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MONETARY-FISCAL POLICY INTERACTIONS DURING UNCERTAINTY SHOCKS: EVIDENCE FROM EGYPT

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SUSTAINABLE DEVELOPMENT GOALS
AND EXTERNAL SHOCKS IN THE MENA REGION:

FROM RESILIENCE TO CHANGE IN THE WAKE OF COVID-19

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Monetary-Fiscal Policy Interactions During Uncertainty Shocks: Evidence From Egypt

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I. Introduction

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In (El-khishin and Kassab 2020), we examine how rules and institutions as well as the monetary-fiscal coordination setup might affect welfare outcomes of a reform during uncertainty shocks. Through a game theoretic model, we showed that: first, reforms implemented under fiscal dominance accompanied with dependence on discretionary measures result in worst welfare outcomes that are magnified when uncertainty parameters are involved. Second, in the case of central bank independence and immunity to fiscal concerns, reforms signal fiscal discipline and produce desired outcomes. Third, proper fiscal rules and commitments under a scheme of benevolent and coordinating authorities are second best during uncertainty shocks; periods characterized with ambiguity about future course of economic policies chosen by policy makers as well as the possible responses of economic agents to the new policies. Rules and commitments relatively lessen undesired outcomes due to higher credibility and lower time inconsistency.

In this paper, we offer the above results for an empirical examination in Egypt; a MENA-emerging economy that has been subject to repeated reform attempts starting with the 1990 ERSAP program, through the early 2000s reforms and ending with the on-going IMF-supported reform that initiated in 2016. Egypt has also been subject to several uncertainty shocks and political disruptions; especially in the recent decades following the 2011 revolution and the Arab Spring wave. In Egypt, 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, usually growth and financing gaps are prioritized above fiscal and monetary discipline. There is also to earlier evidence of weak budget institutions and a high reliance on politically-motivated discretionary interventions in Egypt (El-khishin and Zaky 2019). Such apparent 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 involve weakened fiscal performance as well as aggravated inflation rates. Based on the abovementioned game results and the motivation for the Egyptian economy; our examined research questions are: (1) how much have uncertainty shocks adversely affected welfare outcomes in Egypt under the prevalent monetary-fiscal coordination setup? and (2)To what extent did fiscal dominance and discretionary interventions in Egypt result in undesired welfare outcomes in normal times and during uncertainty shocks?

We examine those questions through both empirical and narrative evidence. After reviewing relevant literature, we empirically examine El-khishin and Kassab (2020) game through constructing a New-Keynesian system following Saulo et al. (2013), Kirsanova et al. (2005) and Muscatelli et al. (2002) assumptions. We construct an interacted Structural VAR model to model monetary-fiscal interactions in Egypt during uncertainty. Alternative welfare outcomes under counterfactual scenarios of monetary autonomy as opposed to fiscal dominance are examined. We complement this empirical model with narrative evidence that fiscal dominance and more dependence on discretionary interventions are the more predominant setups in Egypt since the start of its economic transition process in the end 1970s. Our results indicate that uncertainty shocks have adversely affected welfare outcomes in Egypt under all setups; however, consistent with our theoretical findings, worst welfare outcomes result under the fiscal dominance.

II. Related Literature

Our paper borrows from and contributes to two strands of the literature: the relationship between uncertainty and monetary policy, and the monetary-fiscal interactions.

Uncertainty and Monetary Policy

Uncertainty increases typically after major economic and political shocks, have 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 policy-makers. 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) are times of political

transition and during electoral cycles where the public would have less information about types and preferences of policy makers.
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 referreing to economic uncertainty in the media (Alexopoulos and Cohen, 2009), count of news articles in Google mentionioning economic uncertainty (Aastveit et al.,) and corporate bond spread (Bachmann et al., 2013).

A recent strand of the literature deals with the relationship between uncertainty and monetary policy, the main question being whether high uncertainty affects the effectiveness of the monetary policy. Several theoretical arguments have been advanced to answer this question. 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 awaiting better information. Uncertainty is also found to increase aggregate price flexibility (Baley and Blanco, 2016), implying that policy-makers ought to either create incentives to spend or act agressively in response to uncertainty shocks. 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 in normal times or during 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.

