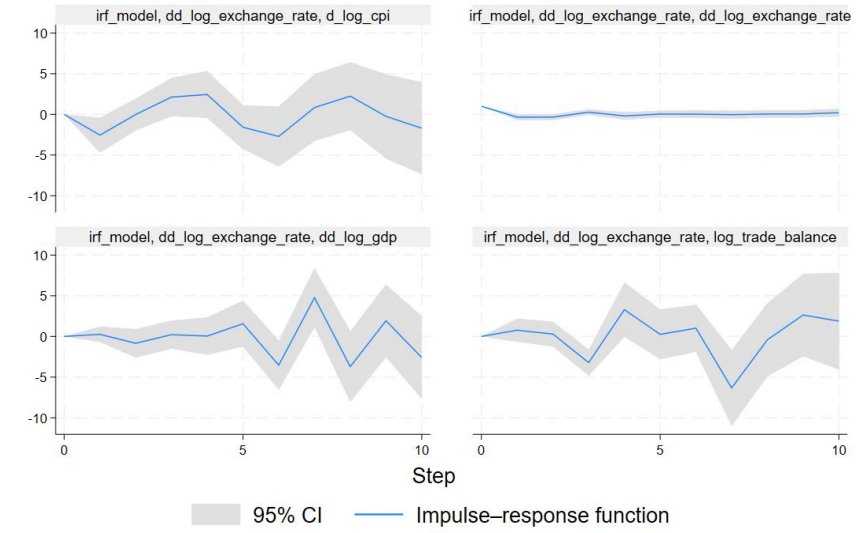
Table B9 Results for the VAR model with lag 4 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	dd_log_gdp	d_log_cpi	dd_log_exchange_rate	log_trade_balance
L4.dd_log_gdp	0.485***	-0.452***	0.0141	0.207
	(0.174)	(0.165)	(0.0258)	(0.243)
L4.d_log_cpi	-0.252	0.274	-0.0815**	-0.329
	(0.225)	(0.212)	(0.0332)	(0.313)
L4.dd_log_exchange_rate	0.538	0.937	-0.249**	-0.404
	(0.856)	(0.809)	(0.127)	(1.193)
L4.log_trade_balance	-0.158*	-0.0308	-0.0152	-0.0404
	(0.0885)	(0.0837)	(0.0131)	(0.123)
d_ifed	-0.0513	-0.258*	0.0410*	-0.243
	(0.144)	(0.136)	(0.0213)	(0.200)
Constant	-1.165*	-0.240	-0.109	-7.751***
	(0.646)	(0.611)	(0.0956)	(0.901)
Observations	22	22	22	22

Table B10 Granger Test Results

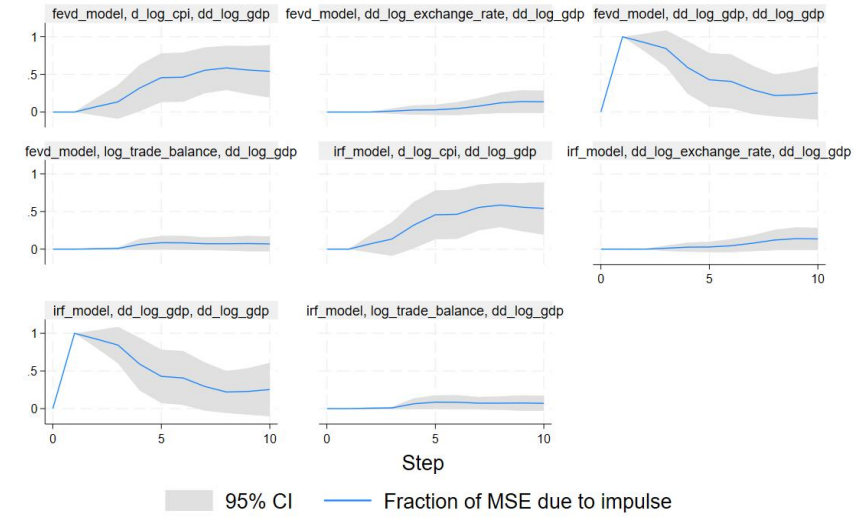
Equation	Excluded	Chi-squared	df	Prob > chi-square
dd_log_gdp	d_log_cpi	1.2626	1	0.261
	dd_log_exchange_rate	0.39584	1	0.529
	log_trade_balance	3.2043	1	0.073
	ALL	4.5527	3	0.208
d_log_cpi	dd_log_gdp	7.5094	1	0.006
	dd_log_exchange_rate	1.3405	1	0.247
	log_trade_balance	0.1357	1	0.713
	ALL	11.443	3	0.01
dd_log_exchange_rate	dd_log_gdp	0.30013	1	0.584
	d_log_cpi	6.0166	1	0.014
	log_trade_balance	1.349	1	0.245
	ALL	16.028	3	0.001
log_trade_balance	dd_log_gdp	0.72649	1	0.394
	d_log_cpi	1.1054	1	0.293
	dd_log_exchange_rate	0.1146	1	0.735
	ALL	7.7205	3	0.052

Figure B5 IRF pre-time



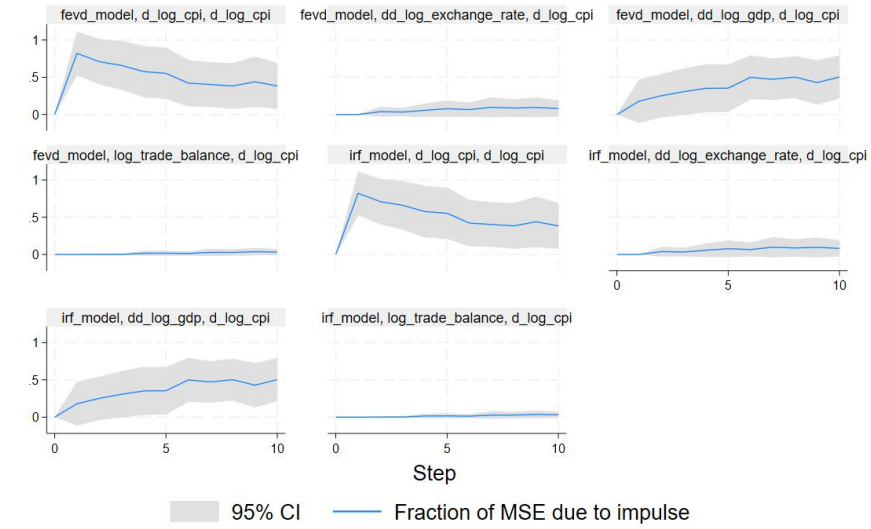
Graphs by irfname, impulse variable, and response variable

Figure B6 FEVD GDP pre-time



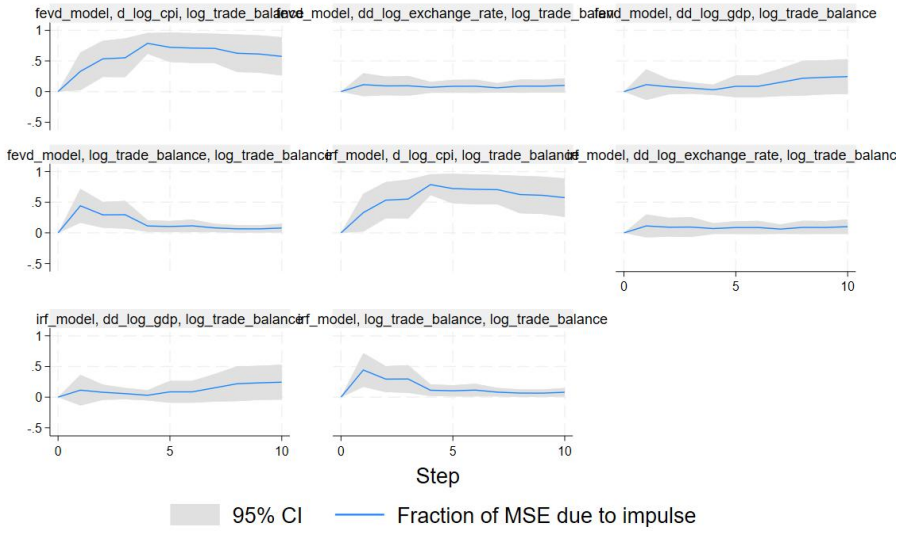
Graphs by irfname, impulse variable, and response variable

Figure B7 FEVD CPI pre-time



Graphs by irfname, impulse variable, and response variable

Figure B8 FEVD Trade Balance pre-time



Graphs by irfname, impulse variable, and response variable

Post-Time Period (2001Q1-2022Q4)

Table B11 ADF Test

Variable	ADF Statistic (Z(t))	p-value
log_gdp (GDP)	0.238	0.9743
log_cpi (CPI)	-2.702	0.0737
log_exchange_rate (Exchange Rate)	0.573	0.9869
log_trade_balance (Trade Balance)	-2.004	0.285
ifed (Foreign Exchange Intervention)	-2.904	0.0449
d_log_gdp (GDP change)	-3.835	0.0026
d_log_cpi (CPI change)	-5.985	0
d_log_exchange_rate (Exchange Rate change)	-3.394	0.0112
d_log_trade_balance (Trade Balance change)	-5.287	0

Table B12 OLS Results post-time

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-Statistic	p-Value	[95% Conf. Interval]
d_log_gdp (GDP change)	d_log_exchange_rate (Exchange Rate Change)	-0.0926	0.1232	-0.75	0.454	[-0.3376, 0.1524]
	d_log_cpi (CPI Change)	0.0036	0.0095	0.39	0.701	[-0.0152, 0.0225]
	d_log_trade_balance (Trade Balance Change)	-0.0841	0.0333	-2.53	0.013	[-0.1503, -0.0179]
	ifed (Foreign Exchange Intervention)	-0.0005	0.0071	-0.07	0.941	[-0.0147, 0.0137]
	_cons (Intercept)	0.0089	0.016	0.56	0.58	[-0.0230, 0.0408]
d_log_cpi (CPI change)	d_log_exchange_rate (Exchange Rate Change)	-1.2422	1.4268	-0.87	0.386	[-4.0800, 1.5955]
	d_log_gdp (GDP Change)	0.4902	1.2718	0.39	0.701	[-2.0393, 3.0196]
	d_log_trade_balance (Trade Balance Change)	-0.5328	0.3963	-1.34	0.183	[-1.3210, 0.2555]
	ifed (Foreign Exchange Intervention)	0.0025	0.0829	0.03	0.976	[-0.1624, 0.1674]
	_cons (Intercept)	-0.0684	0.1863	-0.37	0.715	[-0.4390, 0.3022]
d_log_trade_balance (Trade Balance change)	d_log_exchange_rate (Exchange Rate Change)	-0.6901	0.3854	-1.79	0.077	[-1.4565, 0.0764]
	d_log_gdp (GDP Change)	-0.8496	0.3361	-2.53	0.013	[-1.5181, -0.1812]
	d_log_cpi (CPI Change)	-0.04	0.0298	-1.34	0.183	[-0.0992, 0.0192]
	ifed (Foreign Exchange Intervention)	0.0117	0.0227	0.52	0.607	[-0.0334, 0.0568]
	_cons (Intercept)	-0.0502	0.0508	-0.99	0.326	[-0.1512, 0.0508]

Table B13 Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	-4.00336				0.000016	0.285794	0.378858	0.517301
1	24.5765	57.16	16	0	0.000012	-0.013726	0.265465	0.680793
2	79.099	109.04	16	0	0.0000047	-0.930928	-0.46561	0.226603
3	105.747	53.296	16	0	0.0000036	-1.18445	-0.533003	0.436096
4	139.722	67.951	16	0	0.0000024	-1.61243	-0.774858	0.471126

Table B14 Results for the VAR model with lag 4 (Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

VARIABLES	d_log_gdp	d_log_cpi	d_log_exchange_rate	d_log_trade_balance
L4.d_log_gdp	0.927***	0.970	-0.0430	-0.0605
	(0.0464)	(1.210)	(0.0882)	(0.343)
L4.d_log_cpi	0.00631	-0.360***	0.00221	-0.0401
	(0.00392)	(0.102)	(0.00744)	(0.0289)
L4.d_log_exchange_rate	0.0419	-0.626	-0.0764	-0.461
	(0.0512)	(1.334)	(0.0972)	(0.378)
L4.d_log_trade_balance	0.0441***	-0.747**	0.0194	0.0669
	(0.0142)	(0.371)	(0.0270)	(0.105)
ifed	-0.000907	-0.00467	0.00793	-0.00469
	(0.00313)	(0.0814)	(0.00593)	(0.0230)
Constant	0.00604	-0.0477	-0.0438***	-0.0390
	(0.00653)	(0.170)	(0.0124)	(0.0482)
Observations	84	84	84	84

Table B15 Granger Test Results

Equation	Excluded	Chi-squared	df	Prob > Chi-square
d_log_gdp	d_log_cpi	2.5923	1	0.107
	d_log_exchange_rate	0.6688	1	0.413
	d_log_trade_balance	9.5984	1	0.002
	ALL	11.061	3	0.011
d_log_cpi	d_log_gdp	0.6429	1	0.423
	d_log_exchange_rate	0.2206	1	0.639
	d_log_trade_balance	4.0539	1	0.044
	ALL	6.0735	3	0.108
d_log_exchange_rate	d_log_gdp	0.2382	1	0.626
	d_log_cpi	0.0887	1	0.766
	d_log_trade_balance	0.5158	1	0.473
	ALL	1.0434	3	0.791
d_log_trade_balance	d_log_gdp	0.0312	1	0.86
	d_log_cpi	1.9284	1	0.165
	d_log_exchange_rate	1.4879	1	0.223
	ALL	3.1616	3	0.367

