Interaction between Monetary and Fiscal Policies: Evidence from Egypt

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Abstract

Surviving the COVID-19 crisis would not have been possible without the unprecedented support measures implemented worldwide. Monetary and fiscal policy tools had to be used aggressively and innovatively to withstand the adverse impact of the crisis in 2020. In order to effectively design policy interventions to achieve the desired targets while accounting for potential trade-offs, an understanding of the interaction between monetary and fiscal policies becomes a prerequisite. The changing global and local economic conditions call for rigorous and continuous research on the topic to guide policy makers in navigating through the critical times ahead of the Egyptian economy and the whole world. Accordingly, the main objective of this paper is to study the interaction between monetary and fiscal policy and how effective they are in achieving economic stability in Egypt, i.e., maintaining price levels and GDP growth rate. The proposed paper employs a unified framework for modelling and exploring monetary and fiscal policy interaction and their expected transmission mechanisms in Egypt. The analysis also examines the effect of monetary and fiscal policy mix on Egypt macroeconomic stability via quantifying the impact of policy shocks on output and inflation. Analysis is conducted using Bayesian Vector Autoregression (BVAR) model covering a period of 16 years from 2005/2006 to 2021/2022 using quarterly data of five variables. As for the interaction between the two policies, results show that monetary and fiscal policies act as complements in response to a monetary policy shock. However, a fiscal policy shock doesn't significantly impact monetary policy or non-policy variables.

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1. Introduction

The world is facing unprecedented crises starting with COVID-19 crisis in 2020 and the Russian-Ukrainian war in 2022. Countries are undertaking various exceptional support measures to withstand the adverse impact of these crises. Adopting fiscal stimulus packages and monetary easing minimized economic losses and precluded the path for a smooth recovery from COVID-19 crisis. Yet, inflationary pressures due to disruptions in supply chains remained a source of concern to policy makers which was further aggravated with the Russian-Ukrainian war. Now, fiscal authorities and central banks have to balance between fiscal sustainability and inflation targets.

These crises shifted the debate between Keynesians and Monetarists from focusing on the superiority or dominance of one policy over the other towards the impact of different policy measures on the other policy, i.e., the interaction between monetary and fiscal policy to ensure reaching the desired goals of output and price stability. Tendency towards advocating for one policy while marginalizing the other has always been the case over economic history. Fiscal policy emerged in the 1960s as the main policy tool promoting both growth and employment. Then, with episodes of hyperinflation in the 1970s, monetary policy was at the forefront to stabilize the economy and became the preferred tool since then. Only when the financial crisis hit in 2008 and monetary policy was no longer effective, faith in fiscal policy was restored to boost the economy. Under COVID-19 crisis and Russian-Ukrainian war, both policy tools were of equal importance and the interaction between them gained attention (Havlik et al., 2022; Bordo & Levy, 2020; Adrian et al., 2022)

In Egypt, the orchestration between the two policies, when COVID-19 crisis hit, was profound resulting in a GDP growth rate of 3.57% in 2019/2020 making it one of the few countries worldwide that witnessed growth in that year. In 2020/2021, real GDP growth rate of 3.3% was attained and inflation stood at 4.5% anchored within the Central Bank of Egypt (CBE) objective. Fiscal stimulus measures undertaken by the Egyptian government wouldn't have been possible without the monetary and fiscal reform measures adopted since 2014 that provided the fiscal space needed for that purpose. In 2022, CBE responded to inflationary pressures basically derived from the Russia-Ukraine crisis and Egypt exchange rate movements, by adopting a tight monetary policy.