Monetary-Fiscal Interactions

Another strand of literature examined the outcomes of fiscal-monetary interactions as dynamic players in the system where strategic interactions between political governments and central banks were proven to matter. The level of coordination between these two authorities and their strategic and sequential movements towards each other's economic policies result in different welfare outcomes. Lack of coordination, whether in the form of different objectives or even different weights for different objectives result in less desirable welfare outcomes. This literature generally measure the welfare outcomes of a fiscal policy shock on welfare outcomes given different institutional setups (e.g. rules versus discretion) and different non-coordinated setups; either under leadership or as Nash players. When fiscal authority is introduced into the game as a strategic player, results differ from earlier mainstream literature advocating for commitment over discretion.

In general, commitments and higher degrees of coordination reduce time inconsistency problems while oppositely discretionary interventions within Nash setups result in lower output and higher inflation rates compared to other setups, if the two policy authorities are not properly coordinating; that is they don't assign equal weights to their policy objectives, a regime of commitment wouldn't necessarily be welfare improving because the reduction in seignorage will lead to an increase in taxes to finance public spending and hence lower 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 the level of coordination ultimately impacts the time inconsistency resulting from policy; either for one authority or for both authorities (Alesina and Tabellini, 1987; Dixit and Lambertini 2000).

Dixit and Lambertini (2000) interesting finding is that, while good monetary rules decrease time inconsistency, discretionary fiscal interventions during shocks limit the operation of these monetary rules. Oppositely, good fiscal rules will not be undermined by discretionary monetary interventions and will still lead to welfare gains that surpass the Nash setup; that is, fiscal leadership under commitment provide the second best outcomes in general. In similar manners, Credible central banks or central banks with good reputation can result in desirable social welfare outcomes even under discretionary regimes. Good reputation decreases time inconsistency of discretionary measures. Bennett and Loayza (2002), Kirsanova et al. (2005) and Saulo et al. (2012) findings prove that non-coordinated setups result in higher deficits and higher interest rates during shocks. Coordination, both at 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 someplace between the Nash equilibria of tight monetary policy and loose fiscal policy, produce optimum welfare outcomes where neither fiscal sustainability nor output or investment capacity are compromised.

Monetary-fiscal non-coordinated interactions under discretionary regimes result in lowest welfare outcomes; that is, 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. Central bank independence in general not only lead to lower inflation but can also result in better fiscal performance as a result of decreasing time inconsistency in fiscal policy. An independent central bank, though results in lower output and public spending, however, it can eventually lead to better fiscal performance since it will decrease time inconsistency in fiscal policy since money demand will not be affected by fiscal policy.

Although the theroretical literature on monetary-fiscal coordination is relatively abundant, its empirical evidence has received less attention and, particularly, that 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. This paper aims at filling this gap by analyzing how the effectiveness of monetary and fiscal policies are affected by uncertainty shocks. Our empirical methodology consists in first 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 how (i) monetary policy reacts to output and inflation shocks; (ii) output and inflation react to interest rate shocks, and (iii) how these interactions vary according to the prevailing level of economic uncertainty.

III. Empirical Analysis

Data

We use quarterly data on key macroeconomic variables in Egypt over the period FY2006/2007:Q1 to FY2018/2019Q4 to study the fiscal-monetary interactions and their impact on economic stabilization after uncertainty shocks[3]. Including fiscal data before 2006 was not possiblebecause the classification of the Egyptian budget has changed post 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.

[3] Most recent quarterly fiscal data available.

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 Planing, Monitoring and Administrative Reform (MOP), exchange rate series and CPI inflation and 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 stock market index is acquired from the Egyptian Exchange (EGX).

Model Specification

We transform El-khishin and Kassab (2020) theoretical system of monetary-fiscal interactions into a New-Keynesian dynamic structural system that is relatively close to the Kirsanova et al. (2005) framework. It introduces a dynamic nature and intertemporal dimensions to the originally designed theoretical model. To estimate the impact of uncertainty shocks on economic outcomes, we design an Interacted Structural Vector Autoregressice (ISVAR) model building on Aastveit et al. (2013) approach where we interact the endogenous vector with an uncertainty indicator. The proposed ISVAR model is given by:

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

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 $\boldsymbol{\beta, A_l, A_l}$ 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 Hodrick-Prescott filtered trend of budget balance (with 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 and one during the period 2011-2013 then zeros again for the period 2014-2019.