Figure B9 IRF post-time

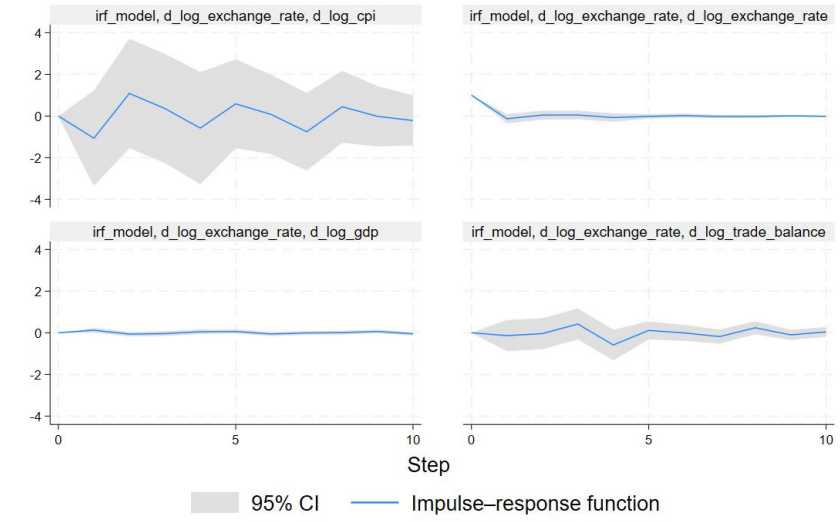


Figure B10 FEVD GDP post-time

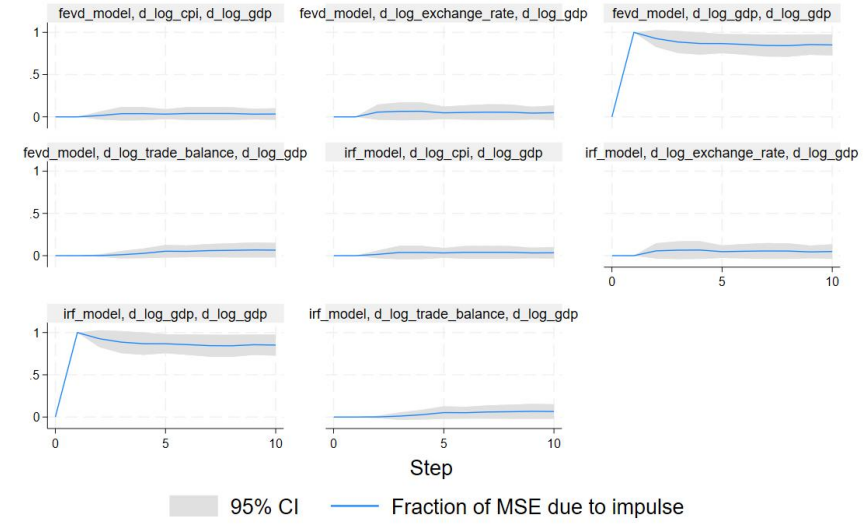
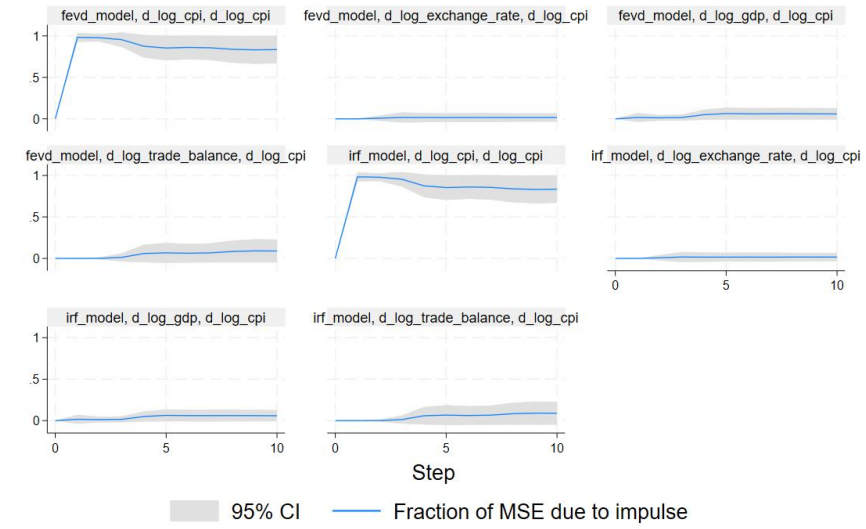
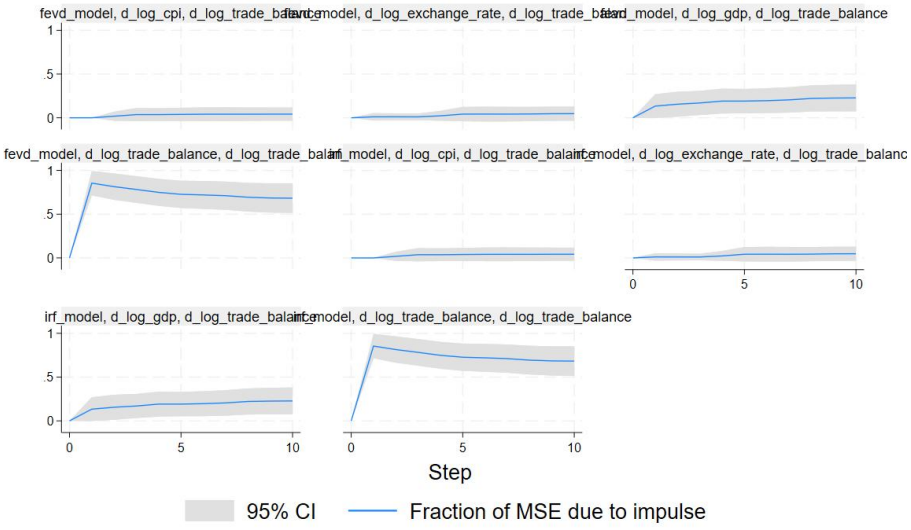


Figure B11 FEVD CPI post-time



Graphs by irfname, impulse variable, and response variable

Figure B12 FEVD Trade Balance post-time



Graphs by irfname, impulse variable, and response variable

Appendix C Kazakhstan

Whole period

Table C1. ADF Test first-time

Variables	ADF Statistics	P-value
log_GDP	-2.03	0.2736***
d_CPI	-5.123	0.000
log_ER	-0.399	0.9103****
d_TB	-3.603	0.0057
log_OIL	-2.453	0.1274**

Table C2. ADF Test second-time

Variables	ADF Statistics	P-value
d_log_GDP	-3.952	0.0017
d_log_ER	-4.311	0.0004
d_log_OIL	-4.069	0.0011

Table C3. OLS results

Dependent Variable	Independent Variables	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d_log_GDP	d_log_NEER	-0.02795	0.02613	-1.07	0.288***	[-0.08004, 0.02415]
	d_log_OIL	-0.00564	0.01488	-0.38	0.706****	[-0.03531, 0.02403]
	d_CPI	0.00459	0.003	1.53	0.13**	[-0.00139, 0.01057]
	d_TB	-0.0007	0.00057	-1.22	0.226**	[-0.00185, 0.00044]
	_cons	0.01134	0.00203	5.6	0	[0.00730, 0.01538]
d_CPI	d_log_NEER	3.19556	0.85803	3.72	0	[1.48469, 4.90642]
	d_log_OIL	0.48286	0.37146	1.3	0.198**	[-0.25781, 1.22353]
	d_log_GDP	5.7713	2.74085	2.11	0.039	[0.30621, 11.23639]
	d_TB	0.00018	0.01566	0.01	0.991****	[-0.03105, 0.03141]
	_cons	-0.1147	0.05853	-1.96	0.054	[-0.23141, 0.00201]
d_TB	d_log_NEER	-11.7293	5.37027	-2.18	0.032	[-22.43728, -1.02126]
	d_log_OIL	-3.05538	3.54879	-0.86	0.392***	[-10.13146, 4.02070]
	d_log_GDP	-55.596	66.00573	-0.84	0.402***	[-187.2077, 76.01569]
	d_CPI	0.01155	0.98577	0.01	0.991****	[-1.95402, 1.97711]
	_cons	1.04101	1.15896	0.9	0.372***	[-1.26988, 3.35191]

Table C4. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	16.3116				9.30E-06	-0.23088	-0.130173*	0.022085*
1	36.721	40.819	16	0.001	8.30E-06	-0.35336	-0.05124	0.405529
2	52.9308	32.42*	16	0.009	8.3e-06*	-0.359188*	0.144338	0.905626
3	60.9211	15.981	16	0.454	0.00001	-0.1367	0.568239	1.63404
4	67.6159	13.39	16	0.644	0.000014	0.121781	1.02813	2.39845

Table C5. VAR results

VARIABLES	d_log_GDP	d_CPI	d_log_NEER	d_TB
L2.d_log_GDP	-0.00105	-4.010	-1.250***	61.34*
	(0.121)	(4.387)	(0.471)	(32.32)
L2.d_CPI	-0.00345	-0.165	-0.00180	1.943**
	(0.00336)	(0.122)	(0.0131)	(0.898)
L2.d_log_NEER	-0.0159	-1.005	-0.0435	-12.77
	(0.0296)	(1.074)	(0.115)	(7.910)
L2.d_TB	2.88e-05	-0.0135	-0.00346**	0.0786
	(0.000417)	(0.0151)	(0.00162)	(0.111)
d_log_OIL	0.00167	0.336	-0.0902**	-2.452
	(0.0110)	(0.400)	(0.0429)	(2.944)
Constant	0.0108***	0.0600	0.0316***	-0.188
	(0.00236)	(0.0857)	(0.00920)	(0.631)
Observations	74	74	74	74

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table C6. Granger Causality Test

Equation	Excluded	chi2	df	Prob > chi2
d_log_GDP	d_CPI	1.0568	1	0.304
	d_log_NEER	0.28894	1	0.591
	d_TB	0.00477	1	0.945
	ALL	1.9792	3	0.577
d_CPI	d_log_GDP	0.8354	1	0.361
	d_log_NEER	0.87518	1	0.35
	d_TB	0.80122	1	0.371
	ALL	1.9796	3	0.577
d_log_NEER	d_log_GDP	7.0429	1	0.008
	d_CPI	0.01883	1	0.891
	d_TB	4.5419	1	0.033
	ALL	10.11	3	0.018
d_TB	d_log_GDP	3.6031	1	0.058
	d_CPI	4.6887	1	0.03
	d_log_NEER	2.6069	1	0.106
	ALL	11.02	3	0.012

