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Abstract

This paper empirically examines monetary-fiscal interactions during uncertainty shocks. Applying on the Egyptian economy, we examine the extent to which fiscal dominance and discretionary interventions resulted in undesired outcomes, particularly during uncertainty shocks. We construct a Structural VAR model to model monetary-fiscal interactions in Egypt during uncertainty. Alternative outcomes under counterfactual scenarios of monetary autonomy, as opposed to fiscal dominance, are examined under the New-Keynesian system of assumptions. Results show that poor monetary autonomy and sustained fiscal dominance contributed to establishing long-run procylical fiscal behavior in Egypt and significantly impeded the effectiveness of monetary policy in stabilizing the economy during uncertainty shocks. We recommend establishing a strong, commitment-based monetary policy framework to lessen the undesired outcomes resulting from the persistent fiscal dominance. Recent IMF-supported reform measures show a stronger role of monetary policy in stabilizing the economy within a coordinated framework. Nevertheless, proper institutional measures need to be established to sustain such outcomes after the materialization of the reform program.

Keywords: Monetary-fiscal interactions, uncertainty shocks, fiscal rules, VAR, counterfactual simulation.

JEL Classifications: C72, H30, E63, D72.

ملخص

يدرس هذا البحث تجريبيًا التفاعلات النقدية والمالية خلال صدمات عدم اليقين. وعند تطبيقها على الاقتصاد المصري، ندرس إلى أي مدى أدت الهيمنة المالية والتدخلات التقديرية إلى نتائج غير مرغوب فيها، لا سيما خلال صدمات عدم اليقين. وننشئ نموذج الانحدار الذاتي للمتجهات (VAR) الهيكلي لنمذجة التفاعلات المالية والنقدية في مصر أثناء فترات عدم اليقين. كما تتم دراسة المخرجات البديلة، في ظل السيناريوهات المخالفة للواقع، للاستقلال النقدي مقارنة بالهيمنة المالية، في ظل نظام الافتراضات الكينزية الجديدة. تُظهر النتائج أن سوء الاستقلال النقدي والهيمنة المالية المستدامة قد أسهم في ترسيخ سلوك مالي مساير للدورات الاقتصادية على المدى الطويل في مصر وأعاق بشكل ملحوظ فعالية السياسة النقدية في تحقيق استقرار الاقتصاد خلال صدمات عدم اليقين. نوصي بإنشاء إطار سياسة نقدية قوي قائم على الالتزامات لتقليل المخرجات غير المرغوب فيها الناتجة عن الهيمنة المالية المستمرة. تُظهِر تدابير الإصلاح الأخيرة التي يدعمها صندوق النقد الدولي دورًا أقوى للسياسة النقدية في تحقيق استقرار الاقتصاد ضمن إطار عمل منسق. ولكن، من الضروري وضع تدابير مؤسسية مناسبة للحفاظ على هذه المخرجات بعد تفعيل برنامج الإصلاح.

1. Introduction

Literature examining the outcomes of fiscal-monetary interactions as dynamic players in the system has proven that strategic interactions between political governments and central banks matter. The level of coordination between these two authorities and their strategic and sequential movements towards each other's economic policies result in different outcomes. In general, commitments and higher degrees of coordination reduce time inconsistency problems while, in contrast, discretionary interventions within Nash setups result in lower output and higher inflation rates compared to other setups if there is no proper coordination between the two policy authorities. Meaning, if they don't assign equal weights to their policy objectives, a regime of commitment wouldn't necessarily improve welfare because the reduction in seignorage would lead to an increase in taxes to finance public spending and, therefore, a decrease in output. Output losses under a non-coordinated setup can be too large to offset the gains from the reduced inflation. The desirability of commitment depends on the level of coordination between monetary and fiscal authorities since it ultimately impacts the time inconsistency resulting from policy, either for one authority or for both authorities (Alesina and Tabellini, 1987; Dixit and Lambertini, 2000).

In this paper, we examine monetary-fiscal interactions during uncertainty shocks in Egypt, where there appears to be a continued setup of either fiscal dominance or a centralized authority within which both fiscal and monetary policies are coordinated by a single authority. Under both setups, growth and financing gaps are usually prioritized over fiscal and monetary discipline. There is also earlier evidence of weak budget institutions and a high reliance on politically-motivated discretionary interventions in Egypt (El-khishin and Zaky, 2019). This setup and evidence are argued to have affected welfare outcomes in Egypt and increased fiscal fragility, particularly during periods of political and economic uncertainty. Fragility in this context involves weakened fiscal performance as well as aggravated inflation rates. Our examined research questions are: (1) how much have uncertainty shocks adversely affected macroeconomic outcomes in Egypt under the prevalent monetary-fiscal coordination setup? and (2) to what extent have fiscal dominance and discretionary interventions in Egypt resulted in undesired outcomes in normal times and during uncertainty shocks?

We construct a New-Keynesian system following the assumptions of Saulo et al. (2013), Kirsanova et al. (2005), and Muscatelli et al. (2002). After reviewing related literature in section two, in section three we construct a Structural VAR model to model monetary-fiscal interactions in Egypt during uncertainty. Alternative macroeconomic outcomes under counterfactual scenarios of monetary autonomy, as opposed to fiscal dominance, are examined. Our results indicate that uncertainty shocks have adversely affected macroeconomic outcomes in Egypt under all setups; however, consistent with our theoretical findings, worst outcomes result under fiscal dominance.

2. Related literature

It is established in the literature that central bank independence in general not only leads to lower inflation, but can also result in better fiscal performance as a result of decreasing time inconsistency in fiscal policy. Although an independent central bank results in lower output and public spending, it can eventually lead to better fiscal performance since it will decrease time inconsistency in fiscal policy as money demand will not be affected by fiscal policy. Dixit and Lambertini (2000) interestingly find that while good monetary rules decrease time inconsistency, discretionary fiscal interventions during shocks limit the operation of these monetary rules. In contrast, good fiscal rules will not be undermined by discretionary monetary interventions and will still lead to welfare gains that surpass the Nash setup; meaning, fiscal leadership under commitment provides the second best outcomes in general. Similarly, credible central banks or central banks with a good reputation can result in desirable social welfare outcomes even under discretionary regimes; a good reputation decreases the time inconsistency of discretionary measures. The findings of Bennett and Loayza (2002), Kirsanova et al. (2005), and Saulo et al. (2012) prove that non-coordinated setups result in higher deficits and higher interest rates during shocks. Coordination – both at the level of designing policy objectives and implementing policies – could alleviate policy biases, while sequential movements under Stackleberg solutions only decrease the severity of undesirable welfare outcomes of absolute Nash setups. Coordinated policies that are set somewhere between the tight monetary policy and loose fiscal policy produce optimal welfare outcomes where neither fiscal sustainability nor output or investment capacity are compromised.

In contrast, non-coordinated monetary-fiscal interactions under discretionary regimes result in the lowest welfare outcomes; meaning, the highest inflation and lowest outcomes. Monetary commitments with discretionary fiscal regimes generally don't result in much better outcomes. On the contrary, in a system of fiscal leadership, fiscal rules result in more desirable outcomes even under monetary discretion. Hence, the choice of rules versus discretion cannot be taken independently of the choice of the monetary-fiscal coordination scheme.