Based on the economic context outlined above, it is conspicuous that the Egyptian economy has been facing a lot of changes and challenges both on the domestic and international level which are expected to continue. Locally, the National Structural Reform Program (NSRP) launched by the Egyptian Government in 2021 builds on the reforms undertaken with specific reform targets for year 2024 (Ministry of Planning & Economic Development, 2021). On the global level, rising inflation rates and anticipated hikes in Fed interest rates signal an end to low-cost external borrowing and pose a challenge to an emerging economy like Egypt to maintain its exchange rate stability and achieve a sustainable recovery (Duttagupta & Pazarbasioglu, 2021; WEO, 2021). This means that

monetary and fiscal policy makers are required to remain alerted to ensure economic stability. That's why delving more into this topic and understanding the interaction between the two policies has become crucial to provide policy guidance for decision makers to be able to navigate through the critical times ahead of the Egyptian economy and the whole world.

The aim of this paper is to study the interaction between monetary and fiscal policy and how effective they are in achieving economic stability in Egypt, i.e., maintaining price levels and GDP growth rate. The study employs a unified framework for modelling and exploring monetary and fiscal policy interaction and their expected transmission mechanisms. The analysis examines the effect of monetary and fiscal policy mix on Egypt macroeconomic stability via quantifying the impact of policy shocks on output and inflation. Analysis is conducted using Bayesian Vector Autoregression (VAR), covering a period of 16 years from 2005/2006 to 2021/2022 using quarterly data. The study focuses on that time period as the year 2005/2006 marks the beginning of the Central Bank of Egypt's adoption of the overnight deposit and lending rates as its key interest rates and its announcement to transition towards an Inflation targeting (IT) framework (Al-Mashat, 2011). Moreover, COVID-19 crisis presents a unique case where the economy was faced with an unprecedented supply and demand shock and both monetary and fiscal measures were used to withstand the crisis. Such an event contributes to pronouncing the interaction between monetary and fiscal policies as they come to the forefront of economic policy to maintain economic stability.

Following this introduction, the paper is comprised of three main sections. The second section reviews related empirical literature. The third section provides a description of the data used in this paper and model estimation. The fourth section outlays the main results of the empirical model. The fifth and final section concludes and discusses possible extensions for future research.

2. Literature Review

As argued by Muscatelli et al. (2002), the topic of interaction between monetary and fiscal policy hasn't been widely explored empirically. There is usually a focus on either monetary or fiscal policy alone but not under a unified framework. The commonly used methodologies for studying the interaction between the two policies are Vector Auto-Regressive (VAR) models with its different variations, or Dynamic General Equilibrium (DGE) models applying different structural assumptions, or game-theoretic models. Results show that the interaction between the two policies doesn't only change from one country to the other, but within the same country and over time. The results of a number of papers will be presented hereafter covering both developed and developing countries, with a focus on Egypt as a developing country and subject of this research.

Starting with developed countries, using conventional dynamic stochastic general equilibrium (DSGE) model, Davig & Leeper (2009) conclude that monetary and fiscal policies in the US fluctuate between active and passive behavior. Fragetta & Kirsanova (2007) find no evidence of dominance or cooperation between the two policies adopting a small-scale, structural general equilibrium model of an open economy estimated using Bayesian methods covering the period from 1992 to 2008. In contrast, Mountford & Uhlig (2009) results indicate that the two policies are coordinated in the USA. Their study relies on US quarterly data, from 1955 to 2000, using VAR estimation technique. Monetary dominance in the US starting from the 1980s is shown in Bianchi & Ilut (2017) indicating that inflation was only controlled when monetary actions were fiscally backed. They use a new-Keynesian model (Markow-switching DSGE), covering the period from 1954 to 2009 using quarterly data.

As for the interaction between the two policies in EMU countries, which represent a somewhat special case given that monetary policy is constrained by union-wide economic developments, results are also inconclusive. van Aarle et al. (2003) use Structural VAR (SVAR) to study policy interaction in the Euro-area. Their results show that the two policies are complements in Austria, Belgium, Germany, and the UK, but there is a substitutability relation in the case of Ireland, Portugal, and Sweden.