Figure C1 IRF

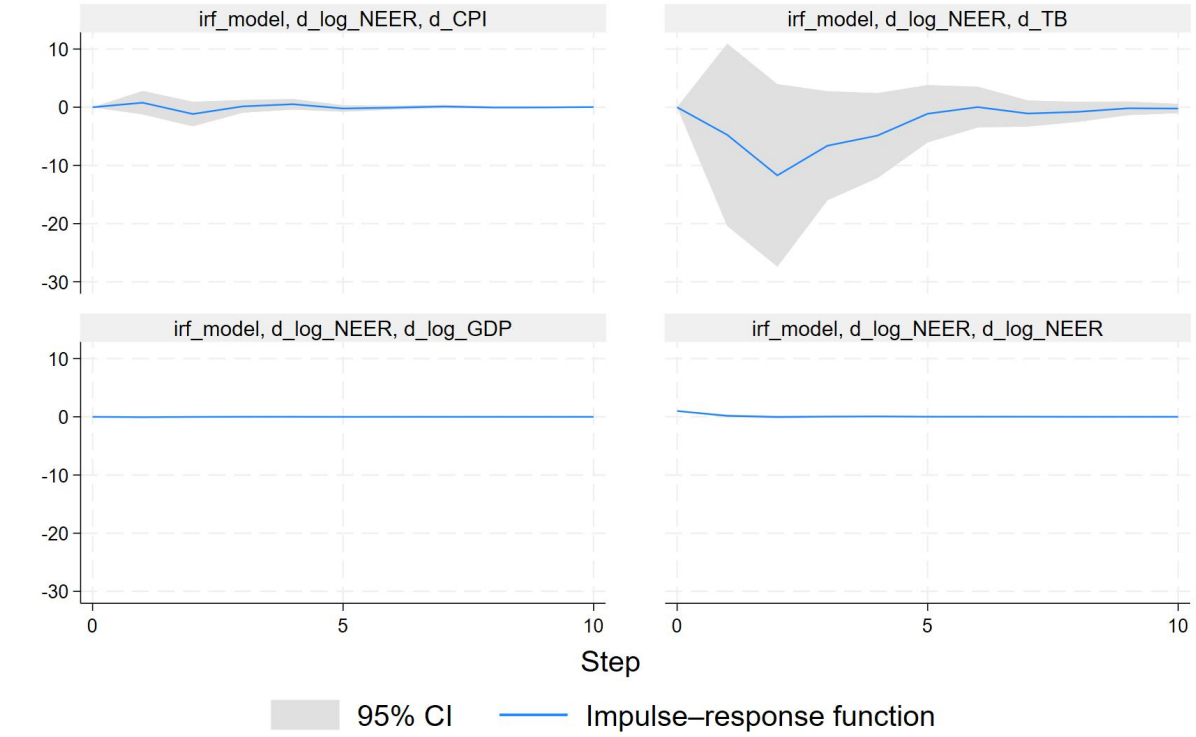


Figure C2. FEVD for

GDP

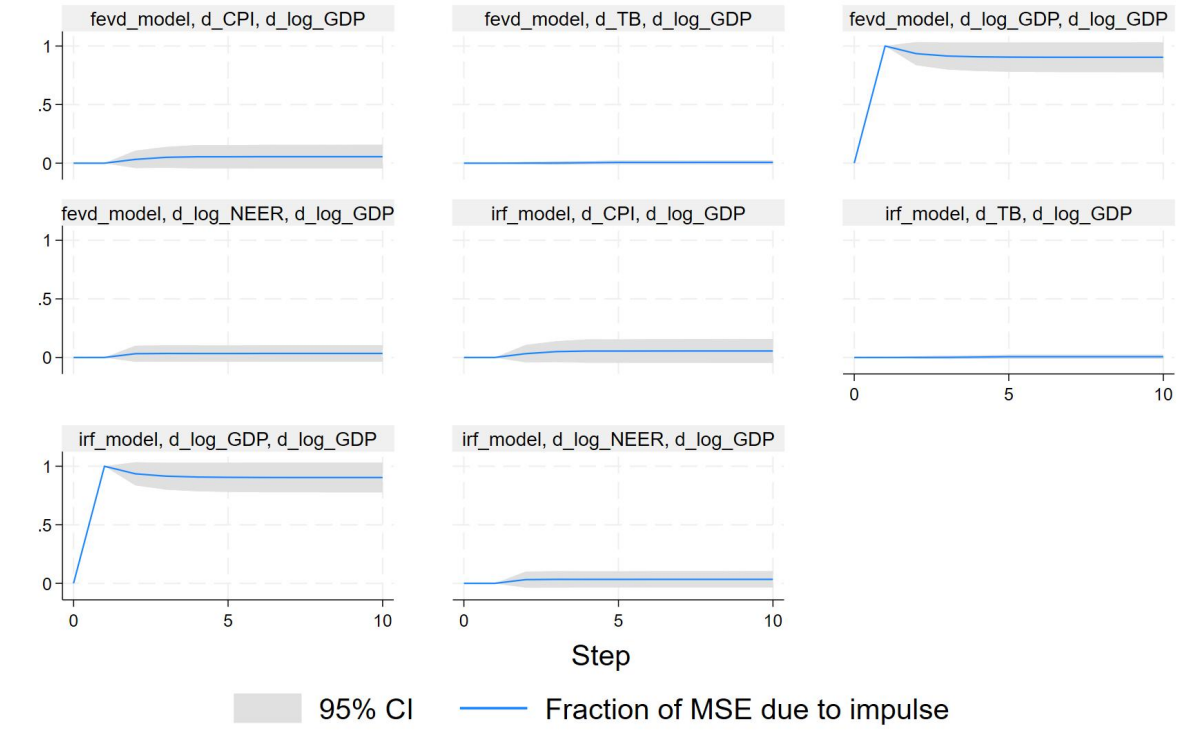
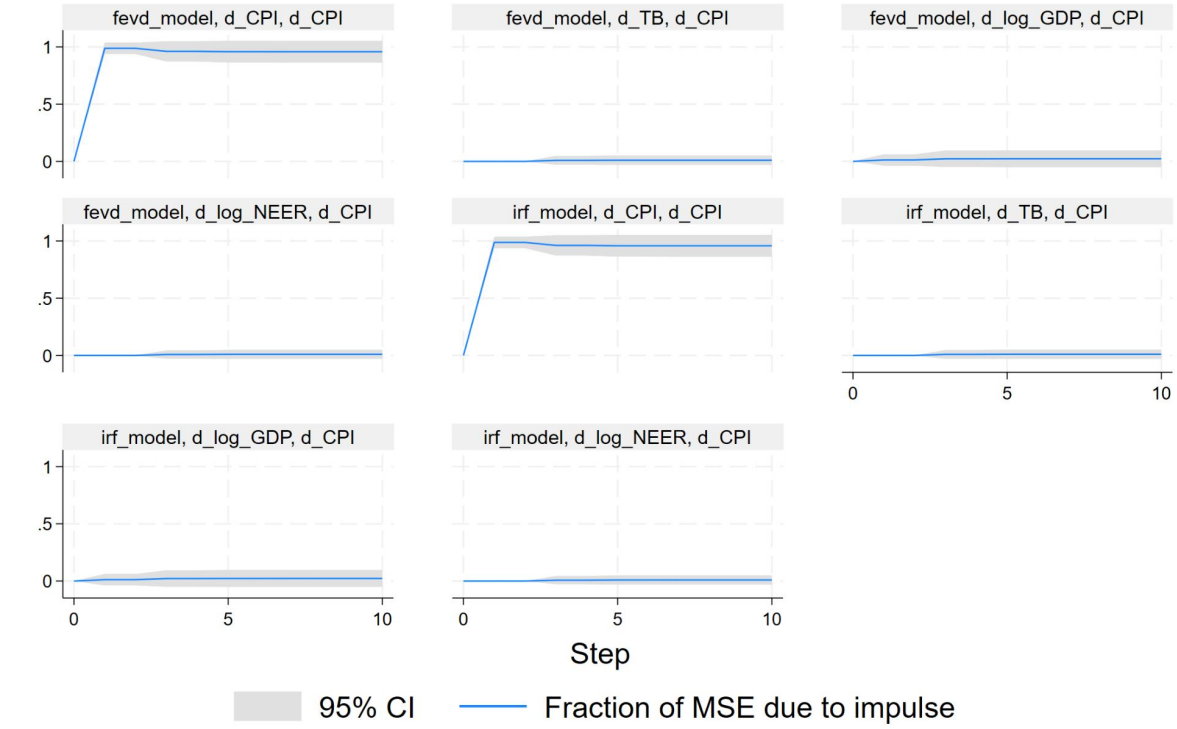
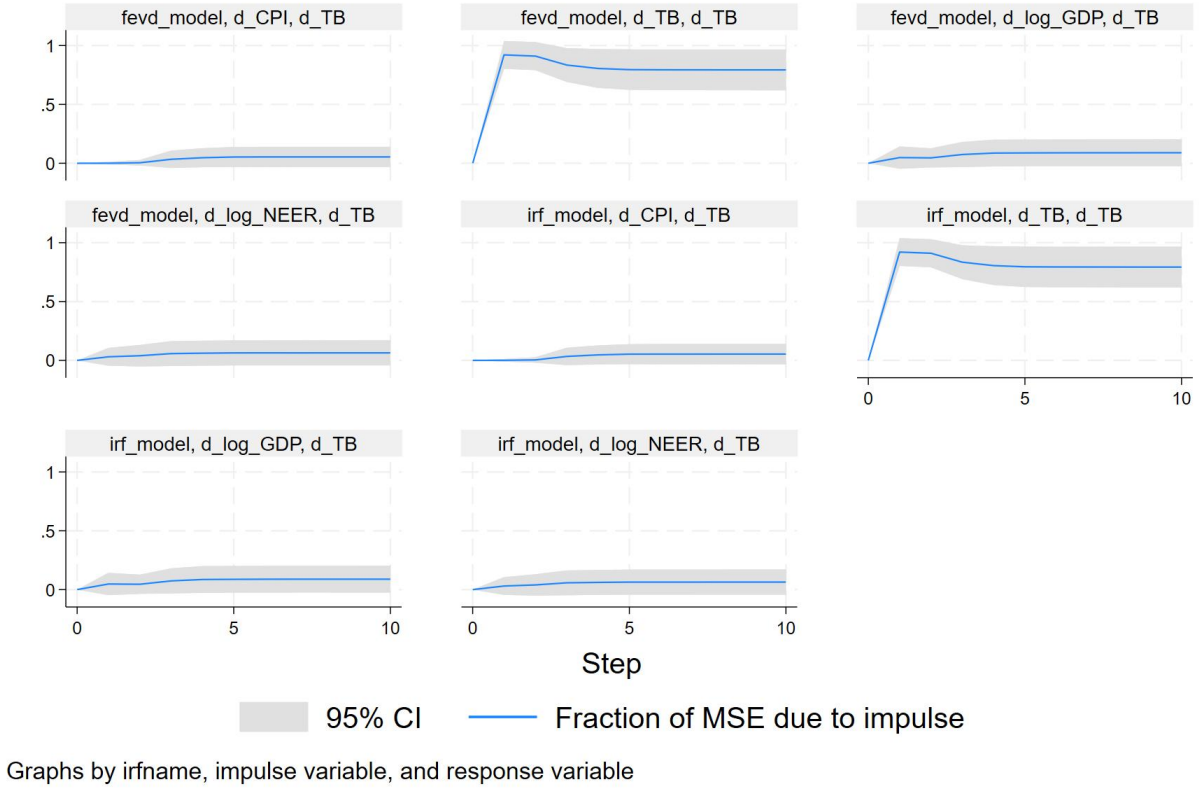


Figure C3. FEVD for CPI



Graphs by irfname, impulse variable, and response variable

Figure C4. FEVD for Trade Balance



Pre Period

Table C7. ADF Test

Variable	ADF Statistic	P-Value
d2_log_GDP	-1.585	0.0012
d_CPI	-3.583	0.0061
d_log_NEER	-3.093	0.027
d2_TB	-4.711	0.0001
d2_log_OIL	-4.417	0.0003

Table C8. OLS results

Dependent Variable	Independent Variables	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d2_log_GDP	d_log_NEER	0.0348	0.0709	0.49	0.627	[-0.1092, 0.1788]
	d2_log_OIL	-0.00498	0.0191	-0.26	0.796	[-0.0438, 0.0339]
	d_CPI	-0.00838	0.0096	-0.87	0.389	[-0.0279, 0.0111]
	d2_TB	-0.00112	0.00038	-2.9	0.006	[-0.00189, -0.00034]
	_cons	-0.0009	0.0035	-0.26	0.8	[-0.00801, 0.00622]
d_CPI	d_log_NEER	1.5993	0.9921	1.61	0.116	[-0.4146, 3.6133]
	d2_log_OIL	0.0425	0.3931	0.11	0.914	[-0.7554, 0.8405]
	d2_log_GDP	-3.9109	4.6498	-0.84	0.406	[-13.3505, 5.5287]
	d2_TB	-0.0148	0.0092	-1.6	0.118	[-0.0335, 0.00397]
	_cons	-0.0284	0.0752	-0.38	0.708	[-0.1811, 0.1242]
d2_TB	d_log_NEER	-60.3833	42.2835	-1.43	0.162	[-146.2233, 25.4568]
	d2_log_OIL	2.5041	8.3758	0.3	0.767	[-14.4996, 19.5078]
	d2_log_GDP	-100.904	66.2946	-1.52	0.137	[-235.4891, 33.6812]
	d_CPI	-2.8659	2.2205	-1.29	0.205	[-7.3738, 1.6420]
	_cons	0.2833	0.8927	0.32	0.753	[-1.5290, 2.0956]

Table C9. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	17.2398				7.00E-06	-0.5133	-0.3905	-0.1614*
1	42.2969	50.114	16	0	4.30E-06	-1.0165	-0.6480*	0.0392
2	58.2989	32.004	16	0.01	4.50E-06	-1.0166	-0.4025	0.7429
3	79.0181	41.438	16	0	3.90E-06	-1.2788	-0.419	1.1845
4	96.4102	34.784*	16	0.004	4.50E-06	-1.3561*	-0.2507	1.8109

Table C10. VAR results

VARIABLES	d2_log_GDP	d_log_NEER	d_CPI	d2_TB
L4.d2_log_GDP	0.307**	0.752**	8.226**	-224.0***
	(0.133)	(0.362)	(3.780)	(55.26)
L4.d_log_NEER	-0.128**	-0.0256	1.628	-1.477
	(0.0608)	(0.166)	(1.731)	(25.30)
L4.d_CPI	-0.0190***	-0.0263	-0.0629	0.0883
	(0.00661)	(0.0180)	(0.188)	(2.750)
L4.d2_TB	0.000156	0.000658	0.0174	-0.445**
	(0.000416)	(0.00114)	(0.0118)	(0.173)
d2_log_OIL	-0.00637	0.0504	0.0911	-2.270
	(0.0130)	(0.0355)	(0.370)	(5.413)
Constant	-0.000152	0.0129*	-0.0252	-0.162
	(0.00246)	(0.00672)	(0.0701)	(1.025)
Observations	36	36	36	36

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table C11. Granger Causality Test

Equation	Excluded	Chi-Square	df	Prob > Chi-Square
d2_log_GDP	d_log_NEER	11.147	4	0.025
	d_CPI	3.6808	4	0.451
	d2_TB	1.5382	4	0.82
	ALL	40.001	12	0
d_log_NEER	d2_log_GDP	11.598	4	0.021
	d_CPI	17.574	4	0.001
	d2_TB	8.9044	4	0.064
	ALL	50.668	12	0
d_CPI	d2_log_GDP	19.08	4	0.001
	d_log_NEER	8.3937	4	0.078
	d2_TB	0.64876	4	0.957
	ALL	33.26	12	0.001
d2_TB	d2_log_GDP	17.167	4	0.002
	d_log_NEER	20.539	4	0
	d_CPI	16.258	4	0.003
	ALL	56.79	12	0

Figure C5. IRF

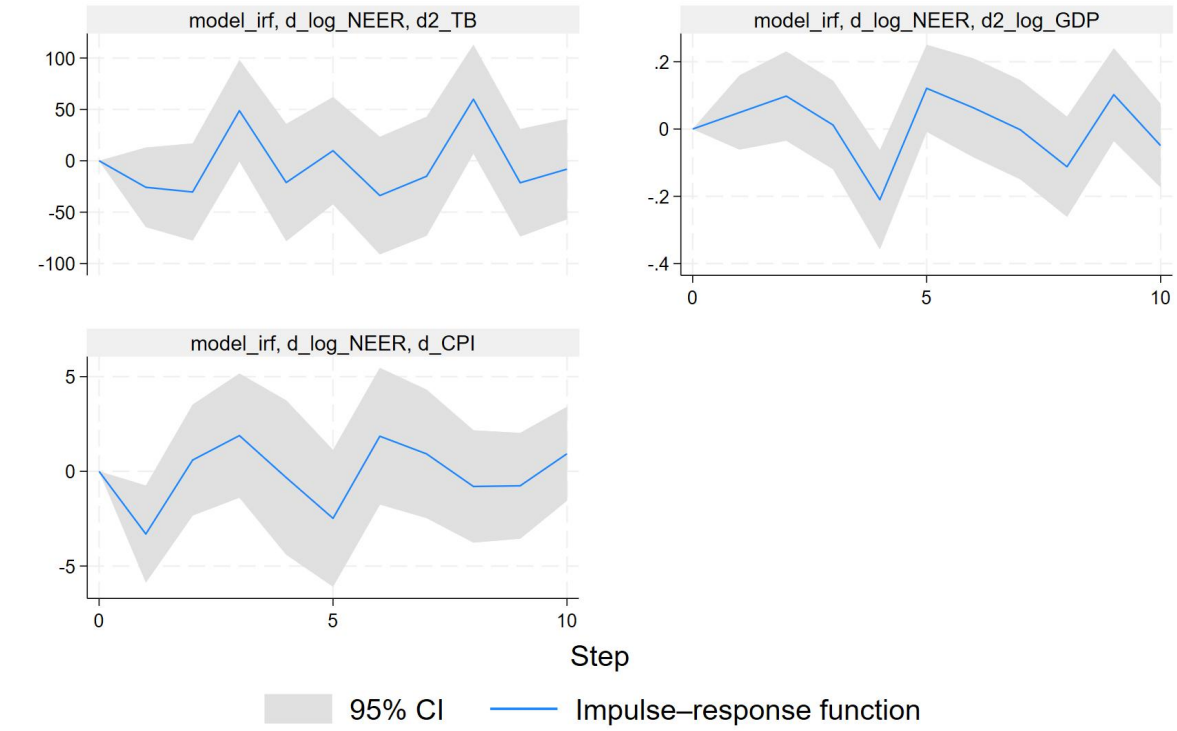
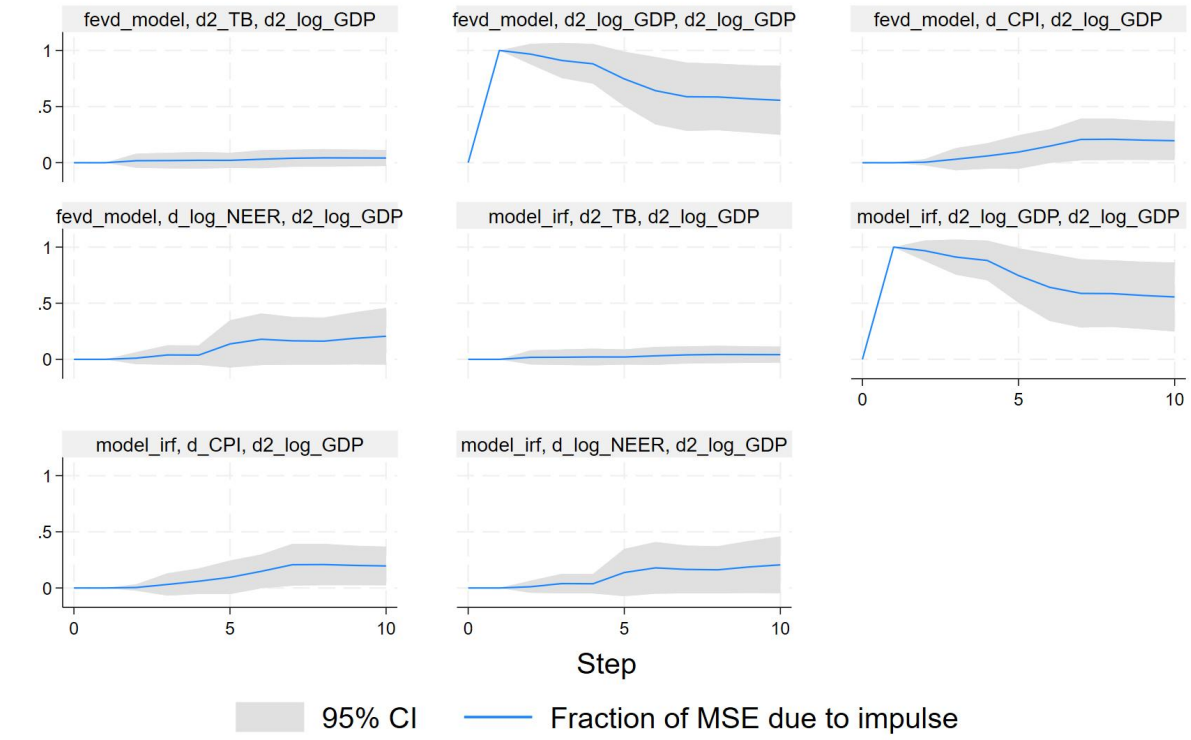