Although the theroretical literature on monetary-fiscal coordination is relatively abundant, its empirical evidence has received less attention, particularly those dealing with uncertainty shocks. The impact of the monetary-fiscal interaction scheme in the aftermath of uncertainty shocks is a particularly interesting question. Bloom (2019) argues that in the immediate aftermath of an uncertainty shock, monetary or fiscal policies can even become ineffective. Uncertainty is also found to increase aggregate price flexibility (Baley and Blanco, 2016), implying that policymakers ought to either create incentives to spend or act agressively in response to uncertainty shocks. The "wait and see" hypothesis postulates that, in the presence of non-convex adjustment costs for capital and labor, uncertainty weakens the impact of changes in factor prices (and interest rates in particular) as it motivates agents to postpone decisions as they await better information. Using monthly data on macroeconomic variables in the U.S. over the period 1986-2008, Caggiano et al. (2017a) apply a smooth transition vector autoregression (STVAR) model to investigate the non-linear effect of uncertainty shocks occuring during busts and booms. The authors find that uncertainty shocks occuring during recessions have a deeper adverse effect in terms of real economic activity but a faster recovery than those hitting during expansions. The results of counterfactual simulations suggest that systematic monetary policy after uncertainty shocks in the U.S. is more effective in expansions. In a similar vein, uncertainty shocks are found to have different effects depending on the level of financial stress (Alessandri and Mumtaz, 2014) and whether they occur during normal times or the zero lower bound period (Caggiano et al., 2017b). Our analysis thus builds on the idea that the stabilizing power of monetary policy is state-contingent, as suggested by the findings of this literature.

This paper links the mathematically founded evidence on the outcomes of monetary-fiscal interactions with empirical evidence on such interactions during uncertainty shocks. In the next section, we construct a New-Keynesian system following the assumptions of Saulo et al. (2013), Kirsanova et al. (2005), and Muscatelli et al. (2002) to model monetary-fiscal interactions in Egypt during uncertainty and to examine alternative macroeconomic outcomes under counterfactual scenarios of monetary autonomy as opposed to fiscal dominance.

3. Empirical analysis

Data

We use quarterly data on key macroeconomic variables in Egypt from Q1 of FY 2006/2007 to Q4 of FY 2018/2019 to study the fiscal-monetary interactions and their impact on macroeconomic outcomes during uncertainty shocks.[3] Including fiscal data before 2006 was not possible because the classification of the Egyptian budget changed after the implementation of the 2005 new budget law. Six variables are used in this study: real GDP, CPI inflation, budget deficit, discount rate, stock market index, and effective exchange rate.

The real GDP and inflation series are the quarterly real GDP at constant prices and the CPI growth rate. The budget deficit, which is the gap between public spending and tax revenues, proxies the fiscal policy instrument in our model. The monetary policy instrument is represented by the quarterly discount interest rate. Budget deficit and GDP at constant prices are obtained from the Ministry of Planning, Monitoring and Administrative Reform (MOP), while exchange rate series and CPI inflation are retrieved from the IMF database. Data on the discount interest rate is obtained from the Central Bank of Egypt (CBE) and monthly data on the stock market index is acquired from the Egyptian Exchange (EGX).

Model specification

We construct a model of monetary-fiscal interactions based on a New-Keynesian dynamic structural system that is relatively close to the Kirsanova et al. (2005) framework. To estimate the impact of uncertainty shocks on economic outcomes, we design a Structural Vector Autoregressice (ISVAR) model building on the approach of Aastveit et al. (2013), where we interact the endogenous vector with an uncertainty indicator. The proposed ISVAR model is given by:

[3] Most recent quarterly fiscal data available.

$$Y_t = \alpha_0 + \beta X_t + \sum_{l=1}^{L} (A_l Y_{t-l} + \beta_l Y_{t-l} X_t) + \gamma Z_t + \varepsilon_t$$

where $\boldsymbol{Y_t}$ is the vector of endogenous variables which include: (i) the detrended budget balance (*BB*) as the fiscal stance parameter, (ii) the discount interest rate (*DIR*) used as a proxy for the monetary instrument, (iii) inflation rate (*INF*), (iv) the output gap (*gGap*), and (v) the stock market index (*EGX*). $\boldsymbol{X_t}$ is the vector of dummies representing the uncertainty shock (based on the stock market (EGX) index variable as will be explained further below). $\boldsymbol{Z_t}$ is the vector of exogenous variables, including real effective exchange rate (Exchgrate) and political regime change (dummy for structural breaks), and $\boldsymbol{\varepsilon_t}$ is the vector of error terms. $\boldsymbol{\alpha_0}$ is the vector of constant terms and $\boldsymbol{\beta}, \boldsymbol{A_l}$, and $\boldsymbol{\gamma}$ are the parameter vectors of the shock variable, the lags of the endogeneous variable, the interaction term, and the exogeneous variables, respectively. For each of the VAR equations, *L* is the optimal autoregressive lag length which is determined during the estimation process (using SIC, AIC, …).

As a proxy for the fiscal policy instrument, we use the detrended budget deficit which is calculated as the deviations from the Hodrick-Prescott filtered trend of budget balance (with the HP factor set at 1600). As explained in Muscatelli et al. (2002), this indicator removes the trend component from the budget deficit that is mainly driven by debt dynamics and interest rate influence. Hence, it captures the short-run fiscal responses and gives a measurable representation of the countercyclical fiscal policy. The discount interest rate is used as the monetary policy instrument. Following Aastveit et al. (2013) and Mohieldin (2020), another proxy is included to account for political regime changes and turbulence. The proxy takes the value of zero before 2011, one during the period 2011-2013, and then zero again for the period 2014-2019.

Second, to examine the extent to which fiscal dominance and discretionary policies result in undesired welfare outcomes, we design a counterfactual scenario and calibrate our model with a fiscal rule and a monetary rule. Saulo et al. (2013) ran a simulation model to obtain variances of their variables under optimal trajectories and derive impulse response functions under different scenarios of MF coordination. They then measured the expected social loss associated with each scheme of coordination between monetary and fiscal authorities. On the other hand, Caggiano et al. (2017) run counterfactual simulations with multivariate non-linear VAR to account for second round effects in policy rates, uncertainty, and changes in economic activity. They designed a counterfactual scenario to measure the policy versus no policy scenario and hence constructed a policy gap analysis. They run counterfactual scenarios assuming that monetary policy is ineffective by "zeroing" the coefficients of the federal funds rate and running the STVAR. In this case, they assume that monetary policy doesn't respond to an uncertainty shock. Following their simulation techniques, we construct counterfactual simulations to test the possible welfare outcomes under alternative monetary-fiscal setups and alternative levels of dependence on rules as opposed to discretion. The counterfactual scenario is done by constraining one variable under the structural VAR, either by IRFs or forward iteration that produce alternatives in case of no policy intervention.

Parameterizing uncertainty

Uncertainty typically increases after major economic and political shocks, has real effects on macroeconomic outcomes, and can disturb the behavior of monetary and fiscal policies during such abnormal times (Baker et al., 2016). Issing (2002) defines three categories of uncertainty: (i) uncertainty about prevailing economic conditions, (ii) uncertainty about the structure of the economy, and (iii) "strategic uncertainty" or uncertainty about the interaction of private agents and policymakers. Born and Pfeifer (2014) define uncertainty as the dispersion of the economic shock distribution or the "mean-preserving spread." Examples of high uncertainty episodes identified in Born and Pfeifer (2014) include times of political transition and electoral cycles where the public would have less information about the types and preferences of policymakers.

Empirically, uncertainty has been identified through different measures. In Bloom (2009), uncertainty is associated with extreme jumps in the level of the S&P 100 Volatility Index (VXO). Alternative measures for uncertainty include the frequency of referring to economic uncertainty in the media (Alexopoulos and Cohen, 2009), count of news articles in Google mentioning economic uncertainty (Aastveit et al. 2013), and corporate bond spread (Bachmann et al., 2013).