Cevik et al. (2014) examine the interaction between the two policies in 6 European emerging economies (Czech Republic, Estonia, Hungary, Poland, Slovenia and the Slovak Republic) using a Markov regime-switching model. They find that there is an alternating interaction mode between the two policies in the Czech Republic, Estonia, Hungary and Poland, whereas Slovenia and the Slovak Republic follow an active fiscal policy regime.

In Brazil, Fialho & Portugal (2005) show that monetary policy is the dominant adopting the VAR model and covering the period from 1993 to 2004. However, other studies found results leading to fiscal dominance in Brazil (Machado Melo & Gomes Da Silva, 2019). Büyükbasaran et al. (2020) use Bayesian structural VAR model to study the interaction between the two policies in the Turkish economy. Their results confirm the importance of type of shock on the behavior of policies, that is they act as subsidies in response to policy shocks and as complements in response to supply and demand shocks. A study conducted by Havi & Enu (2014) on the Ghanaian economy shows that both fiscal and monetary policies have a positive impact on output growth, yet monetary policy is more effective. They use Ordinary Least Squares to reach that conclusion covering the period from 1980 to 2012. Al-Zoubi et al. (2013) use a Vector Error Correction Model (VECM) to study the interaction between the two policies in the Jordanian economy during the period from 1996 to 2011. Their results indicate that both policies are not effective in inducing economic activity, yet they are able to control inflation. The study conducted by Rezabek & Doucek (2018) on the economy of the Czech Republic using Bayesian VAR model during the period from 1995 to 2015 implies that more coordination is needed to achieve macroeconomic stability.

As for the **Egyptian economy**, there are few research papers that analyze the interaction between monetary and fiscal policy, covering different time periods and using different estimation techniques. A compilation of the results of these studies indicates that fiscal policy in Egypt can be described as dominant, passive and procyclical. It also shows that both monetary and fiscal policies have a positive impact on output and inflation, i.e., effective. However, their effectiveness is often jeopardized or lowered by the weak coordination level between the two policies.

Fiscal dominance in Egypt appears in the results of Hassan et al. (2014), Elhendawy (2019) and El-Khishin & Kassab (2021). Hassan et al. (2014) use a Structural VAR (SVAR) model, covering the period from 1975 to 2011. Their results show that fiscal dominance fades after the issuance of the CBE law No. 88 in 2003 that grants CBE a higher level of independence. El-Khishin & Kassab (2021) use the same methodology (SVAR) to analyze the interaction between the two policies during times of uncertainty and the impact of economic uncertainty on policy effectiveness, covering the period from 2006/2007 to 2018/2019. Their results also confirm the existence of fiscal dominance in Egypt and increasing empowerment of CBE is acknowledged. Elhendawy (2019) on the other hand proves that there is fiscal dominance over monetary policy in Egypt, which affects the ability of the central bank to control inflation, yet results don't show if fiscal dominance is fading. His paper examines the level of coordination between monetary and fiscal policy in Egypt during the period from 1980 to 2018 using the Vector Error Correction (VEC) model.

Fiscal policy is described as passive in Leeper (1991) sense in Al-shawarby & El Mossallamy (2019). In other words, decisions of fiscal policy are affected by the current public debt position with a focus on generating enough revenues to balance the deficit. Al-shawarby & El Mossallamy (2019) examine the interaction between the two policies as well as the optimal policy rules using a new Keynesian small open economy model, covering the period from 2004/2005 until 2015/2016 based on quarterly data.

According to results of both Panizza (2001) and Al-shawarby & El Mossallamy (2019), procyclical government spending and countercyclical tax policies are used in Egypt for output stabilization. Panizza (2001)'s results are based on the analysis of macroeconomic policies in Egypt using a unified IS-LM framework. Applying reform measures on the fiscal side to allow for counter-cyclical fiscal measures is stressed by Panizza (2001).