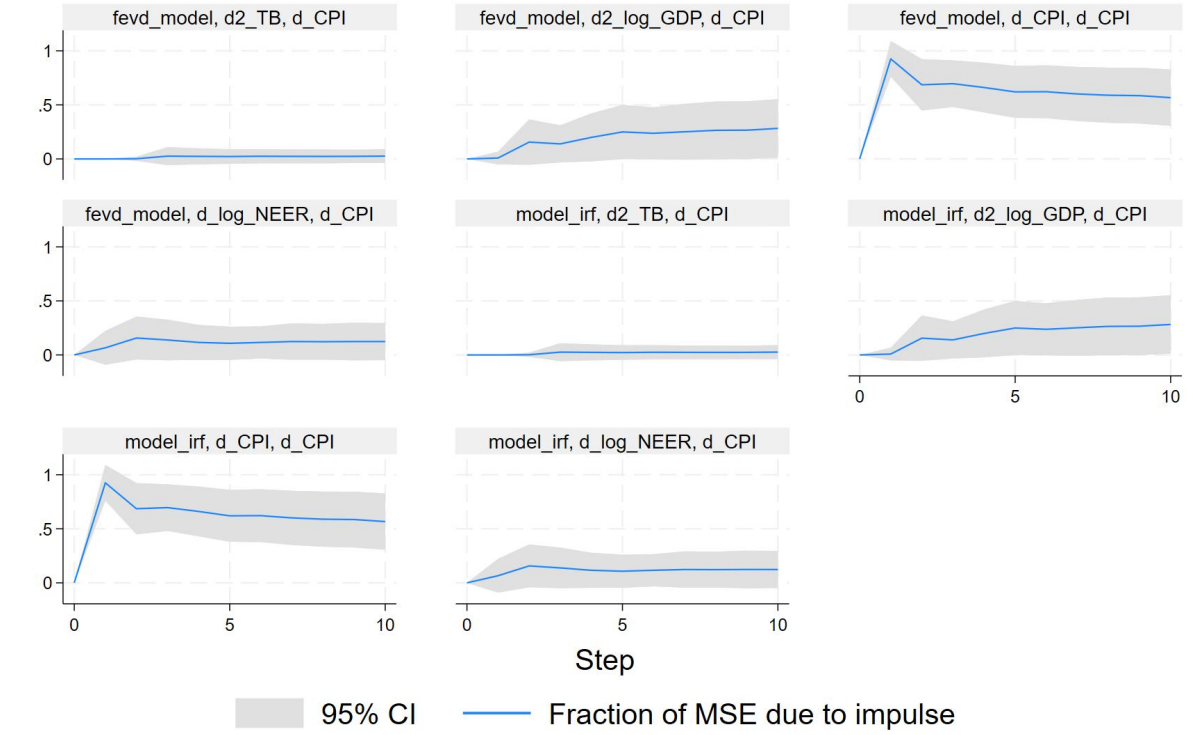
Figure C6. FEVD for

GDP



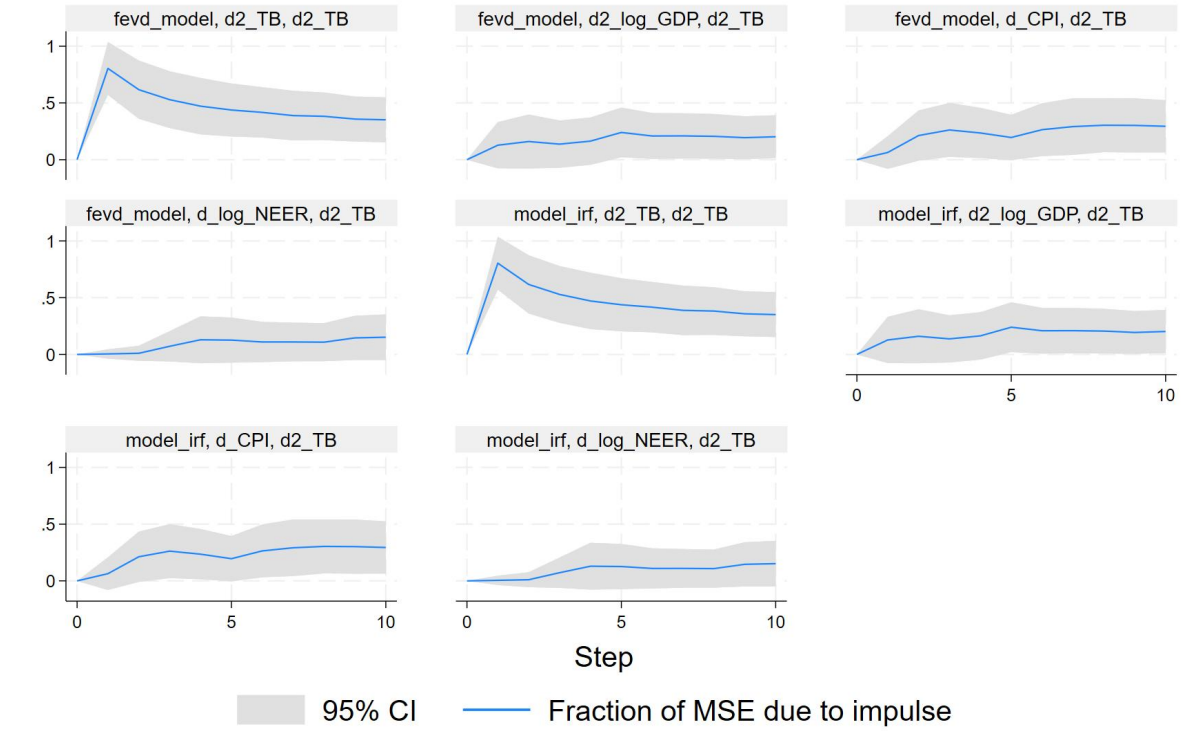
Graphs by irfname, impulse variable, and response variable

Figure C7. FEVD for CPI



Graphs by irfname, impulse variable, and response variable

Figure C8. FEVD for Trade Balance



Post Period

Table C12. ADF Test

Variable	ADF Statistic	P-Value
d_log_GDP	-3.371	0.012
d_CPI	-3.407	0.0107
log_ER	-5.117	0.000
log_TB	-3.12	0.0251
d2_OIL	-3.665	0.0046

Table C13. OLS results

Dependent Variable	Independent Variables	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d_log_GDP	log_NEER	0.000979	0.015512	0.06	0.95	[-0.0307014, 0.0326597]
	d2_OIL	-0.00052	0.000481	-1.08	0.288	[-0.0015011, 0.0004618]
	d_CPI	0.002793	0.00365	0.77	0.45	[-0.0046608, 0.0102468]
	log_TB	-0.00153	0.004672	-0.33	0.745	[-0.0110716, 0.0080095]
	_cons	0.005986	0.092871	0.06	0.949	[-0.1836813, 0.1956523]
d_CPI	log_NEER	-0.1955	1.065937	-0.18	0.856	[-2.372437, 1.981432]
	d2_OIL	0.003867	0.016848	0.23	0.82	[-0.0305416, 0.0382749]
	d_log_GDP	6.927233	6.562162	1.06	0.3	[-6.474489, 20.32895]
	log_TB	-0.12043	0.24513	-0.49	0.627	[-0.6210492, 0.3801939]
	_cons	1.48342	6.457395	0.23	0.82	[-11.70434, 14.67118]
log_TB	log_NEER	0.567497	0.423928	1.34	0.191	[-0.2982786, 1.433273]
	d2_OIL	-0.00036	0.006021	-0.06	0.953	[-0.0126515, 0.0119401]
	d_log_GDP	-1.11224	3.502588	-0.32	0.753	[-8.265482, 6.040996]
	d_CPI	-0.03527	0.079817	-0.44	0.662	[-0.1982805, 0.1277355]
	_cons	-0.50255	2.513411	-0.2	0.843	[-5.635618, 4.630524]

Table C14. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	52.5539				6.60E-07	-2.87444	-2.75381	-2.50438
1	117.728	130.35	16	0	2.80E-08	-6.04698	-5.68508	-4.93679
2	141.711	47.965	16	0	1.80E-08	-6.56198	-5.95883	-4.71168
3	168.357	53.292	16	0	1.10E-08	-7.24883	-6.40441	-4.6584
4	201.068	65.422*	16	0	5.5e-09*	-8.32697*	-7.24129*	-4.99642*

Table C15. VAR results

VARIABLES	d_log_GDP	log_NEER	d_CPI	log_TB
L.d_log_GDP	0.0438	-0.361	6.291	5.505***
	-0.147	-0.536	-4.151	-1.022
L2.d_log_GDP	-0.125	-0.377	-3.406	3.508***
	-0.18	-0.658	-5.089	-1.253
L3.d_log_GDP	0.0957	0.396	1.513	8.118***
	-0.141	-0.514	-3.981	-0.98
L4.d_log_GDP	0.0974	0.149	0.934	5.139***
	-0.172	-0.629	-4.87	-1.198
L.log_NEER	-0.0274	0.606***	2.885*	0.432
	-0.0567	-0.207	-1.604	-0.395
L2.log_NEER	0.146**	-0.0112	0.29	1.142**
	-0.0688	-0.251	-1.946	-0.479
L3.log_NEER	0.0245	0.0561	-5.335**	-1.457***
	-0.0764	-0.279	-2.161	-0.532

L4.log_NEER	-0.125**	0.29	2.445*	-0.0524
	-0.0502	-0.183	-1.42	-0.349
L.d_CPI	-0.0238***	0.0117	-0.520***	-0.0245
	-0.00535	-0.0196	-0.151	-0.0373
L2.d_CPI	-0.0229***	0.0252	-0.232	0.00782
	-0.00538	-0.0197	-0.152	-0.0375
L3.d_CPI	-0.0103**	0.0166	-0.222*	0.0629**
	-0.00435	-0.0159	-0.123	-0.0303
L4.d_CPI	-0.00721**	0.00932	-0.146	0.0255
	-0.00333	-0.0122	-0.0943	-0.0232
L.log_TB	-0.00948	0.0333	-1.885***	0.739***
	-0.0201	-0.0735	-0.569	-0.14
L2.log_TB	-0.0511	0.0749	5.735***	-0.112
	-0.0315	-0.115	-0.892	-0.219
L3.log_TB	0.109***	-0.189	-7.104***	0.254
	-0.0318	-0.116	-0.9	-0.222
L4.log_TB	-0.0858***	0.133*	2.887***	-0.380**
	-0.0215	-0.0785	-0.607	-0.149
d2_OIL	-0.000605**	-0.00189**	-0.0134*	0.00225
	-0.00024	-0.00089	-0.00692	-0.0017
Constant	0.00419	0.231	-0.699	0.873
	-0.0823	-0.301	-2.328	-0.573
Observations	31	31	31	31

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table C16. Granger Causality Test

Equation	Excluded	chi^2	df	p-value
d_log_GDP	log_NEER	0.13726	1	0.711
	d_CPI	0.15029	1	0.698
	log_TB	0.00286	1	0.957
	ALL	0.30275	3	0.96
log_NEER	d_log_GDP	0.706	1	0.401
	d_CPI	0.14792	1	0.701
	log_TB	0.17051	1	0.68
	ALL	1.0658	3	0.785
d_CPI	d_log_GDP	0.3257	1	0.568
	log_NEER	0.00435	1	0.947
	log_TB	0.49216	1	0.483
	ALL	0.77175	3	0.856
log_TB	d_log_GDP	10.698	1	0.001
	log_NEER	0.22041	1	0.639
	d_CPI	0.00204	1	0.964
	ALL	11.215	3	0.011