For the purpose of this study, an uncertainty shock is defined as a sudden event that involves a major transformation in the ruling administration, the economic system, or the structure of the economy in a way that generates ambiguity about (a) future policy preferences and/or (b) the possible responses of economic agents to the new policies. There were several attempts in the literature to parametrize uncertainty within the New-Keynesian dynamic structural models. Uncertainty can be measured as unpredicted movements in specific macroeconomic or financial indicators illustrated by observing deviations from long-run trends. The literature used different proxies for uncertainty. Rossi and Sekhposyan (2015, 2017) propose uncertainty measures based on the distribution of real GDP forecast error. Rossi et al. (2017) depend on data from the Survey of Professional Forecasts and use the real GNP/GDP growth density forecasts to extract measures of macroeconomic uncertainty, as real GNP/GDP fluctuations are indicative of the state of the business cycle and are therefore representative of macroeconomic uncertainty.

Baker, Bloom, and Davis (2016) create an uncertainty index that reflects on the use of a quantitative text analysis of newspapers regarding uncertainty-related concepts. Scotti (2016) define uncertainty proxy based on Bloomberg forecasts that depend on agents' expectations of economic activity.[4] Jurado et al. (2015) and Ludvigson et al. (2015) parameterize uncertainty using unpredictability in a set of macroeconomic and financial indicators. In their application on the U.S. economy, Bloom (2009) and Caggiano, Castelnuovo, and Nodari (2017) identify uncertainty shocks resulting from extreme events

[4] For a more comprehensive literature review, see Caggiano, Castelnuovo, and Nodari (2017) and Bloom (2009).

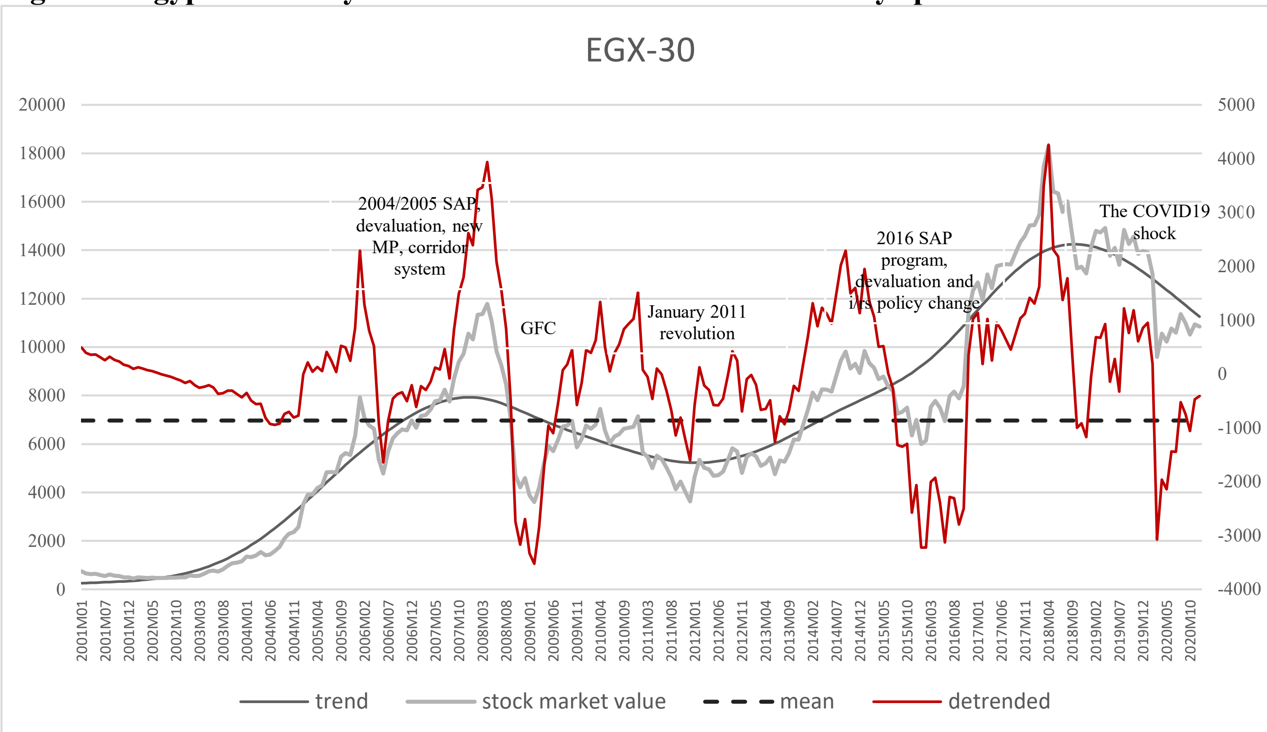
that lead to unpredictable movements in the level of the S&P 100 Volatility Index (VXO).[5, 6] Using monthly stock market data, Caggiano et al. (2017) measure uncertainty shocks as an unpredictable movement of the VXO indicator. Using a dummy-based approach, they represent uncertainty through a dummy that takes 'one' if the standard deviations from the mean of the detrended VXO exceed a specific threshold, and zero otherwise.

Our empirical methodology first comprises identifying uncertainty shocks through financial volatility following Bloom (2009). Then, using a structural vector autoregression model (SVAR) and, precisely, exploiting the interacted VAR methodology (Towbbin and Weber, 2013; Sa et al., 2013), we interact our uncertainty indicator, treated as exogeneous, with the endogeneous macroeconomic variables. Our aim is then to depict a picture of (i) how monetary policy reacts to output and inflation shocks, (ii) how output and inflation react to interest rate shocks, and (iii) how these interactions vary according to the prevailing level of economic uncertainty.

We follow the dummy approach of Caggiano et al. (2017) and construct an uncertainty variable based on Egypt's EGX-30 Stock Market Index. We primarily calculate the HP-detrended EGX-30 series using a monthly dataset covering Q1 of 2007 to Q4 of 2018. We then design the uncertainty indicator which takes the value of 'one' whenever the standard deviations from the mean exceed an absolute value of 7.5 points and 'zero' otherwise. Based on our definition of uncertainty presented earlier in this paper, uncertainty episodes identified in the mentioned indicator comprise uncertainty-inducing events in Egypt in the covered period, such as periods of structural adjustment programs and radical changes in macroeconomic policy, political cycles, domestic and global economic and financial crises, and the recent COVID-19 shock (Figure 3).

[5] Monthly stock market volatility. Proxy is annualized standard deviations.
[6] Caggiano, Castelnuovo, and Nodari (2017) measure the impact of monetary policy in countering the effects of uncertainty shocks in the U.S. economy during times of booms and recessions. Using simulations, they find that monetary policy is more effective during expansions in countering uncertainty shocks.

Figure 3. Egypt's monthly stock market EGX-30 and uncertainty episodes



Source: Authors, using data from the Egyptian Exchange (EGX).

Results

We primarily examine the stationarity of all data series (see Table 1). Our results suggest that the selected variables, except for the detrended budget balance, are non-stationary at levels but stationary at difference. The optimal VAR order was selected based on the conventional information criteria (AIC – SC-HQ) obtained from the LR tests (see Annex 1). We focus in our analysis on Impulse Response Functions (IRFs) resulting from the SVAR explained in the previous section. The below figures show the IRFs obtained at 95 percent confidence around the orthogonalized responses obtained from the Choleski decomposition of the Variance-Covariance Matrix of the endogeneous variables.