Hassan et al. (2014) and Al-shawarby & El Mossallamy (2019) affirm the effectiveness of both monetary and fiscal policy in achieving output and inflation stability. However, results of Hassan et al. (2014) indicate the magnitude of their impact is rather small mainly due to the low fiscal multiplier.

Coordination between the two polices is explored by Abdel-Haleim (2016) and Hassan et al. (2014). In their papers, policies are said to be coordinated if macroeconomic objectives are achieved. Optimal coordination entails using monetary and fiscal policies as substitutes in case of an economic boom or stagflation. Whereas, in the face of an economic recession,

policies should act as complements. Abdel-Haleim (2016) uses a simple ratio for quantifying the level of coordination based on the ratio of domestic liquidity to GDP as an indicator of monetary policy, and the ratio of government expenditure to GDP to capture the stance of fiscal policy. A coordination coefficient of 1 indicates optimal coordination and zero shows no coordination. Egypt's coordination coefficient is below 0.32 over the whole study period (1974 to 2015) indicating weak coordination between the two policies. Nevertheless, coordination coefficient reaches its highest level (0.31) during the subperiod from 2003 to 2015. Such weak coordination negatively affects macroeconomic stability as shown in Hassan et al. (2014).

To conclude, the constantly changing interrelation between monetary and fiscal policy calls for rigorous and continuous research on the topic to guide policy makers. The limited number of research papers on the topic in general and in Egypt in specific limits the ability of researchers and policy makers to formulate a clear understanding on the interaction between the two policies and their effectiveness.

3. Methodology and Estimation

3.1. Data

Five variables are used in this study to examine the interaction between monetary and fiscal policy in Egypt. Government spending and overnight rate are used as fiscal and monetary policy variables, respectively, whereas output, inflation, and exchange rate act as non-policy variables (macroeconomic variables). All variables are based on quarterly data from Q1: 2005/2006 to Q4: 2021/2022, covering a period of 16 years.

The rationale for choosing the year 2005/2006 as the starting point is the adoption of a new operational target by the CBE in June 2005, announcing the use of overnight lending and deposit rate as its key interest rates, and transitioning towards an inflation-targeting system (Al-Mashat, 2011). More details on each variable and rationale for selecting them is presented hereafter.

Variables entering the BVAR model are defined as follows:

Government spending (GSIS): following earlier literature (Hassan et al., 2014), primary government spending as a share of GDP is used in this model. Primary government spending is calculated by excluding interest payments from total government spending. Government spending and interest payments data is retrieved from the publications of the Egyptian Ministry of Finance (MoF). Nominal GDP is obtained from the Egyptian Ministry of Planning & Economic Development data portal. Government spending, interest rate and nominal GDP were seasonally adjusted using X13 methodology. Excluding interest payment from government spending means that only changes in wages, subsidies, investments, and purchase of goods and services are captured. Using primary government spending is argued to better reflect fiscal policy stance given the lagged effect of interest payment (Muscatelli et al., 2002; Hassan et al., 2014). In other words, an increase in total government spending

during a certain period might be a result of increased interest payment caused by past cyclical downturns that stimulated a higher overall deficit. Fiscal policy stance is captured in this model by primary government spending as a share of GDP.

Overnight Rate (ONR): Overnight rate is used to reflect monetary policy stance given that the CBE has been using it as one of its key interest rates since June 2005 as previously mentioned. CBE publishes the overnight rate on a daily basis based on which the average rate for each quarter is calculated.

Change in Real Gross Domestic Product (RGDPGR): quarterly real GDP growth rate announced by the Ministry of Planning & Economic Development (MPED) is used.

Inflation Rate (inf): Change in core inflation is used in the model[5]. It is published monthly by the Central Bank of Egypt, based on which the average rate for each quarter is calculated. Quarterly change in core inflation is calculated as percent change from previous year.