Figure C9. IRF

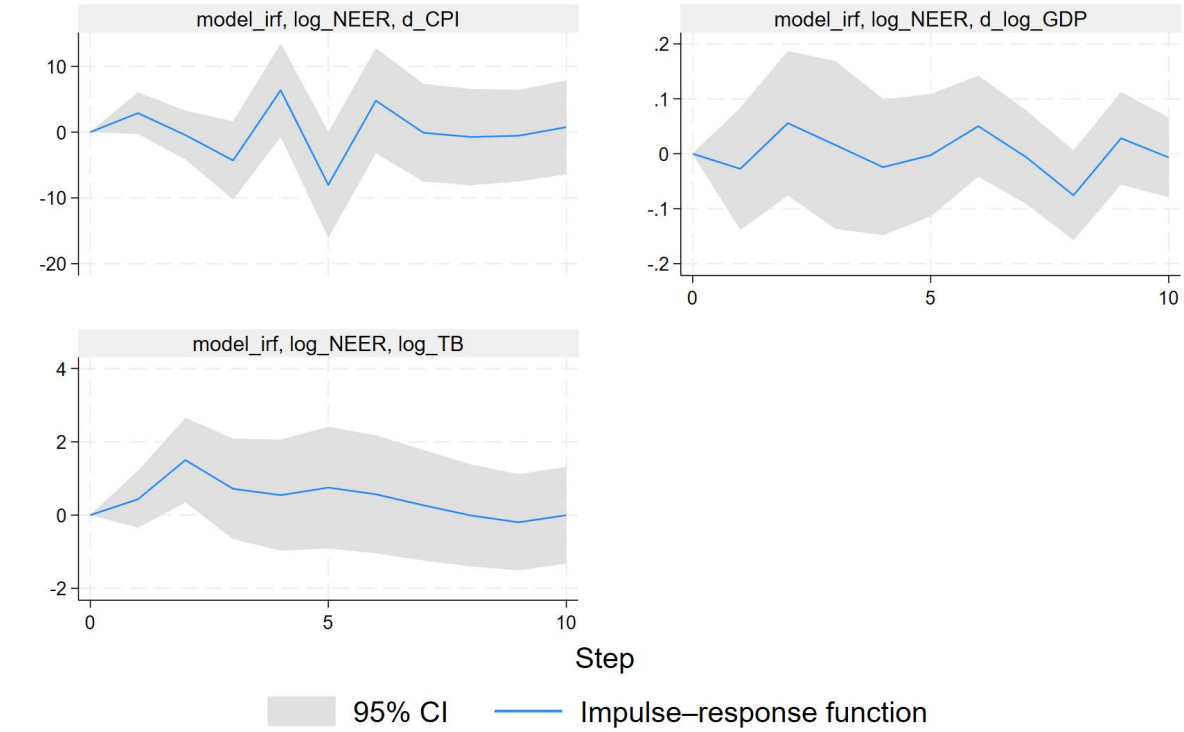


Figure C10. FEVD for GDP

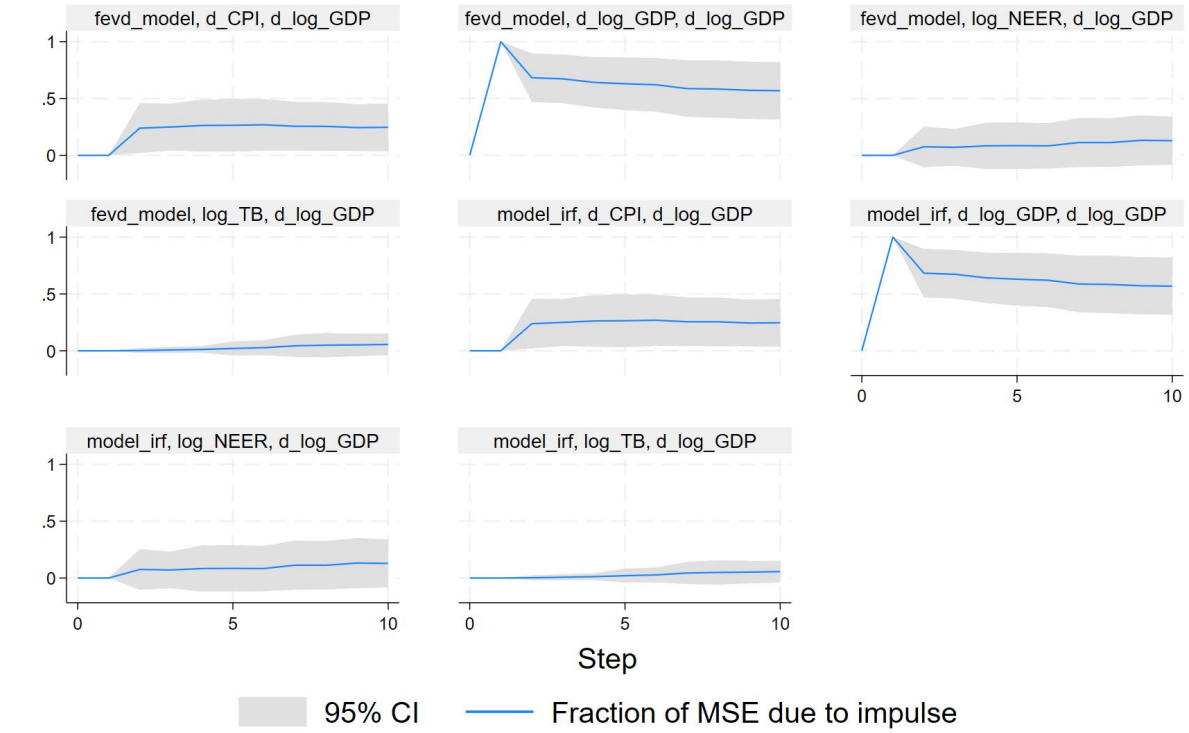


Figure C11. FEVD for CPI

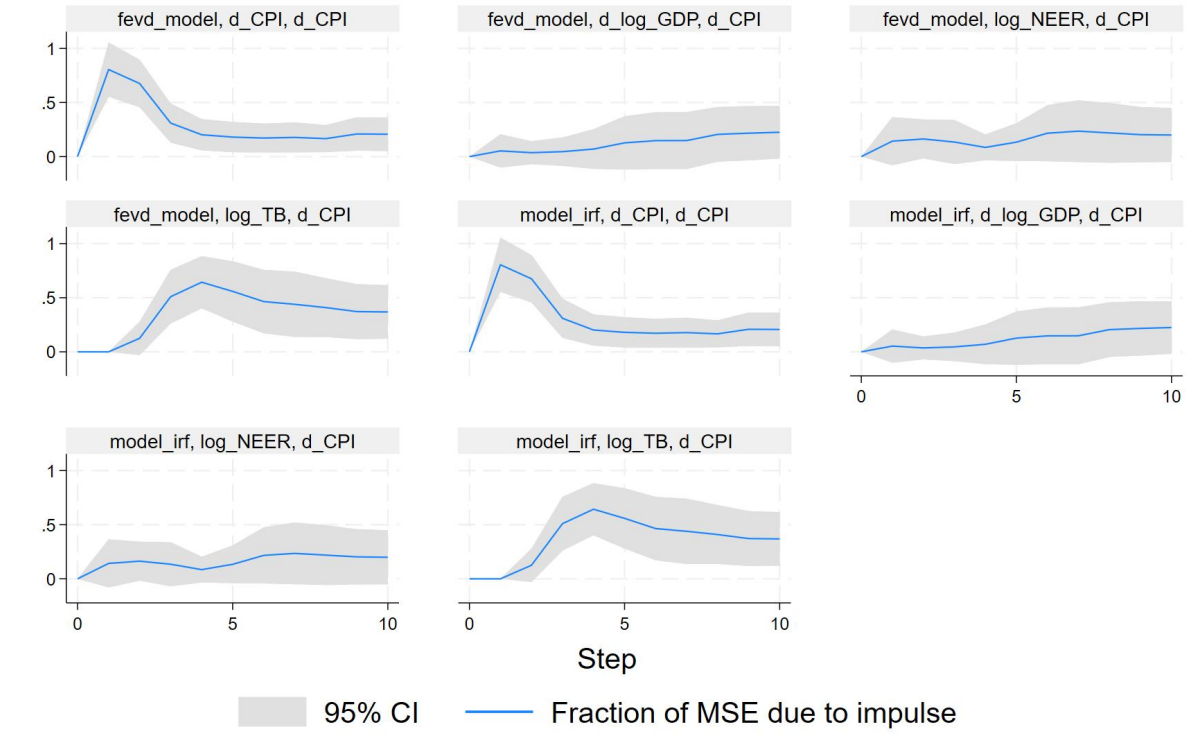
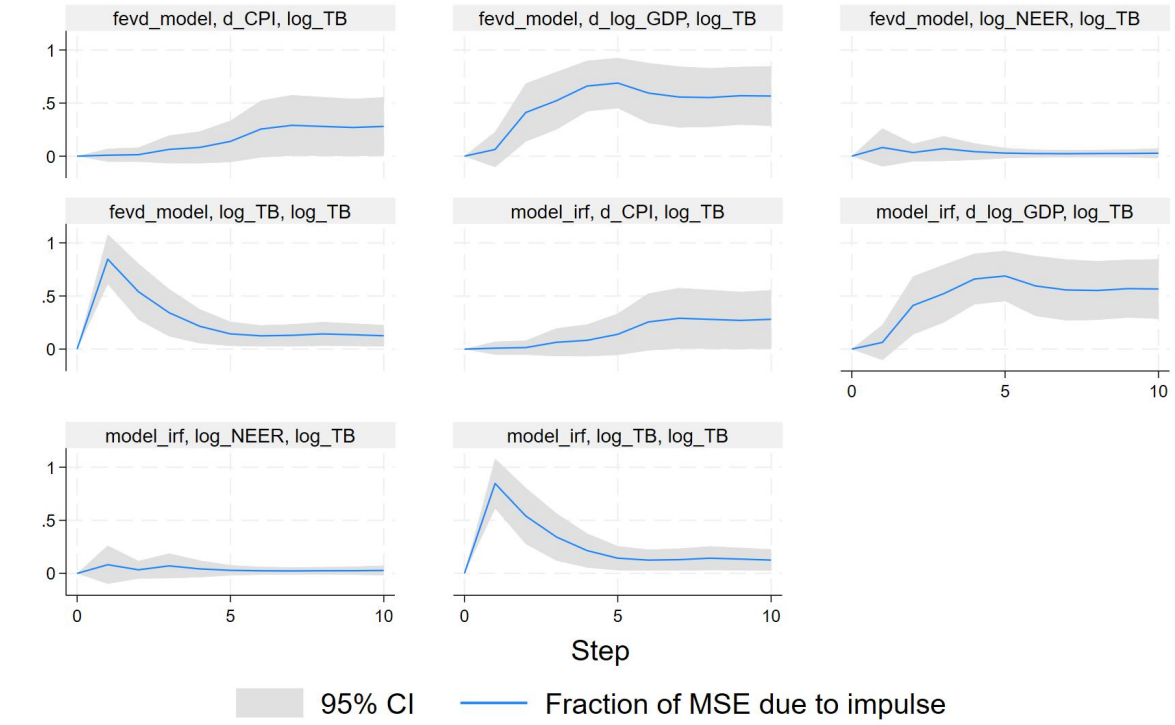


Figure C12. FEVD for Trade Balance



Appendix D Russia

Whole Period

Table D1. ADF Test

Variable	ADF Test Statistic (Z(t))	P-value
d_CPI	-4.678	0.0001
d_log_GDP	-3.491	0.0082
d_log_NEER	-3.238	0.0179
d_log_OIL	-3.615	0.0055
d2_log_TB	-5.307	0.0000

Table D2. OLS results

Dependent Variable	Independent Variables	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d_log_GDP	d_log_NEER	0.2612	0.2853	0.92	0.364	[-0.3102, 0.8327]
	d_log_OIL	-0.0697	0.0993	-0.7	0.485	[-0.2686, 0.1291]
	d_CPI	-0.0456	0.0334	-1.36	0.178	[-0.1126, 0.0214]
	d2_log_TB	0.1353	0.0882	1.53	0.131	[-0.0414, 0.3120]
	_cons	0.0309	0.0137	2.26	0.028	[0.0035, 0.0584]
d_CPI	d_log_NEER	-3.5177	1.0273	-3.42	0.001	[-5.5756, -1.4599]
	d_log_OIL	-0.0795	0.3918	-0.2	0.84	[-0.8644, 0.7054]
	d_log_GDP	-0.7048	0.5168	-1.36	0.178	[-1.7401, 0.3304]
	d2_log_TB	-0.4522	0.3488	-1.3	0.2	[-1.1510, 0.2465]
	_cons	-0.0157	0.0562	-0.28	0.78	[-0.1283, 0.0968]
d2_log_TB	d_log_NEER	-1.8152	0.3507	-5.18	0	[-2.5178, -1.1126]
	d_log_OIL	0.7379	0.1103	6.69	0	[0.5169, 0.9589]
	d_log_GDP	0.2979	0.1943	1.53	0.131	[-0.0913, 0.6870]
	d_CPI	-0.0644	0.0497	-1.3	0.2	[-0.1640, 0.0351]
	_cons	-0.0292	0.0209	-1.4	0.166	[-0.0710, 0.0125]

Table D3. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	121.243	-	-	-	2.20E-07	-3.97344	-3.862	-3.6867
1	160.514	78.543	16	0	9.80E-08	-4.78998	-4.45566	-3.92974
2	201.346	81.663	16	0	4.10E-08	-5.66126	-5.10407	-4.22754
3	245.142	87.593	16	0	1.60E-08	-6.63658	-5.85651	-4.62937
4	307.432	124.58*	16	0	3.3e-09*	-8.26076*	-7.25782*	-5.68007*

Table D4. VAR results

VARIABLES	d_log_GDP	d_CPI	d_log_NEER	d2_log_TB
L4.d_log_GDP	0.846***	-1.457**	0.0624	0.208
	(0.0673)	(0.577)	(0.0848)	(0.243)
L4.d_CPI	-0.0145	0.149	-0.0100	-0.0710
	(0.0171)	(0.147)	(0.0216)	(0.0619)
L4.d_log_NEER	0.149	1.025	0.117	-1.012**
	(0.137)	(1.178)	(0.173)	(0.497)
L4.d2_log_TB	0.0943**	0.318	-0.0103	-0.0940
	(0.0387)	(0.332)	(0.0488)	(0.140)
d_log_OIL	-0.0294	-0.126	-0.0549	0.804***
	(0.0363)	(0.311)	(0.0457)	(0.131)
Constant	0.00280	0.0599	-0.0133	-0.0167
	(0.00706)	(0.0605)	(0.00889)	(0.0255)
Observations	57	57	57	57