Table 1. Unit roots

Ho: variable contain unit roots Ha: variable is stationary	level	First difference
	P-value	P-value
	ADF	ADF
gGAP	0.3875	0.0000
INF	0.0009	0.0000
Detrended BB	0.0000	0.0000
DIR	0.9609	0.0001
EGX	0.1608	0.0139
Exgchrate	0.1678	0.0002

First, we analyze the contemporaneous effects of an uncertainty shock on welfare outcomes, identifying a short-run span of three lags. The analysis carried out in this paper focuses on impulse response functions. Figure 4 shows 95 percent confidence bands for the impulse responses computed from our structural VAR model estimated over the sample. The nature of the interdependence between the monetary and fiscal policies seems to be asymmetric. While interest rates increase in the first few quarters after the fiscal expansionary shock, fiscal policy tends to act temporarily as a strategic substitute for monetary policy (this reaction, however, is subsequently reversed in the medium run). Turning to how the policy instruments react to the output gap and inflation, it can be seen that the monetary policy reactions to output gap and inflation have the predicted sign; an increase in the output gap and inflation induce an increase in the interest rate, although the monetary policy seems to be more responsive to output gap shocks in the short run. The fiscal policy instrument increases after an inflation shock, suggesting a weak countercyclical response of fiscal policy to inflation. The idea of inertia in the fiscal policy can also be seen from the weak response of the fiscal policy to the output gap in the first lags.

Moreover, an uncertainty shock doesn't appear to have a contemporaneous impact output gap while it appears to have a direct negative effect on inflation rate. An interpretation of the two welfare outcomes can be clearer after checking the responses of the fiscal and monetary parameters, where it shows that fiscal policy doesn't respond to the uncertainty shock before the third lag. The response of the monetary policy parameter seems to be relatively faster than the fiscal policy parameter as it shows a contemporaneous negative impact that switches to positive after the second lag and then stabilizes. Contemporaneous fiscal policy response to a shock in the output gap also appears to be weak, reflecting a weak countercyclical response to output gaps during uncertainty shocks after isolating the debt dynamics and interest rate effects from the budget balance, as highlighted earlier. On the other hand, monetary policy seems to be more reactive to the countercyclical effect of output shocks.

Results are intuitive under New-Keynesian assumptions on sticky prices, the Taylor rule, and assumptions on discretionary policy lags and contemporaneous fiscal and monetary policy tools on welfare outcomes. Precisely, fiscal policy response does not start before the third lag since discretionary interventions usually take time to pass through the legislative process, particularly in the absence of strong automatic stabilizers (Fernández and Cos, 2006). In addition, monetary response would start in the third lag, also assuming sticky prices and that the transmission mechanism transmits through the money market (Leeper, 1991; Leeper, Sims, and ZHA, 1996; Cazacu, 2015).

Second, we restrict the VAR with counterfactual assumptions on fiscal and monetary policy. The assumption was done by calibrating monetary policy and fiscal policy parameters to zeros, alternatively following the Caggiano, Castelnuovo, and Nodari (2017) simulation model as indicated earlier. Under both scenarios, we find that an uncertainty shock has a positive contemporaneous effect on the output gap. However, the magnitude of the impact is significantly higher under the fiscal dominance scenario as indicated by the size of the coefficients in Annex 2. In the absence of monetary policy, the contemporaneous effect of fiscal policy on output gap is negative and large, which indicates a strong short-run countercyclical response to output shocks. However, fiscal policy switches towards procyclical behavior in the long run. This result is intuitive and consistent with El-khishin and Zaky (2019), indicating that fiscal policy in Egypt turns into procyclical behavior after exceeding a specific deficit threshold.

On the other hand, in the absence of fiscal policy, monetary policy appears to be more responsive to uncertainty shocks in a countercyclical direction. Both the contemporanous and long-run effect of monetary policy on output gap is negative and significant, indicating a countercyclical response to output gap shocks. This reaffirms the result that fiscal dominance and the long-run procylical fiscal behavior in Egypt has played a role in impeding the effectiveness of monetary policy in stabilizing the economy during uncertainty shocks.

Finally, the results of the variance decomposition are shown in Table 2. The variance decomposition shows that budget balance explains approximately 53 percent of its own variation, which confirms the finding in Alshawarby and Elmosallamy (2018) regarding the "inertia" in the fiscal policy in the sense that the past values of fiscal instruments determine, to a great extent, future ones. The output gap explains about eight percent of the changes in the budget balance, 30 percent of the fluctuations in the discount interest rate, and 31 percent of the fluctuations in the stock market index, whereas inflation explains about 24 percent of the changes in the budget balance and only seven percent of the fluctuations in the discount interest rate.

Figure 4. Uncertainty, monetary-fiscal policies, and welfare outcomes in Egypt, impulse-response functions

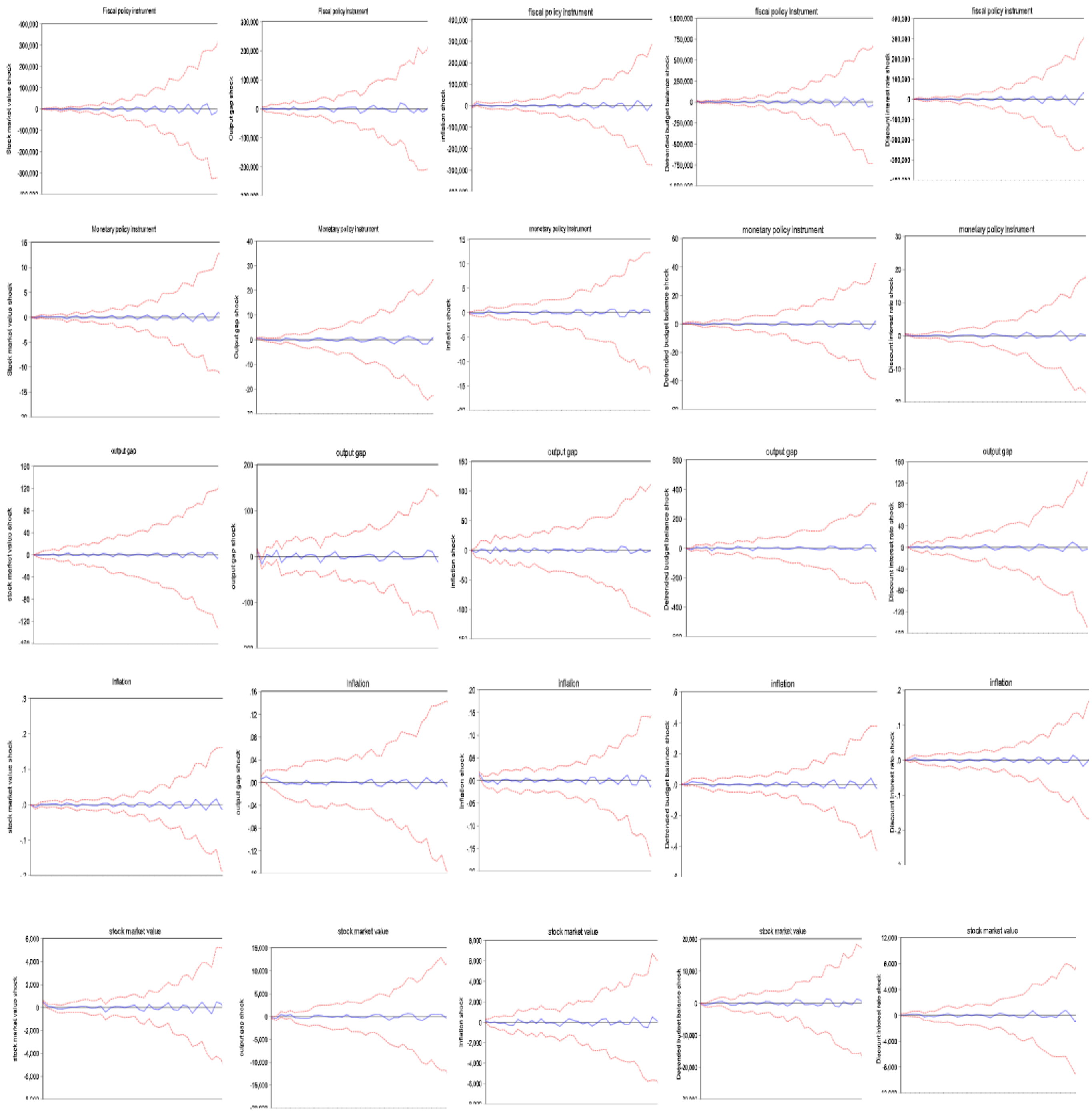


Table 2. Variance decomposition of the VAR model (%)