Change in Nominal Exchange Rate (NERGR): nominal exchange rate data is retrieved from the Central Bank of Egypt. Data is published on a daily basis, and the average of each quarter is calculated. Nominal exchange rate is used in the model as percent change (Year-on-Year). Exchange rate is denoted in Egyptian Pound (EGP) per United States Dollar (USD). Hence, an increase in NER means a devaluation in EGP relative to USD.

The following table (Table 1) provides a summary for the variables used in this research outlined above (a graphical representation for all variables is provided in the annex - Figure 1).

Table 1: Variables' Summary

Variable	N	Mean	Std. Dev.	Min	Max
Real GDP Growth Rate (RGDPGR) (%)	68	4.5	2.5	-4.3	9.8
Core Inflation (inf_c) (%)	68	9.5	6.9	1.6	34.5
Change in Nominal Exchange Rate (NERGR) (%)	68	8.1	25.2	-10.2	117.6
Overnight Rate (ONR) (%)	68	10.7	3	8.2	18.9
Government Spending (% of GDP) – (SGSIS)	68	21.3	4.9	11.8	36.9

Stationarity properties of the variables used are analyzed. Results indicate that all variables are stationary.

3.2. Model Estimation

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[5] It is worth mentioning that the model was also run using headline inflation, however, results were insignificant on all variables. As such, core inflation was used instead which better reflects the persistence of inflation.

Bayesian VAR model (**BVAR**) is estimated for the Egyptian economy using five variables to examine the interaction between monetary and fiscal policy in Egypt. Results are interpreted through the lens of Impulse Response Functions (IRFs). To our knowledge, this is the first study on the topic in Egypt that adopts a Bayesian approach in estimating the VAR model and it follows the study conducted by Muscatelli et el. (2002) and Rezabek & Doucek (2018). The choice of Bayesian VAR is motivated by two main reasons.

First, VAR model is generally considered to be one of the most widely used estimation techniques for the analysis of multivariate time series (Rezabek & Doucek, 2018). It captures the dynamic behavior between economic variables over time. Finally, the simplicity of VAR models makes it easy to construct and interpret when compared to large-scale macroeconometric models (Sims, 1980).

Second, to address estimation inefficiency associated with unrestricted VAR models, Bayesian estimation approach is adopted to overcome the "overfitting" problem as originally advocated by Litterman (1986). Using unrestricted VAR models, especially ones with many variables and relatively little data means that there are too many parameters to estimate which causes loss of degrees of freedom and leads to inefficient estimations. As such, introducing the prior probability distributions to the parameters of the model restricts its lag structure, hence resolving the over-fitting/ over parameterization problem (Litterman, 1986; Koop & Korobilis, 2010; Koop, 2003). Bayesian estimation uses prior information on the model parameters to impose additional structure on the estimated model. It combines both data and non-data information. This means that all possible variations of the parameters are not ignored under Bayesian method as opposed to sign restriction approach which would simply overlook information embedded in the data in case it conflicts with the prior information (zero restriction) (Kocięcki, 2010; Ciccarelli & Rebucci, 2003).

Bayesian vector autoregression (BVAR) applies Bayes' theorem which was introduced by Thomas Bayes. Bayes' rule is the foundation of Bayes' theorem used in statistical inference to obtain a probability statement about what is not known (the model) conditional on what is known (data). The main building blocks of Bayes' rule is the likelihood function and the prior information which are multiplied to produce the posterior distribution. The posterior distribution is defined as the updated probability of an event occurring after taking into consideration new information (prior) (Koop, 2003).

The **BVAR model** adopted in this study produces a system of five equations whereby each endogenous variable is expressed as a function of its own past values and past values of other variables in the system. The reduced-form representation of the BVAR can be written as follows:

$$Y_t = A_0 + A_i Y_{t-i} + U_t$$

Where Y_t is the K-dimensional vector of endogenous variables, i is the number of lags, A_0 is a $K \times 1$ vector of intercepts, U is a vector of errors.