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D5. Granger Causality Test

Equation	Excluded	Chi-squared	df	p-value
d_log_GDP	d_CPI	0.71364	1	0.398
	d_log_NEER	1.1676	1	0.28
	d2_log_TB	5.9224	1	0.015
	ALL	8.3655	3	0.039
d_CPI	d_log_GDP	6.3878	1	0.011
	d_log_NEER	0.7565	1	0.384
	d2_log_TB	0.91452	1	0.339
	ALL	6.8982	3	0.075
d_log_NEER	d_log_GDP	0.54202	1	0.462
	d_CPI	0.21512	1	0.643
	d2_log_TB	0.04464	1	0.833
	ALL	0.93359	3	0.817
d2_log_TB	d_log_GDP	0.72906	1	0.393
	d_CPI	1.3168	1	0.251
	d_log_NEER	4.1416	1	0.042
	ALL	4.8357	3	0.184

Figure D1. IRF

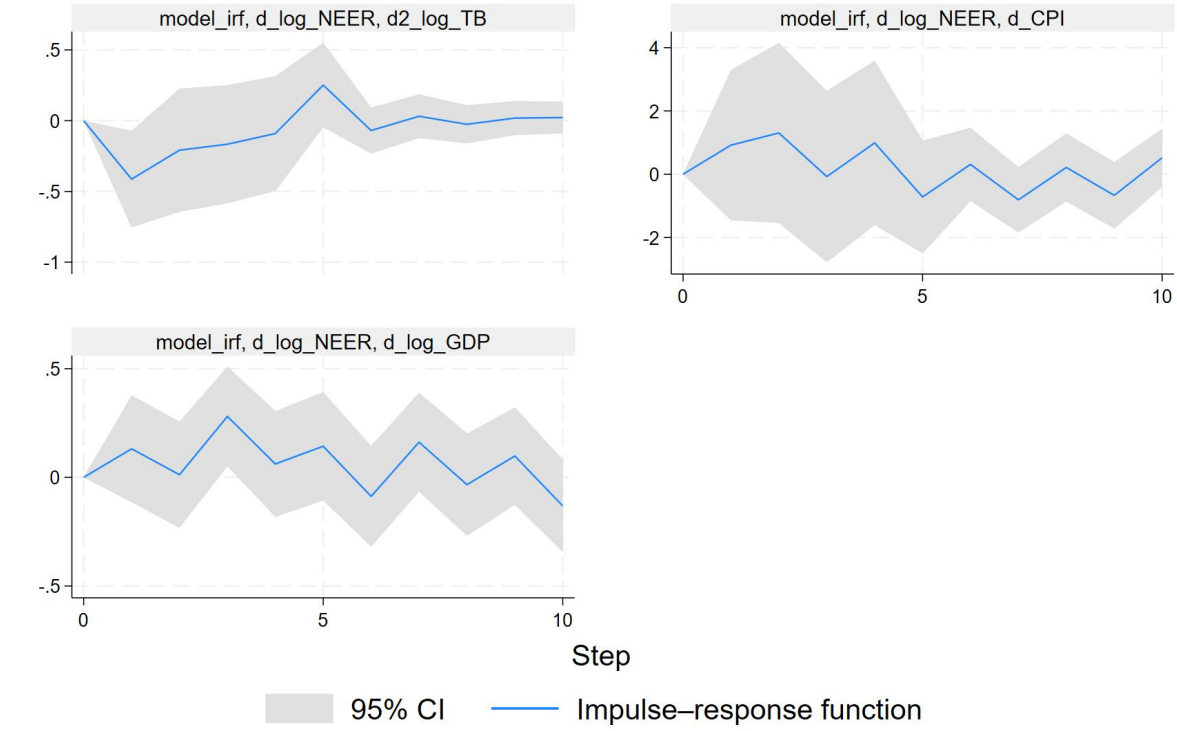
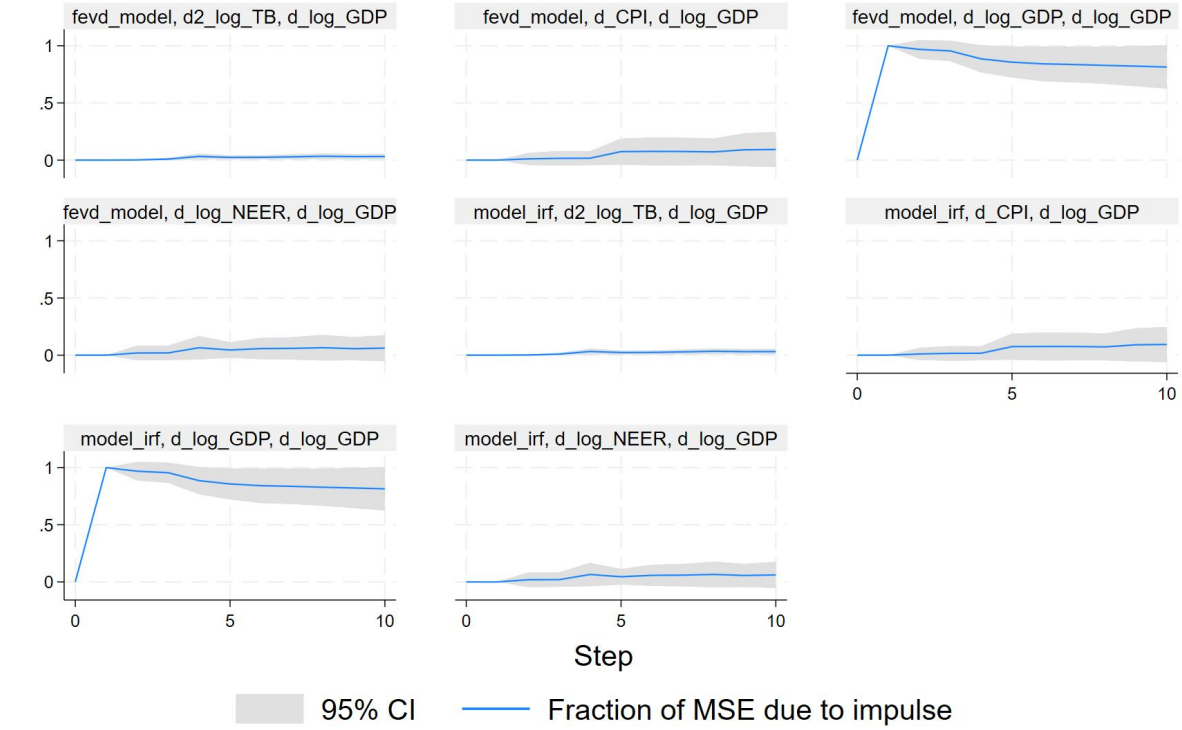
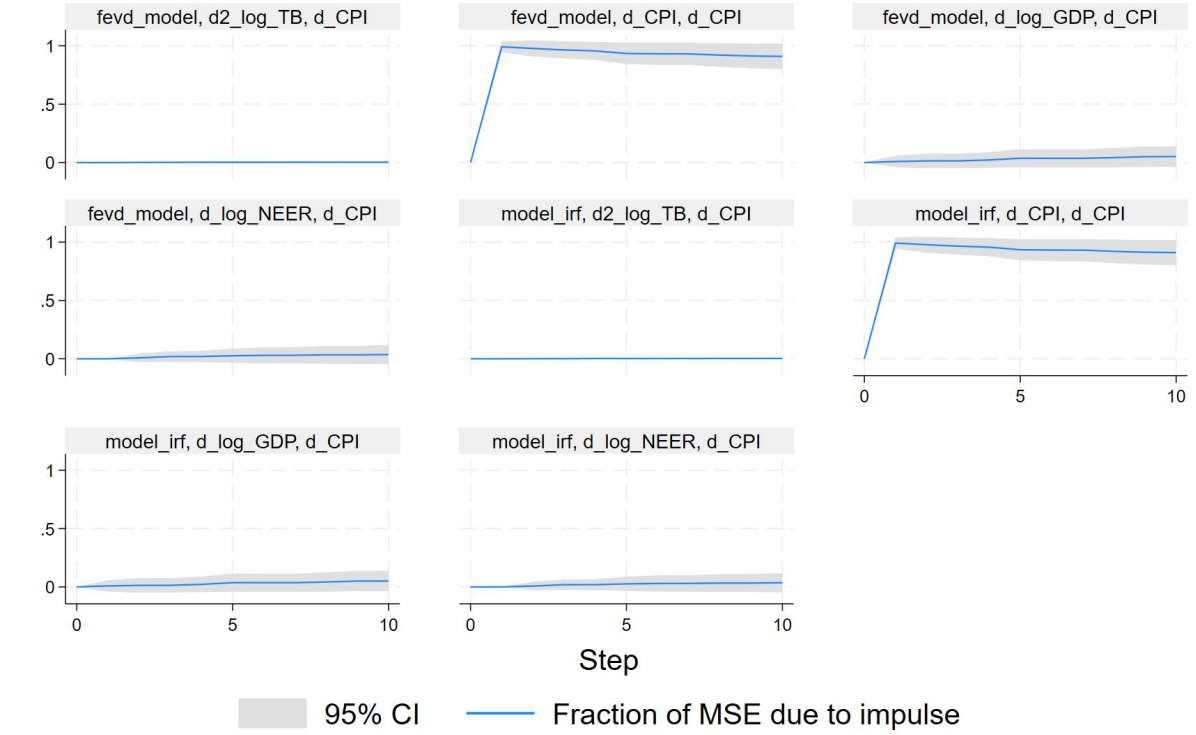


Figure D2. FEVD for GDP



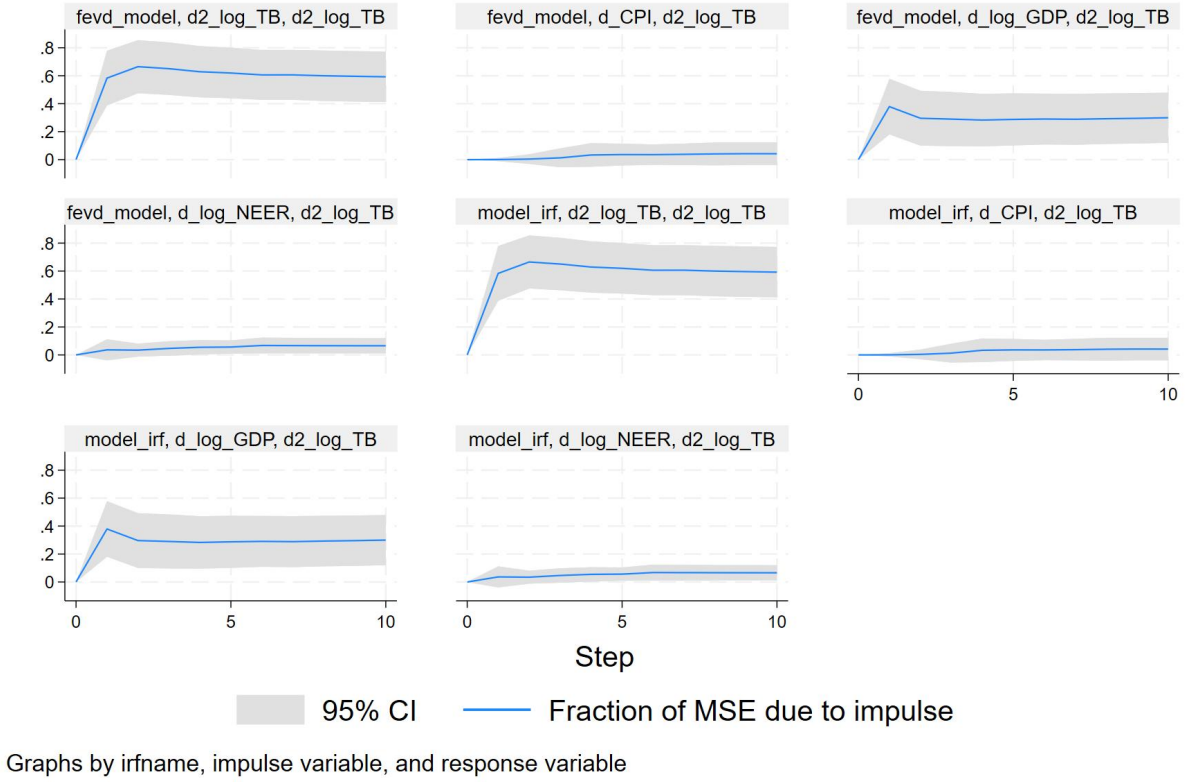
Graphs by irfname, impulse variable, and response variable

Figure D3. FEVD for CPI



Graphs by irfname, impulse variable, and response variable

Figure D4. FEVD for Trade Balance



Pre Period

Table D6. ADF Test

Variable	ADF Statistic	P-value
d_CPI	-3.522	0.0074
d_log_GDP	-3.323	0.0139
d2_log_NEER	-4.761	0.0001
d2_log_TB	-3.726	0.0038
d2_log_OIL	-4.243	0.0006

Table D7. OLS results

Dependent Variable	Independent Variable	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d_log_GDP	d2_log_NEER	-0.155	0.2578	-0.6	0.552	[-0.6795, 0.3694]
	d2_log_OIL	0.1572	0.0858	1.83	0.076	[-0.0173, 0.3317]
	d_CPI	-0.0595	0.0383	-1.55	0.13	[-0.1374, 0.0185]
	d2_log_TB	0.3305	0.258	1.28	0.209	[-0.1943, 0.8553]
	_cons	0.0412	0.0151	2.72	0.01	[0.0104, 0.0720]
d_CPI	d2_log_NEER	-4.5203	0.8209	-5.51	0	[-6.1903, -2.8502]
	d2_log_OIL	-0.6435	0.3787	-1.7	0.099	[-1.4140, 0.1270]
	d_log_GDP	-1.1443	0.7373	-1.55	0.13	[-2.6443, 0.3556]
	d2_log_TB	-0.5559	1.1554	-0.48	0.634	[-2.9066, 1.7949]
	_cons	0.0537	0.0728	0.74	0.466	[-0.0944, 0.2019]
d_log_TB	d2_log_NEER	-0.2487	0.1851	-1.34	0.188	[-0.6252, 0.1279]
	d2_log_OIL	-0.1886	0.0595	-3.17	0.003	[-0.3097, -0.0676]
	d_log_GDP	0.3439	0.1214	2.83	0.008	[0.0968, 0.5909]
	d_CPI	-0.0003	0.0283	-0.01	0.991	[-0.0578, 0.0572]
	_cons	-0.0049	0.0118	-0.42	0.68	[-0.0290, 0.0191]