	D.gGAP	D.INF	D.Det_BB	D.DIR	D.EGX
D.gGAP	55.32968	15.31839	7.890438	29.57947	30.75026
D.INF	6.686937	21.97689	24.12273	7.111232	7.601728
D.Det_BB	33.59456	51.54959	52.82761	45.56112	46.76855
D.DIR	2.881545	3.494266	6.899684	13.18677	6.297399
D.EGX	1.507281	7.660865	8.259531	4.561406	8.582068

Notes: The results are based on the orthogonalized impulse-responses. Percent in variation in the column variable (10 periods ahead) is explained by the row variable. D. denotes the first differences.

4. Conclusion

In this paper, we examine monetary-fiscal policy interaction in the Egyptian economy and study the impact of economic uncertainty on policy effectiveness. A few interesting results emerge from our empirical analysis. First, we find evidence to support the hypothesis that uncertainty shocks have hazardous welfare effects on the Egyptian economy during the study period. The magnitude of the negative impact is evidently larger under a fiscal dominance setup compared to a counterfactual scenario of monetary independence. Moreover, fiscal policy – under a fiscal dominance setup – tends to follow procylical behavior in the long run. In contrast, under the counterfactual scenario of no fiscal dominance, monetary policy appears to be more responsive to uncertainty shocks in a countercyclical manner. The ineffectiveness of monetary policy in stabilizing the economy during uncertainty shocks can be attributed to the prevailing fiscal dominance, the long-run procylical fiscal behavior, and the discretionary-based intervention of the fiscal policy.

The above empirical findings are combined with narrative evidence that chronologically plots the developments in the monetary-fiscal interaction setups in Egypt since the 1990s, particularly during the implementation of structural adjustment programs and in times of political and economic disruptions. Since the early 2000s, de jure institutions developed to increase monetary independence and enhance the CBE's role in stabilizing the economy – therefore improving monetary policy instruments and developing the financial sector – along with a more open external sector, have given the CBE some hand in influencing the economy since the 2000s. Nevertheless, de facto practices show the continuation of fiscal dominance in light of loose fiscal rules and heavy discretions, strong political concentration of power, and weak fiscal institutions. The hazards of fiscal dominance are magnified during spells of political uncertainty and political cycles within which monetary policy loses a great part of its autonomy.

Since the adoption of the 2016 Structural Adjustment Program (SAP), the monetary authority played a more active role in stablizing the economy. This was reflected in the exchange rate floatation, more active revisions in key policy rates, as well as the active countermeasures to the COVID-19 shock. The reform program clearly empowered the Egyptian monetary authority towards using appropriate tools to stabilize the economy and mitigate the effects of the counter fiscal austerity measures. Restored confidence in the Egyptian economy made the transmission mechanism of monetary tools more effective. However, the sustainability of the empowered role of the CBE, being a part of an ex-ante designed SAP, is at risk. In light of the still prevailing loose fiscal rules, the continuing dependence on discretionary measures, and the enduring institutional setting of the legislative and executives, doubts arise on the CBE's ability to preserve its autonomy after the full realization of the SAP. Uncertainty challenges are more availing with the onset of the current COVID-19 crisis. While the countercyclical polices to the current COVID-19 shock are essential and intuitive, institutional measures are crucial to ensure efficient and contained countermeasures and act as a safeguard against excessive misuse.

In terms of policy, our results have clear implications regarding the policymaking of fiscal and monetary policies in Egypt. First, a strong, commitment-based monetary-fiscal framework should be established. Such a framework would decrease time-inconsistency and lags that accompany discretionary interventions, limit politically-motivated misuse of fiscal tools, and enhance credibility in monetary and fiscal authorities. Maintaining the desirable welfare gains of the SAP, in terms of sustained growth as well as fiscal discipline, can be achieved through introducing appropriate fiscal rules that limit politically-driven influence over the budget and minimize uncontrolled discretionary interventions. Proper fiscal rules are expected to result in more CBE empowerment since it will protect monetary policy from future fiscal dominance, especially in periods of high uncertainty. Second, the Egyptian economy could substantially benefit from sustaining the improved monetary-fiscal coordination and active monetary policy as one of the important outcomes of recent reforms that continue to show through the current COVID-19 crisis. This benovelent coordination setup is proven to result in better welfare outcomes both in normal times and during spells of uncertainty. Finally, accommodative fiscal and monetary interventions should be done in a timely yet cautious manner and within a proper set of institutional guarantees. This is not only to ensure the sustainability of the realized fiscal and monetary outcomes, but also to avoid the exacerbation of structural imbalances that persist in Egypt regardless of cycles and crisis times.

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Annex 1. Structural VAR Results

Notes: * indicates lag order selected by the criterion. LR: sequential modified. LR: test statistic (each test at 5 percent level). FPE: Final prediction error. AIC: Akaike information criterion. SIC: Schwarz information criterion. HQ: Hannan-Quinn information criterion.

VAR lag order selection criteria

Included observations: 41

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-919.4339	NA	4.31e+13	45.58214	46.20906*	45.81043
1	-891.5121	44.94732	3.83e+13	45.43961	47.11139	46.04838
2	-867.7452	32.46207	4.44e+13	45.49977	48.21641	46.48902
3	-821.3615	52.04028*	1.92e+13	44.45666	48.21816	45.82639
4	-785.2526	31.70533	1.69e+13	43.91476	48.72112	45.66497
5	-750.8822	21.79590	2.34e+13	43.45767	49.30889	45.58836
6	-673.4692	30.20996	8.63e+12*	40.90094*	47.79702	43.41211*