Estimating the model presented required identifying the priors applied to the model's parameters. There are different types of priors to choose from in the literature available (Doan et al., 1983; Litterman, 1986; Kadiyala & Karlsson, 1997; Del Negro & Schorfheide, 2004; Villani, 2009). The present study employs the Minnesota prior also called the Litterman prior which imposes the hypothesis that individual variables all follow random walk processes (Litterman, 1986).

Computation of posterior distributions is based on the traditional Gibbs sampler. Its implementation in the R package BVAR was used to obtain the results. In total, 100.000 of posterior draws were generated from the posterior distribution and first 25.000 draws were discarded as a burn-in period. Retained draws are then used to calculate the posterior distribution of impulse-response (IR) functions.

The number of lags in the model was set to one based on the results of Akaike's information criterion (AIC) and Schwarz's information criterion (SIC)).

4. Results

The results of impulse response functions from the BVAR model as shown in Figure 2, is used to evaluate the dynamic interactions between fiscal and monetary policies in response to policy and non-policy shocks, as discussed hereafter. In each plot, the y-axis expresses deviations from the steady-state owing to a shock and the x-axis represents a time horizon spanning 40 quarters. That horizon is sufficient for all variables to return to steady-state values following a shock, thus providing further validation for stability of the model solution.

Response to interest rate shock

A positive shock to interest rate (overnight rate) reduces core inflation (contractionary monetary policy). Inflation reaches its lowest level by the second year after the shock before it converges into a steady state by the fourth year.

In response to the interest rate shock, government spending significantly decreases (contractionary fiscal policy) starting from the second quarter after the shock until the fourth year before it converges to a steady state. This shows that fiscal policy acts as a complement to monetary policy actions and the target of reducing inflation is effectively realised. In other words, the actions of both policies are in harmony, the contractionary/ expansionary behaviour of monetary policy is faced by a contractionary/ expansionary fiscal policy stance.

The response of real GDP and nominal exchange rate to an interest rate shock appears to be insignificant based on impulse response analysis. Nevertheless, the shock induces an

increase in real GDP, while nominal exchange rate decreases (appreciation of EGP against USD).

Response to government spending shock

Shocks to government spending produce insignificant responses from all variables. The direction of responses are in line with economic theory and literature though, whereby, real GDP and core inflation increase, while nominal exchange rate and overnight rate decreases (expansionary monetary policy). This shows that monetary and fiscal policies also act as components in the face of a fiscal policy shock. Hence, an expansionary fiscal policy is met with an expansionary fiscal policy. This complementarity behavior aids in boosting economic activity, however, the tradeoff of higher price levels is not well contained. However, the fact that the responses of the impulse response functions is insignificant indicates that the transmission mechanisms of higher government spending are rather weak.

Response to exchange rate shock

A positive shock to exchange rate (depreciation) leads to an increase in inflation rate which reaches it peak level by the fourth quarter after the shock. The rise in inflation rate is automatically combated by a significant rise in interest rate (contractionary monetary policy). Inflation rate insignificantly drops before converging into a steady state by the fifth after the shock.

Government spending decreases in response but the decrease is only significant from the second to fourth quarter after the shock, and from tenth to twentieth quarter. Real GDP insignficantly increases in response. This shows that monetary and fiscal policies act as complements in the face of a shock in exchange rate and effectively succeed in reducing inflation.

5. Concluding Remarks and Discussion

In this paper, the interaction between monetary and fiscal policies was examined using a five-variable Bayesian VAR model. Results indicate that fiscal and monetary policies act as complements in response to a monetary policy shock. Monetary policy tools contribute to economic stability in Egypt through its effect on inflation. However, a fiscal policy shock doesn't significantly impact monetary policy or non-policy variables.