Table D8. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	98.6806	-	-	-	5.70E-08	-5.33415	-5.21168	-4.97501
1	120.281	43.2	16	0	4.10E-08	-5.66356	-5.29613	-4.58613
2	152.132	63.703	16	0	1.70E-08	-6.596	-5.98361	-4.80028
3	173.782	43.3	16	0	1.40E-08	-6.92836	-6.07101	-4.41436
4	218.482	89.401	16	0	3.40E-09	-8.61661	-7.51431	-5.38432

Table D9. VAR results

VARIABLES	d_log_GDP	d_CPI	d2_log_NEER	d2_log_TB
L4.d_log_GDP	0.777***	-2.175**	0.217	0.263***
	(0.116)	(1.067)	(0.168)	(0.0774)
L4.d_CPI	-0.0210	0.190	-0.0148	-0.00629
	(0.0319)	(0.293)	(0.0460)	(0.0212)
L4.d2_log_NEER	0.215	-0.240	0.135	-0.437***
	(0.249)	(2.288)	(0.360)	(0.166)
L4.d2_log_TB	-0.185	0.0513	0.0885	-0.485***
	(0.157)	(1.436)	(0.226)	(0.104)
d2_log_OIL	0.0380	0.303	-0.185**	-0.151***
	(0.0502)	(0.461)	(0.0724)	(0.0334)
Constant	0.00541	0.0807	-0.00423	-0.0131*
	(0.0108)	(0.0990)	(0.0156)	(0.00718)
Observations	34	34	34	34

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D10. Granger Causality Test

Equation	Excluded	chi2	df	Prob > chi2
d_log_GDP	d_CPI	0.43526	1	0.509
	d2_log_NEER	0.74446	1	0.388
	d2_log_TB	1.3967	1	0.237
	ALL	3.9676	3	0.265
d_CPI	d_log_GDP	4.1562	1	0.041
	d2_log_NEER	0.01103	1	0.916
	d2_log_TB	0.00128	1	0.972
	ALL	4.4389	3	0.218
d2_log_NEER	d_log_GDP	1.6748	1	0.196
	d_CPI	0.10303	1	0.748
	d2_log_TB	0.15363	1	0.695
	ALL	2.9138	3	0.405
d2_log_TB	d_log_GDP	11.508	1	0.001
	d_CPI	0.08784	1	0.767
	d2_log_NEER	6.9193	1	0.009
	ALL	26.057	3	0

Figure D5. IRF

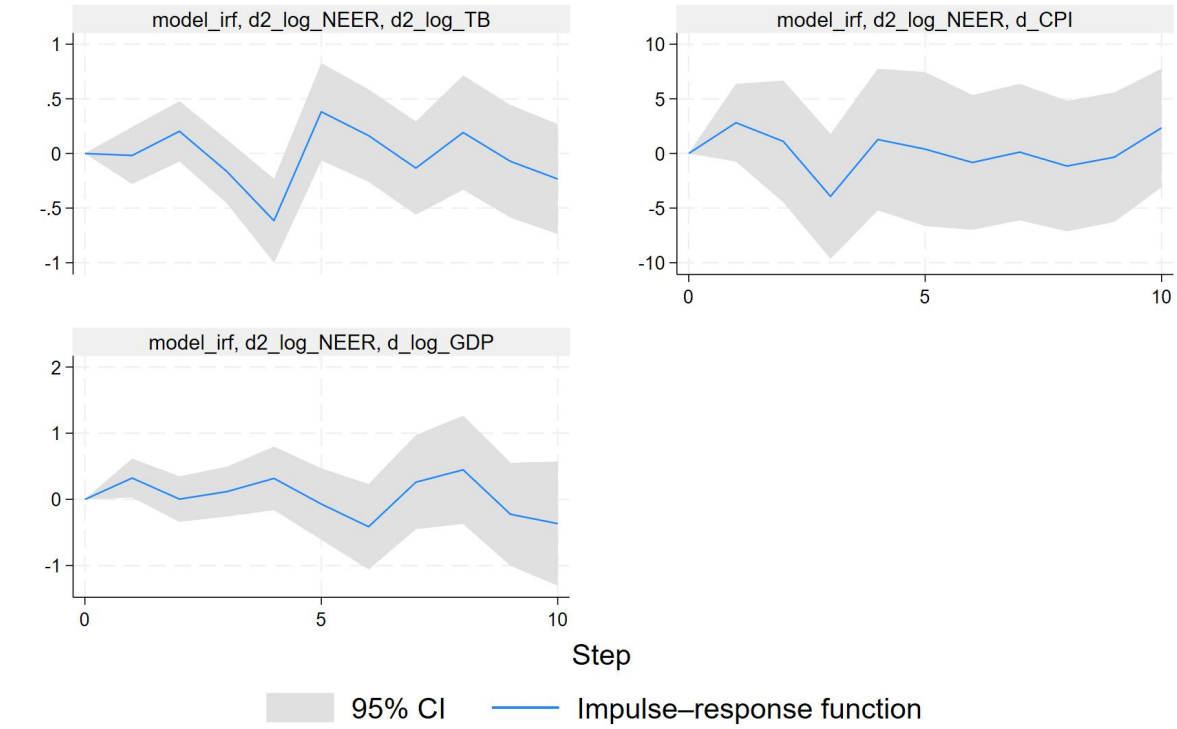
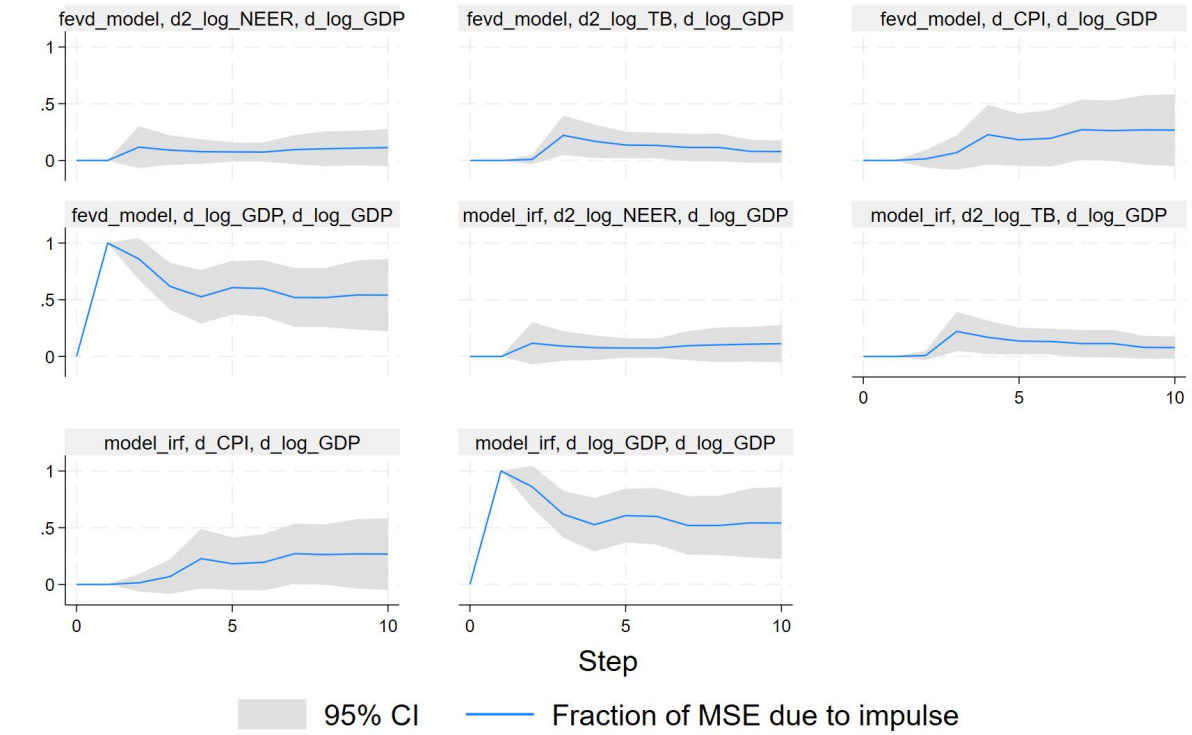


Figure D6. FEVD for GDP



Graphs by irfname, impulse variable, and response variable

Figure D7. FEVD for CPI

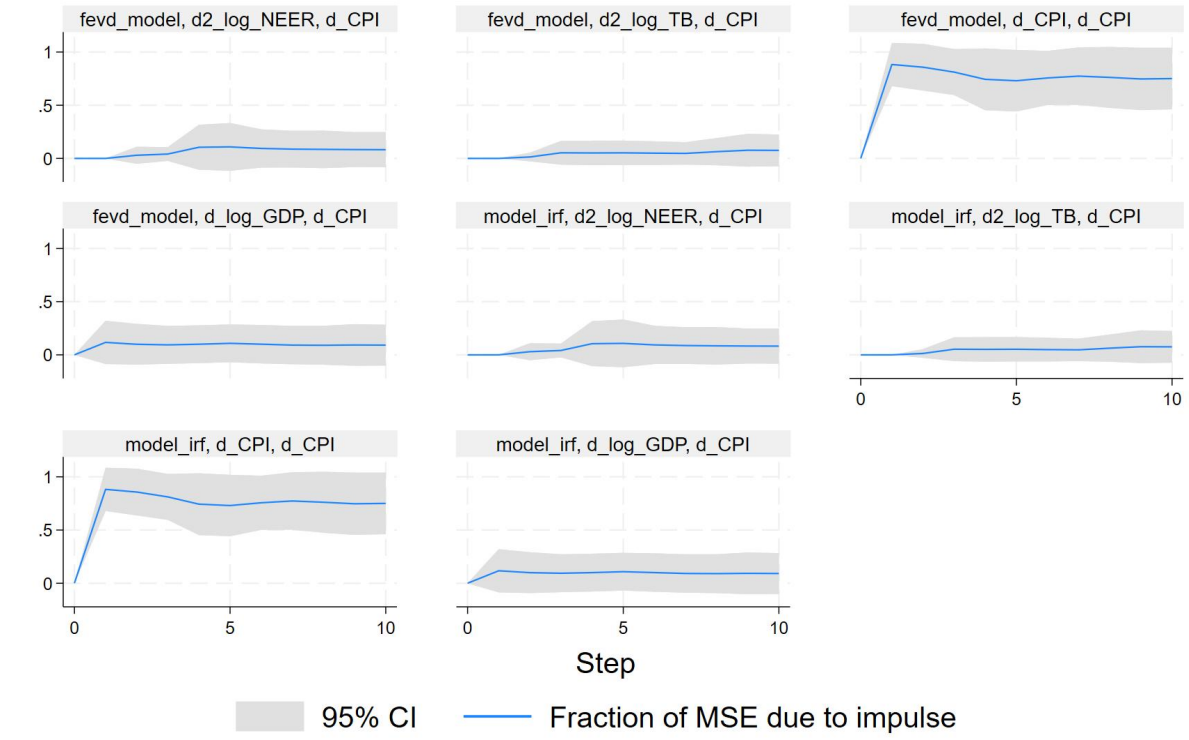


Figure D8. FEVD for Trade Balance

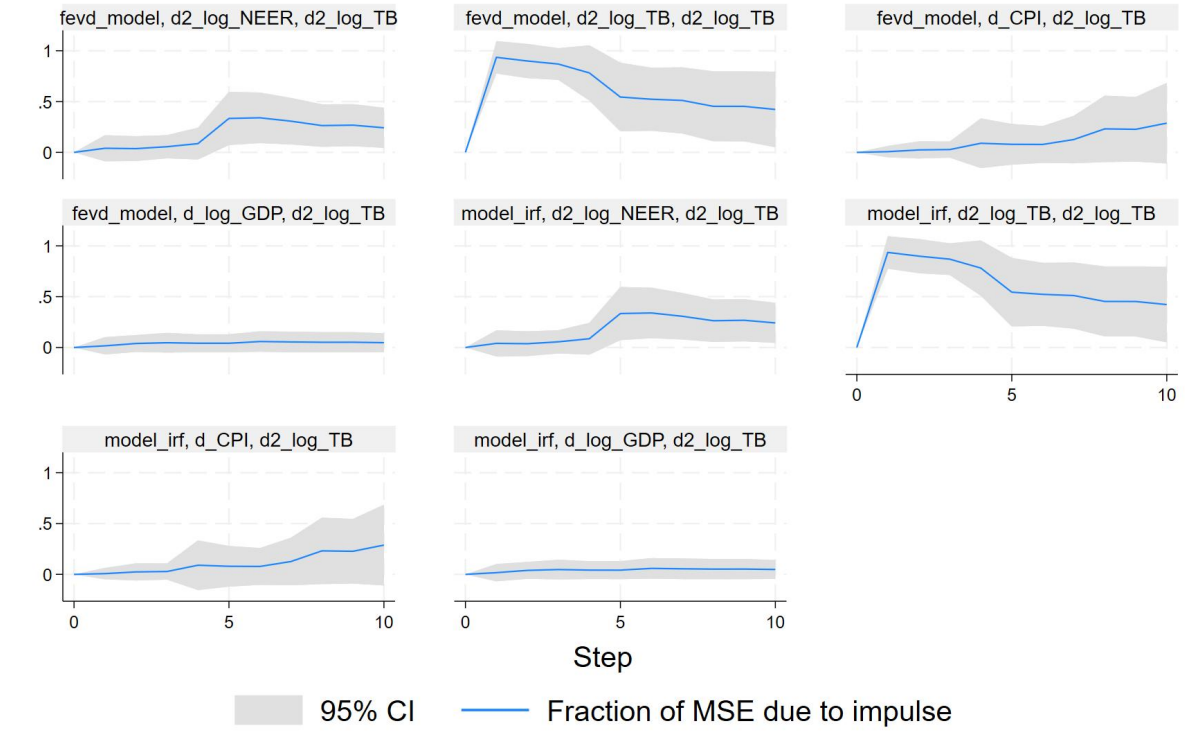


Table D11. ADF Test

Variable	ADF Statistic	P-Value
log_NEER	-4.105	0.001
log_TB	-3.486	0.0084
d2_CPI	-5.976	0
d3_log_OIL	-4.477	0.0002
d3_log_GDP	-5.006	0