Table 4. Results of the VAR model

Variables	D. gGAP	INF	Detrended BB	DIR	EGX
L.D.gGAP	-0.786600	0.000337	19.45576	0.042037	-64.57980
	(0.47549)	(0.00058)	(474.063)	(0.02692)	(20.0997)
	[-1.65431]	[0.58008]	[0.04104]	[1.56163]	[-3.21297]
L.INF	-174.8017	-0.406685	127493.3	4.382938	-22585.33
	(209.043)	(0.25556)	(208417.)	(11.8346)	(8836.65)
	[-0.83620]	[-1.59137]	[0.61172]	[0.37035]	[-2.55587]
L.Detrended_BB	-0.000507	4.53E-07	0.070676	5.58E-05	-0.038648
	(0.00042)	(5.1E-07)	(0.41408)	(2.4E-05)	(0.01756)
	[-1.22177]	[0.89221]	[0.17068]	[2.37297]	[-2.20133]
L.D.DIR	4.097802	0.010994	-4836.778	0.799662	0.995302
	(6.73704)	(0.00824)	(6716.89)	(0.38141)	(284.788)
	[0.60825]	[1.33485]	[-0.72009]	[2.09661]	[0.00349]
L.D.EGX	-0.005051	-1.96E-06	-1.766419	0.000561	-0.361916
	(0.00553)	(6.8E-06)	(5.51618)	(0.00031)	(0.23388)
	[-0.91289]	[-0.29019]	[-0.32023]	[1.79048]	[-1.54745]
PolReg	3.802374	0.059707	-37965.26	2.377056	-386.2345
	(21.0711)	(0.02576)	(21008.1)	(1.19291)	(890.718)
	[0.18045]	(0.02576)	[-1.80717]	[1.99265]	[-0.43362]
L.Uncrtnty	-13.30154	-0.028185	11591.29	-0.402891	-439.8319
	(11.6168)	(0.01420)	(11582.1)	(0.65767)	(491.065)
	[-1.14503]	[1.00080]	[1.00080]	[-0.61260]	[-0.89567]
L.D.Exchgrate	1.100720	0.000250	-127.8089	-0.092678	-3.193586
	(0.64135)	(0.00078)	(639.434)	(0.03631)	(27.1112)
	[1.71625]	[0.31932]	[-0.19988]	[-2.55246]	[-0.11780]
Observations	41	41	41	41	41
R-squared	0.933132	0.888954	0.804126	0.841503	0.947560
Adj. R-squared	0.665658	0.444772	0.020630	0.207516	0.737799
Sum sq. resids	1545.660	0.002310	1.54E+09	4.953992	2761976.
S.E. equation	13.89991	0.016993	13858.35	0.786924	587.5772
F-statistic	3.488688	2.001328	1.026331	0.786924	4.517332
Log likelihood	-132.5840	142.3969	-415.6792	-14.85222	-286.0931
Akaike AIC	8.077267	-5.336434	21.88679	2.334255	15.56552
Schwarz SC	9.456484	-5.336434	23.26601	3.713471	16.94473
Mean dependent	-0.056613	0.031298	372.9915	0.140244	120.6963
S.D. dependent	24.03901	0.022805	14003.55	0.883970	1147.487

Notes: Standard errors in ( ) & t-statistics in [ ]. D. denotes that the variable is in first difference and L. denotes the lagged value of the variable.

Table 5. Variance decomposition

Included observations: 42 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	DOutputG	INFLATION_CHANGE_IN_CPI_	DETRENDED_BB	DDISCOUNT	DTB	DSTOCK
DOG(-1)	-0.747551	0.000539	-476.4186	0.004153	0.000622	0.156861
	(0.34864)	(0.00029)	(237.263)	(0.02085)	(0.01627)	(17.0660)
	[-2.14420]	[1.85269]	[-2.00798]	[0.19922]	[0.03821]	[0.00919]
DOG(-2)	-0.408188	0.000183	-941.9269	0.003131	-0.009661	31.01568
	(0.49220)	(0.00041)	(334.966)	(0.02943)	(0.02297)	(24.0936)
	[-0.82930]	[0.44685]	[-2.81200]	[0.10640]	[-0.42059]	[1.28730]
DOG(-3)	-0.314712	0.000135	-812.6003	0.000744	-0.004942	27.16793
	(0.49364)	(0.00041)	(335.946)	(0.02952)	(0.02304)	(24.1641)
	[-0.63753]	[0.32812]	[-2.41884]	[0.02521]	[-0.21453]	[1.12431]
DOG(-4)	0.448682	-4.75E-05	-868.2321	0.010764	-0.007081	30.55306
	(0.45846)	(0.00038)	(312.002)	(0.02741)	(0.02140)	(22.4419)
	[0.97867]	[-0.12419]	[-2.78277]	[0.39269]	[-0.33096]	[1.36143]
DOG(-5)	0.292747	-0.000566	-516.8331	-0.010260	-0.012422	28.10335
	(0.38842)	(0.00032)	(264.338)	(0.02322)	(0.01813)	(19.0135)
	[0.75368]	[-1.74813]	[-1.95520]	[-0.44179]	[-0.68530]	[1.47808]
INFLATION_CHANGE_IN_CPI_(-1)	-187.9425	-0.529572	395384.4	-12.29650	1.215761	8489.738
	(336.345)	(0.28056)	(228897.)	(20.1102)	(15.6967)	(16464.2)
	[-0.55878]	[-1.88754]	[1.72735]	[-0.61146]	[0.07745]	[0.51565]
INFLATION_CHANGE_IN_CPI_(-2)	-38.41770	-0.085141	292284.2	-4.636390	-7.327346	9039.868
	(283.530)	(0.23651)	(192955.)	(16.9524)	(13.2319)	(13878.9)
	[-0.13550]	[-0.35999]	[1.51478]	[-0.27349]	[-0.55376]	[0.65134]
INFLATION_CHANGE_IN_CPI_(-3)	-137.2390	-0.163064	510656.3	9.074705	16.37674	-142.5964
	(290.056)	(0.24195)	(197396.)	(17.3426)	(13.5364)	(14198.4)
	[-0.47315]	[-0.67395]	[2.58697]	[0.52326]	[1.20983]	[-0.01004]
INFLATION_CHANGE_IN_CPI_(-4)	-328.4531	-0.262127	403448.6	5.989928	-0.692869	-3648.861
	(311.118)	(0.25952)	(211729.)	(18.6019)	(14.5193)	(15229.3)
	[-1.05572]	[-1.01005]	[1.90550]	[0.32201]	[-0.04772]	[-0.23959]
INFLATION_CHANGE_IN_CPI_(-5)	-53.56590	0.073382	-112944.3	-3.964674	14.26705	-9803.054
	(244.355)	(0.20383)	(166294.)	(14.6101)	(11.4037)	(11961.3)
	[-0.21921]	[0.36002]	[-0.67918]	[-0.27137]	[1.25109]	[-0.81956]
DETRENDED_BB(-1)	0.000111	1.18E-07	-1.209604	-2.52E-06	1.03E-05	0.005551
	(0.00047)	(3.9E-07)	(0.31728)	(2.8E-05)	(2.2E-05)	(0.02282)