The complementarity behavior of monetary and fiscal policies in the face of a monetary policy shock shows that when tight monetary policy is supported by fiscal discipline, inflation rate is controlled. Higher interest rates increase the cost of debt services, which raises real government debt. Accumulation of debt stock induces the fiscal authority to implement a tight stabilization policy (i.e., reduce government spending) to offset the increase in debt. The effectiveness of monetary and fiscal policy in maintaining price

stability was also proven in previous research (Hassan et al., 2014; Al-shawarby & El Mossallamy, 2019). The impact of monetary policy on output is negligible which means that using monetary policy effectively maintains price stability without jeopardizing output stability. Such results affirm the argument presented in Al-shawarby & El Mossallamy (2019) that CBE pursues an anti-inflationary policy and is positively contributing to macroeconomic stability despite accumulated government debt.

Egypt's heavily constrained expenditure structure whereby around 70 to 80% is allocated to non-discretionary items (wages, subsidies, and interest), while only 10% on average is allocated to investment, partially explains the weak response of government spending to policy and non-policy shocks induced in the model. Additionally, the insignificant impact of an increase in government spending on real GDP can be attributed to Egypt's weak fiscal multiplier.

Analyzing the response of monetary and fiscal policies to an exchange rate shock shows a significant response from both policies. The two policies act as complements and effectively manage to maintain price stability. This is evident by the recurrent episodes of Egyptian pound devaluation through Egypt's economic history which were followed by spikes in inflation rate. Authorities successfully curb inflation by raising interest rates and controlling government spending.

Results of this study primarily suggest an improvement in coordination between monetary and fiscal authorities in Egypt, particularly in maintaining price stability. It also shows that fiscal discipline is necessary to achieve monetary policy targets. Adverse impact of the use of monetary policy in combating inflation on output is negligible, which allows CBE to focus on its inflation targets, i.e., more independence.

Further analysis and investigation are planned to solidify the results of the adopted model. First, by extending the time period of this study, the sample can be split into subsamples to explicitly account for the impact of COVID-19 crisis. Second, utilization of calibrated priors as introduced in Hartwig (2021) to account for the impact of COVID-19 crisis on the time series data will also be examined. Third, the impact of using different types of priors shall be analyzed.

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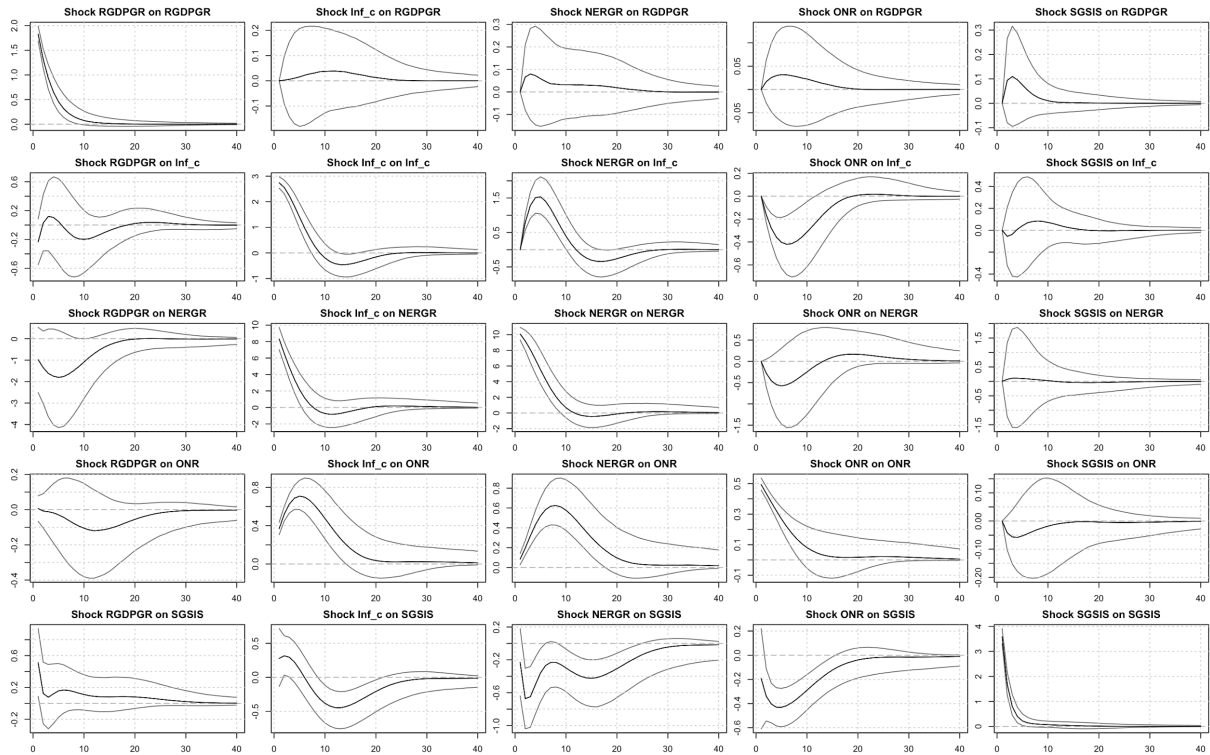
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Annex