Table D12. OLS results

Dependent Variable	Independent Variables	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
d3_log_GDP	log_NEER	0.0271	0.1442	0.19	0.852	[-0.2620, 0.3161]
	d3_log_OIL	0.0675	0.0846	0.8	0.429	[-0.1021, 0.2371]
	d2_CPI	-0.0849	0.044	-1.93	0.059	[-0.1731, 0.0033]
	log_TB	-0.1068	0.1645	-0.65	0.519	[-0.4364, 0.2228]
	_cons	0.4301	0.8473	0.51	0.614	[-1.2680, 2.1282]
d2_CPI	log_NEER	0.0901	0.4277	0.21	0.834	[-0.7670, 0.9473]
	d3_log_OIL	-0.0172	0.2524	-0.07	0.946	[-0.5231, 0.4887]
	d3_log_GDP	-0.7464	0.387	-1.93	0.059	[-1.5219, 0.0292]
	log_TB	-0.2128	0.4887	-0.44	0.665	[-1.1922, 0.7666]
	_cons	0.6958	2.5169	0.28	0.783	[-4.3483, 5.7398]
log_TB	log_NEER	0.3253	0.1094	2.97	0.004	[0.1060, 0.5445]
	d3_log_OIL	0.0538	0.0691	0.78	0.44	[-0.0848, 0.1924]
	d3_log_GDP	-0.0712	0.1097	-0.65	0.519	[-0.2911, 0.1486]
	d2_CPI	-0.0161	0.0371	-0.44	0.665	[-0.0904, 0.0582]
	_cons	3.6777	0.4851	7.58	0	[2.7055, 4.6498]

Table D13. Lag-order Selection Criteria for VAR Model

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	-59.9507	-	-	-	0.000133	2.42681	2.53899	2.71615
1	113.538	346.98	16	0	4.80E-07	-3.19777	-2.86125	-2.32977
2	169.869	112.66	16	0	1.20E-07	-4.63819	-4.07731	-3.19151
3	263.755	187.77	16	0	7.40E-09	-7.41983	-6.63461	-5.39448
4	285.205	42.9	16	0	6.40E-09	-7.61447	-6.6049	-5.01045

Table D14. VAR results

VARIABLES	d3_log_GDP	d2_CPI	log_NEER	log_TB
L.d3_log_GDP	-1.502***	-0.54	-0.0391	0.320***
	-0.128	-1.092	-0.139	-0.0979
L2.d3_log_GDP	-1.523***	-0.925	0.0399	0.273***
	-0.133	-1.137	-0.145	-0.102
L3.d3_log_GDP	-1.508***	-0.453	0.00454	0.249**
	-0.133	-1.141	-0.145	-0.102
L4.d3_log_GDP	-0.535***	-0.327	0.0226	0.307***
	-0.128	-1.093	-0.139	-0.098
L.d2_CPI	0.0217	-1.141***	0.00079	0.00936
	-0.0172	-0.147	-0.0187	-0.0132
L2.d2_CPI	0.0278	-0.687***	0.0324	-0.0207
	-0.0245	-0.209	-0.0266	-0.0188
L3.d2_CPI	0.00823	-0.363**	0.0179	-0.0289*
	-0.0205	-0.175	-0.0223	-0.0157
L4.d2_CPI	-0.0112	-0.0619	0.00532	-0.00075
	-0.0146	-0.124	-0.0158	-0.0112
L.log_NEER	0.11	2.779**	1.119***	0.117
	-0.133	-1.134	-0.144	-0.102
L2.log_NEER	-0.145	-0.718	-0.0775	-0.215

	-0.199	-1.701	-0.216	-0.152
L3.log_NEER	-0.176	-2.076	-0.0942	0.228*
	-0.18	-1.543	-0.196	-0.138
L4.log_NEER	0.215	0.0262	0.042	-0.0824
	-0.14	-1.196	-0.152	-0.107
L.log_TB	0.193	-2.206	0.338*	2.292***
	-0.159	-1.358	-0.173	-0.122
L2.log_TB	0.024	6.692**	-1.078***	-2.298***
	-0.357	-3.057	-0.389	-0.274
L3.log_TB	-0.849**	-7.869**	1.097***	1.303***
	-0.362	-3.097	-0.394	-0.278
L4.log_TB	0.662***	3.587***	-0.415**	-0.389***
	-0.16	-1.369	-0.174	-0.123
d3_log_OIL	-0.0134	0.123	-0.0764***	-0.0538***
	-0.0171	-0.146	-0.0186	-0.0131
Constant	-0.167	-1.031	0.335	0.262*
	-0.193	-1.653	-0.21	-0.148
Observations	56	56	56	56

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D15. Granger Causality Test

Equation	Excluded	Chi2	df	Prob > Chi2
d3_log_GDP	d2_CPI	2.9954	1	0.084
	log_NEER	0.29074	1	0.59
	log_TB	0.89768	1	0.343
	ALL	4.1326	3	0.247
d2_CPI	d3_log_GDP	2.8802	1	0.09
	log_NEER	0.00163	1	0.968
	log_TB	0.02126	1	0.884
	ALL	2.9298	3	0.403
log_NEER	d3_log_GDP	0.20377	1	0.652
	d2_CPI	0.45175	1	0.502
	log_TB	12.125	1	0
	ALL	12.456	3	0.006
log_TB	d3_log_GDP	0.065	1	0.799
	d2_CPI	0.05303	1	0.818
	log_NEER	15.105	1	0
	ALL	15.134	3	0.002

Figure D9. IRF

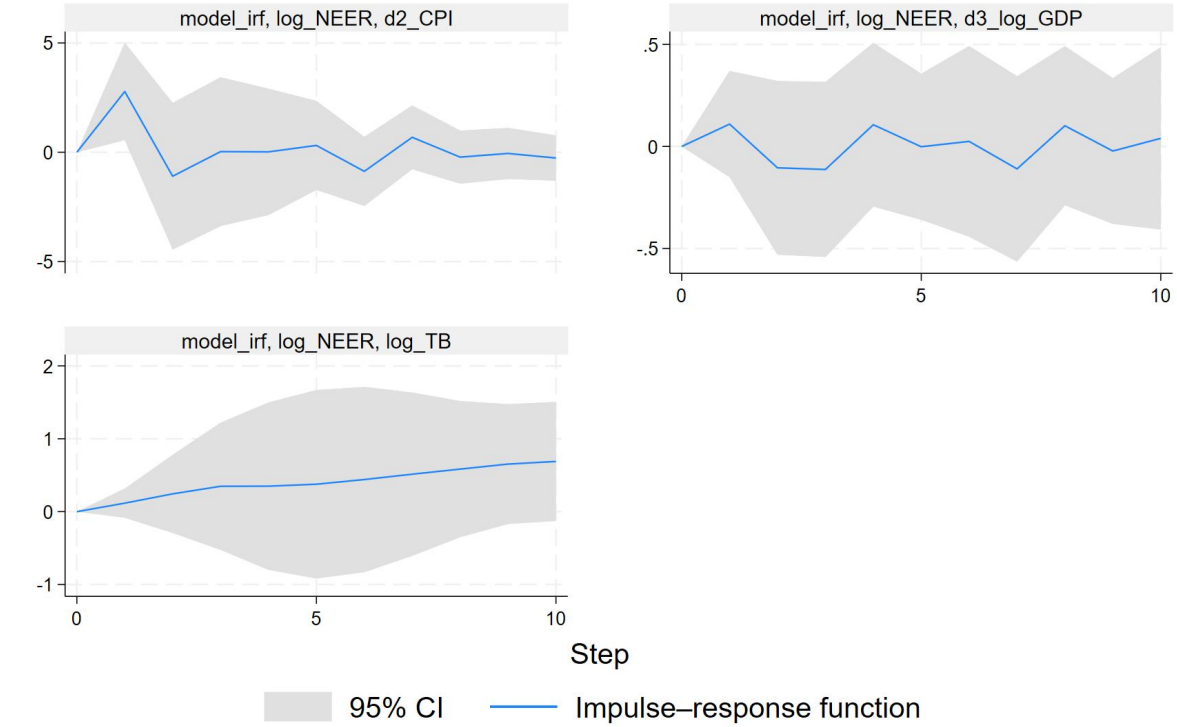


Figure D10. FEVD for GDP

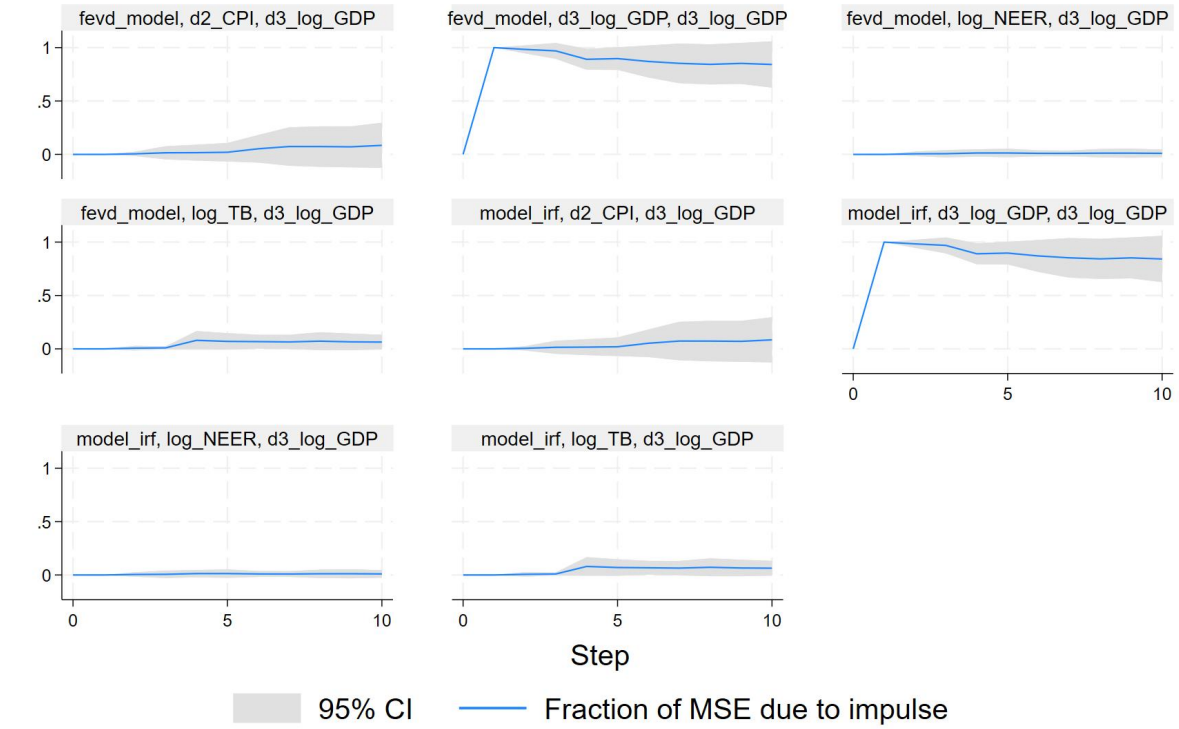
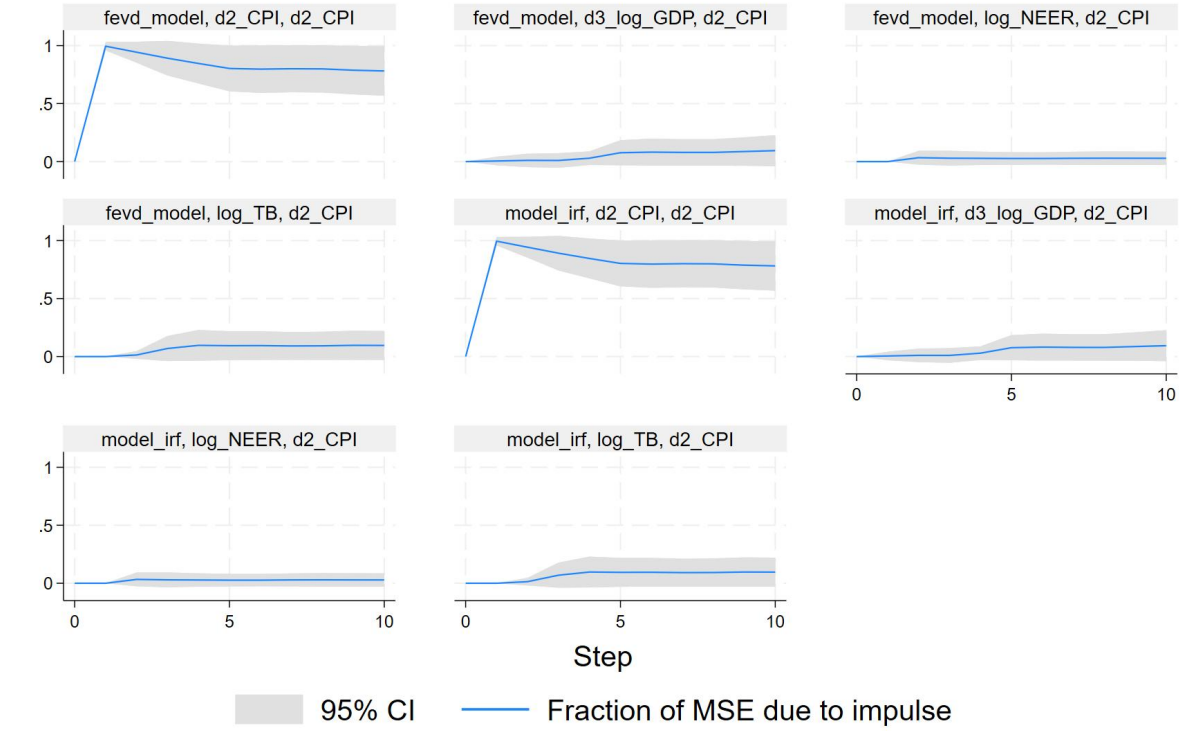


Figure D11. FEVD for CPI



Graphs by irfname, impulse variable, and response variable

Figure D12. FEVD for Trade Balance