	[0.23845]	[0.30362]	[-3.81244]	[-0.09039]	[0.47440]	[0.24323]
DETRENDED_BB(-2)	0.000471	3.77E-07	-1.274057	-1.98E-05	-1.11E-05	0.023107
	(0.00058)	(4.8E-07)	(0.39170)	(3.4E-05)	(2.7E-05)	(0.02817)
	[0.81881]	[0.78445]	[-3.25267]	[-0.57628]	[-0.41467]	[0.82014]
DETRENDED_BB(-3)	0.000317	-3.10E-07	-0.967664	-4.21E-06	-4.38E-06	0.027540
	(0.00058)	(4.8E-07)	(0.39533)	(3.5E-05)	(2.7E-05)	(0.02844)
	[0.54581]	[-0.63982]	[-2.44772]	[-0.12123]	[-0.16171]	[0.96850]
DETRENDED_BB(-4)	0.000293	-1.50E-07	-0.605421	-2.72E-05	-5.55E-06	-0.003193
	(0.00041)	(3.4E-07)	(0.28026)	(2.5E-05)	(1.9E-05)	(0.02016)
	[0.71072]	[-0.43599]	[-2.16023]	[-1.10276]	[-0.28866]	[-0.15841]
DETRENDED_BB(-5)	-1.06E-05	-1.54E-07	-0.434609	-2.37E-05	1.20E-06	0.017461
	(0.00038)	(3.2E-07)	(0.25951)	(2.3E-05)	(1.8E-05)	(0.01867)
	[-0.02776]	[-0.48342]	[-1.67474]	[-1.04072]	[0.06733]	[0.93545]
DDISCOUNT(-1)	-2.693041	0.009229	1922.749	0.192603	0.540131	-12.19261
	(6.78333)	(0.00566)	(4616.35)	(0.40558)	(0.31657)	(332.047)
	[-0.39701]	[1.63105]	[0.41651]	[0.47488]	[1.70621]	[-0.03672]
DDISCOUNT(-2)	0.690677	0.010160	-5580.063	-0.191749	-0.261537	353.1646
	(6.79031)	(0.00566)	(4621.09)	(0.40600)	(0.31689)	(332.388)
	[0.10172]	[1.79376]	[-1.20752]	[-0.47229]	[-0.82532]	[1.06251]
DDISCOUNT(-3)	8.061758	0.016408	-15796.42	0.255202	0.600847	295.6120
	(9.36236)	(0.00781)	(6371.49)	(0.55978)	(0.43693)	(458.292)
	[0.86108]	[2.10104]	[-2.47924]	[0.45590]	[1.37517]	[0.64503]
DDISCOUNT(-4)	14.08449	0.006244	-14403.17	-0.174638	-0.350196	-35.05081
	(8.74754)	(0.00730)	(5953.08)	(0.52302)	(0.40823)	(428.196)
	[1.61011]	[0.85575]	[-2.41945]	[-0.33390]	[-0.85783]	[-0.08186]
DDISCOUNT(-5)	10.48460	-0.001226	-5768.958	-0.212893	0.302963	129.3483
	(8.79732)	(0.00734)	(5986.95)	(0.52600)	(0.41056)	(430.632)
	[1.19180]	[-0.16711]	[-0.96359]	[-0.40474]	[0.73793]	[0.30037]
DTB(-1)	3.492992	0.004373	4033.483	0.199480	0.592792	-500.8727
	(5.28310)	(0.00441)	(3595.38)	(0.31588)	(0.24655)	(258.610)
	[0.66116]	[0.99219]	[1.12185]	[0.63151]	[2.40431]	[-1.93679]
DTB(-2)	-5.187268	-0.004258	6322.959	0.107308	-0.331706	-102.9810
	(5.79555)	(0.00483)	(3944.12)	(0.34652)	(0.27047)	(283.694)
	[-0.89504]	[-0.88069]	[1.60314]	[0.30968]	[-1.22641]	[-0.36300]
DTB(-3)	-4.085884	-0.000584	1209.325	0.067271	-0.113908	59.89519
	(5.64365)	(0.00471)	(3840.75)	(0.33744)	(0.26338)	(276.259)
	[-0.72398]	[-0.12404]	[0.31487]	[0.19936]	[-0.43248]	[0.21681]
DTB(-4)	0.369453	0.016874	-462.9838	0.086859	0.065808	-255.5259
	(6.17065)	(0.00515)	(4199.39)	(0.36895)	(0.28797)	(302.056)
	[0.05987]	[3.27820]	[-0.11025]	[0.23542]	[0.22852]	[-0.84596]
DTB(-5)	0.558715	0.000490	-82.43523	-0.020205	-0.505189	-135.4998
	(5.71466)	(0.00477)	(3889.07)	(0.34168)	(0.26669)	(279.735)

	[0.09777]	[0.10278]	[-0.02120]	[-0.05913]	[-1.89427]	[-0.48439]
DSTOCK(-1)	-0.003316	-1.98E-05	5.396040	-0.000160	-0.000110	0.334915
	(0.00596)	(5.0E-06)	(4.05412)	(0.00036)	(0.00028)	(0.29161)
	[-0.55658]	[-3.97866]	[1.33100]	[-0.44979]	[-0.39394]	[1.14852]
DSTOCK(-2)	-0.006869	1.03E-06	6.219084	0.000419	0.000210	0.096301
	(0.00630)	(5.3E-06)	(4.28895)	(0.00038)	(0.00029)	(0.30850)
	[-1.08988]	[0.19603]	[1.45002]	[1.11194]	[0.71260]	[0.31216]
DSTOCK(-3)	0.000155	1.41E-06	3.045861	7.78E-05	-0.000339	-0.097696
	(0.00613)	(5.1E-06)	(4.17016)	(0.00037)	(0.00029)	(0.29995)
	[0.02529]	[0.27593]	[0.73039]	[0.21246]	[-1.18482]	[-0.32571]
DSTOCK(-4)	-4.62E-05	-2.34E-06	-3.388505	9.64E-05	7.36E-05	-0.282724
	(0.00621)	(5.2E-06)	(4.22325)	(0.00037)	(0.00029)	(0.30377)
	[-0.00744]	[-0.45119]	[-0.80235]	[0.25974]	[0.25400]	[-0.93071]
DSTOCK(-5)	-0.007508	-7.36E-06	3.215469	-0.000188	-0.000176	-0.161988
	(0.00560)	(4.7E-06)	(3.81093)	(0.00033)	(0.00026)	(0.27411)
	[-1.34079]	[-1.57663]	[0.84375]	[-0.56167]	[-0.67415]	[-0.59095]
C	27.11042	0.075487	-49423.08	0.172819	-0.491994	25.14054
	(33.5392)	(0.02798)	(22824.9)	(2.00532)	(1.56522)	(1641.76)
	[0.80832]	[2.69821]	[-2.16532]	[0.08618]	[-0.31433]	[0.01531]
UNCERTAINTY_DUMMY	-17.02688	-0.051190	19177.57	0.183741	0.007092	153.4543
	(20.1837)	(0.01684)	(13735.9)	(1.20679)	(0.94194)	(988.000)
	[-0.84360]	[-3.04045]	[1.39617]	[0.15226]	[0.00753]	[0.15532]
DREER	0.508905	0.000592	-466.9829	-0.041827	-0.019465	-54.36170
	(0.52729)	(0.00044)	(358.844)	(0.03153)	(0.02461)	(25.8111)
	[0.96513]	[1.34599]	[-1.30135]	[-1.32670]	[-0.79100]	[-2.10614]
R-squared	0.901676	0.924450	0.856649	0.737449	0.892974	0.903183
Adj. R-squared	0.552080	0.655826	0.346957	-0.196065	0.512436	0.558943
Sum sq. resids	2428.094	0.001689	1.12E+09	8.680196	5.288230	5818064.
S.E. equation	16.42523	0.013701	11178.07	0.982072	0.766538	804.0221
F-statistic	2.579193	3.441431	1.680720	0.789971	2.346611	2.623706
Log likelihood	-144.7965	152.9455	-418.7579	-26.48628	-16.07951	-308.2104
Akaike AIC	8.466498	-5.711693	21.51228	2.832680	2.337120	16.24811
Schwarz SC	9.831810	-4.346381	22.87759	4.197992	3.702431	17.61343
Mean dependent	0.901234	0.032250	393.5199	0.172619	0.279524	55.03524
S.D. dependent	24.54207	0.023354	13832.36	0.897979	1.097787	1210.656

Determinant resid covariance (dof adj.)	1.02E+11
Determinant resid covariance	9836690.
Log likelihood	-695.7067
Akaike information criterion	42.55746
Schwarz criterion	50.74933

Annex 2: Counterfactual Scenarios with Structural VAR (Short and Long Run)

Scenario (1): Monetary autonomy (discretionary fiscal policy=0)

c(4) is the effect of uncertainty on output gap

c(7) is the effect of the uncertainty on inflation

c(8) is the effect of the uncertainty on discount rate

c(3) is the effect of discount rate on output gap

c(1) is the effect of inflation on output gap

Structural VAR Estimates
Date: 02/07/21 Time: 20:38
Sample (adjusted): 2008Q4 2018Q4
Included observations: 41 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is over-identified (2 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix

	A = output gap	inflation	Detrended BB	Discount rate	Stock market value
Output gap	1	0	0	0	0
inflation	C(1)	1	0	0	0
Detrended BB	C(2)	C(5)	1	0	0
Discount rate	C(3)	C(6)	0	1	0
Stock market value	C(4)	C(7)	0	C(8)	1
B =					
	C(9)	0	0	0	0
	0	C(10)	0	0	0
	0	0	C(11)	0	0
	0	0	0	C(12)	0
	0	0	0	0	C(13)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.000452	0.000177	-2.546700	0.0109
C(2)	-338.4846	144.5261	-2.342031	0.0192
C(3)	-0.041911	0.006641	-6.310828	0.0000
C(4)	23.90559	8.799346	2.716746	0.0066
C(5)	425067.8	118221.0	3.595536	0.0003
C(6)	3.445708	5.432382	0.634290	0.5259
C(7)	-9262.755	5151.502	-1.798069	0.0722
C(8)	-71.31627	147.3775	-0.483902	0.6285
C(9)	13.89991	1.534988	9.055385	0.0000
C(10)	0.015790	0.001744	9.055385	0.0000
C(11)	11952.56	1319.939	9.055385	0.0000
C(12)	0.549233	0.060653	9.055385	0.0000
C(13)	518.2983	57.23647	9.055385	0.0000

Log likelihood	-845.3461		
LR test for over-identification:			
Chi-square(2)	8.757091	Probability	0.0125

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000

-0.000452	1.000000	0.000000	0.000000	0.000000
-338.4846	425067.8	1.000000	0.000000	0.000000
-0.041911	3.445708	0.000000	1.000000	0.000000
23.90559	-9262.755	0.000000	-71.31627	1.000000

Estimated B matrix:

13.89991	0.000000	0.000000	0.000000	0.000000
0.000000	0.015790	0.000000	0.000000	0.000000
0.000000	0.000000	11952.56	0.000000	0.000000
0.000000	0.000000	0.000000	0.549233	0.000000
0.000000	0.000000	0.000000	0.000000	518.2983

Structural VAR Estimates
Date: 02/07/21 Time: 20:38
Sample (adjusted): 2008Q4 2018Q4
Included observations: 41 after adjustments
Estimation method: method of scoring (analytic derivatives)
Failure to improve after 2 iterations
Structural VAR is over-identified (7 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: long-run pattern matrix
Long-run response pattern:

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	0	1	0
C(4)	C(7)	0	C(8)	1

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	14.76322	0.156172	94.53164	0.0000
C(2)	-36.99403	4.981711	-7.425968	0.0000
C(3)	-0.559066	0.286939	-1.948383	0.0514
C(4)	2.774089	0.335071	8.279113	0.0000
C(5)	31.88314	0.156174	204.1520	0.0000
C(6)	1.541341	0.156174	9.869410	0.0000
C(7)	-1.652087	0.213783	-7.727883	0.0000
C(8)	0.934789	0.156173	5.985595	0.0000

Log likelihood	-2.18E+09		
LR test for over-identification:			
Chi-square(7)	4.36E+09	Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000

Estimated B matrix:

-35.48603	-51.55952	0.004537	-30.89755	0.019980
25.94083	1.697601	-2.05E-06	-0.037625	1.72E-05
-18073403	-1196677.	4.532293	17455.78	-0.883779
1105.036	76.12893	-0.000361	0.805087	-0.000808
-357272.8	-25419.33	0.297927	-766.3480	1.711749

Fiscal dominance (monetary policy=0)

C(4) is the effect of the stock market value on output gap

C(2) is the effect of detrended budget deficit on output gap

c(7) is the effect of the stock market value on inflation

c(9) is the effect of the stock market value on detrended budget balance

c(1) is the effect of inflation on output gap

Structural VAR Estimates
Date: 02/07/21 Time: 20:58
Sample (adjusted): 2008Q4 2018Q4
Included observations: 41 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is over-identified (1 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix

A =	output gap	inflation	Detrended BB	Discount rate	Stock market value
Output gap	1	0	0	0	0
Inflation	C(1)	1	0	0	0
Detrended BB	C(2)	C(5)	1	0	0
Discount rate	C(3)	C(6)	C(8)	1	0
Stock market value	C(4)	C(7)	C(9)	0	1

B =

C(10)	0	0	0	0
0	C(11)	0	0	0
0	0	C(12)	0	0
0	0	0	C(13)	0
0	0	0	0	C(14)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.000452	0.000177	-2.546700	0.0109
C(2)	-338.4846	144.5261	-2.342031	0.0192
C(3)	-0.035927	0.006527	-5.504265	0.0000
C(4)	18.25480	6.581835	2.773512	0.0055
C(5)	425067.8	118221.0	3.595536	0.0003
C(6)	-4.069483	5.750628	-0.707659	0.4792
C(7)	-5674.279	5798.891	-0.978511	0.3278
C(8)	-1.77E-05	6.62E-06	-2.669118	0.0076
C(9)	0.007864	0.006679	1.177337	0.2391
C(10)	13.89991	1.534988	9.055385	0.0000
C(11)	0.015790	0.001744	9.055385	0.0000
C(12)	11952.56	1319.939	9.055385	0.0000
C(13)	0.506952	0.055983	9.055385	0.0000
C(14)	511.2067	56.45333	9.055385	0.0000

Log likelihood	-841.4969		
LR test for over-identification:			
Chi-square(1)	1.058651	Probability	0.3035

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-0.000452	1.000000	0.000000	0.000000	0.000000
-338.4846	425067.8	1.000000	0.000000	0.000000

-0.035927	-4.069483	-1.77E-05	1.000000	0.000000
18.25480	-5674.279	0.007864	0.000000	1.000000

Estimated B matrix:

13.89991	0.000000	0.000000	0.000000	0.000000
0.000000	0.015790	0.000000	0.000000	0.000000
0.000000	0.000000	11952.56	0.000000	0.000000
0.000000	0.000000	0.000000	0.506952	0.000000
0.000000	0.000000	0.000000	0.000000	511.2067

Structural VAR Estimates
Date: 02/07/21 Time: 21:54
Sample (adjusted): 2008Q4 2018Q4
Included observations: 41 after adjustments
Estimation method: method of scoring (analytic derivatives)
Failure to improve after 1 iterations
Structural VAR is over-identified (6 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: long-run pattern matrix
Long-run response pattern:

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	C(8)	1	0
C(4)	C(7)	C(9)	0	1

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.144729	0.156174	0.926717	0.3541
C(2)	0.922735	0.213979	4.312259	0.0000
C(3)	0.544176	0.168235	3.234628	0.0012
C(4)	0.067403	0.182257	0.369823	0.7115
C(5)	0.936630	0.156174	5.997359	0.0000
C(6)	0.322898	0.160499	2.011837	0.0442
C(7)	0.235799	0.178498	1.321018	0.1865
C(8)	0.236972	0.156156	1.517534	0.1291
C(9)	0.553465	0.156154	3.544358	0.0004

Log likelihood	-4.03E+09		
LR test for over-identification:			
Chi-square(6)	8.07E+09	Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000

Estimated B matrix:

-10.72852	-13.99254	-7.310694	-30.91623	0.019980
0.233322	1.743560	-0.008912	-0.037641	1.72E-05
-164896.6	-1218089.	4140.774	17456.60	-0.883779
11.03159	75.15671	0.190154	0.805842	-0.000808
-3727.169	-24489.61	-180.7371	-767.9482	1.711749