Figure 1: Model Variables
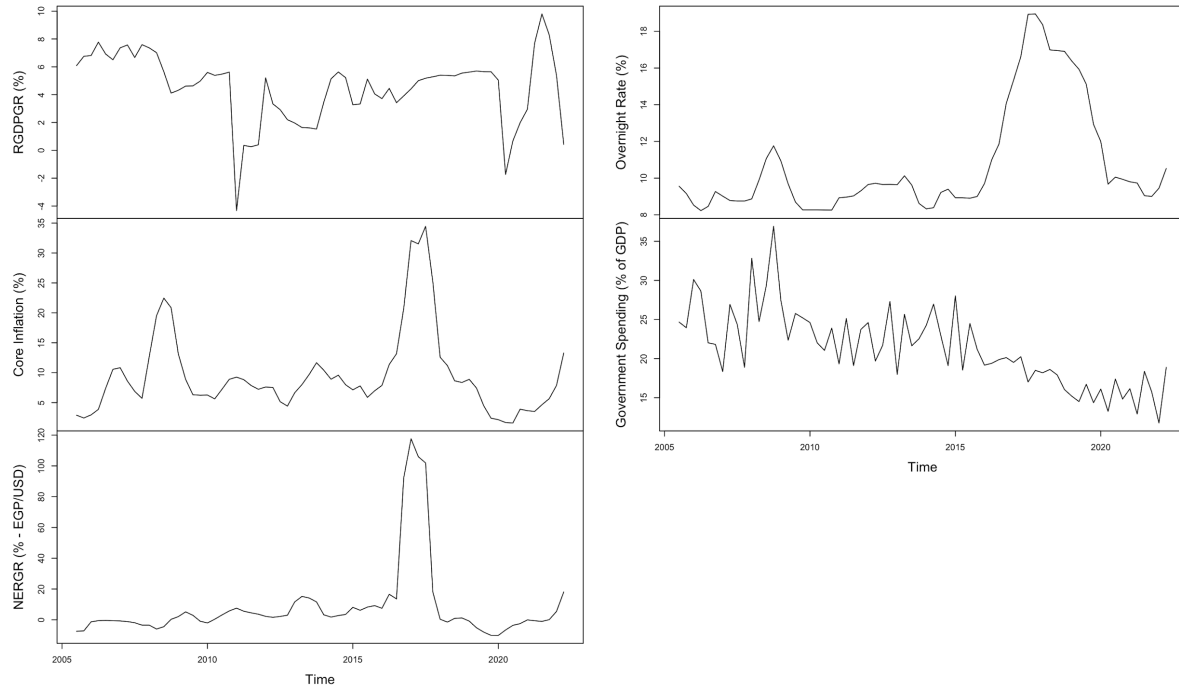
Source: Authors' computation

Figure 2: BVAR IRFs

Source: Authors' computation