Second, to examine to what extent did 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 to 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 counterfactual scenario to measure the policy versus no policy scenario and hence constructed 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 assumed 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. Counterfactual scenario is done by constraining one variable under the structural VAR; either by IRFs or by forward iteration that produce alternative in case of no policy intervention.

Parameterizing uncertainty

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 literature to parametrize uncertainty within New-Keynesian dynamic structural models. Uncertainty can be measured as unpredicted movements in specific macroeconomic or financial indicators illustrated through observing deviations from long run trends. 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 Survey of Professional Forecasts data 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 therefore are representative of macroeconomic uncertainty.

Baker, Bloom and Davis (2016) create an index uncertainty that reflects using a quantitative text analysis of newspapers regarding uncertainty-related concepts. Scotti (2016) define uncertainty proxy based on Bloomberg forecasts that depend on agents' expectations on economic activity[4]. Jurado et al (2015) and Ludvigson et al (2015) parameterize uncertainty using the 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 that result in an 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 shock 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 detrended VXO is exceeds a specific threshold and zero otherwise.

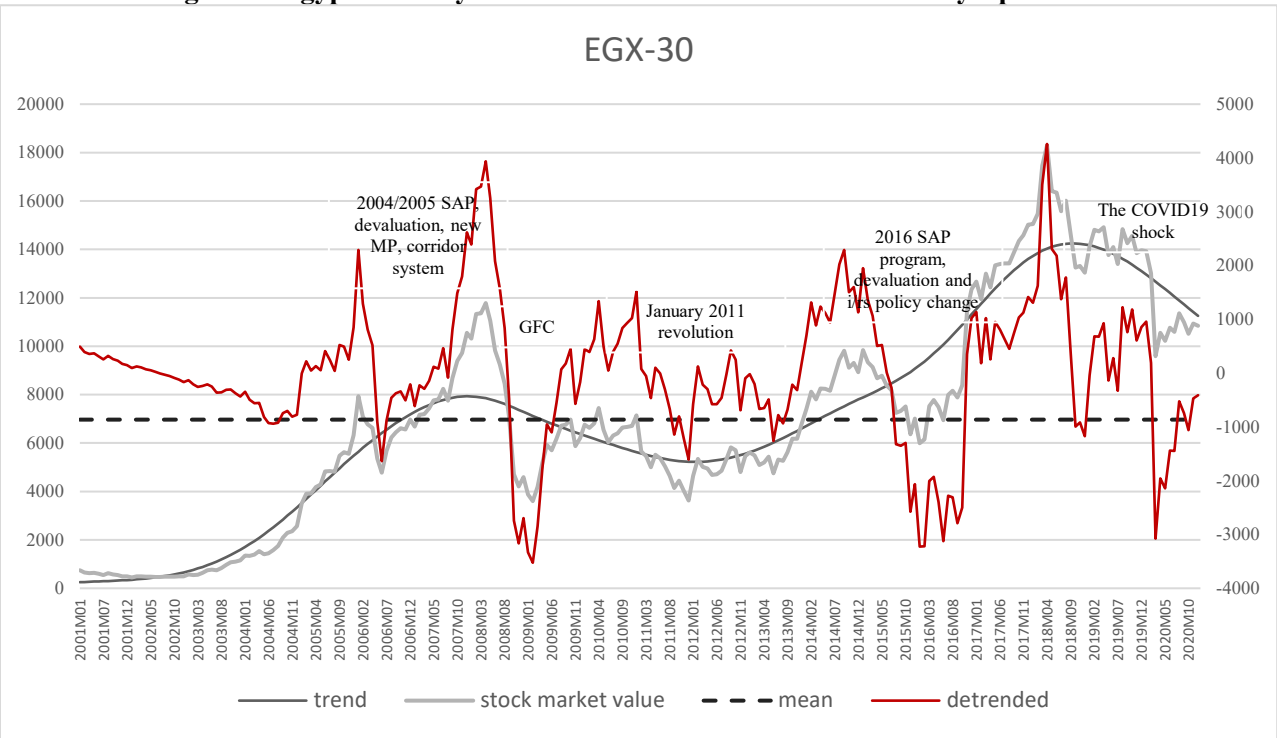
In this paper, we follow Caggiano et al. (2017) dummy approach and construct an uncertainty variable based on Egypt's EGX-30 Stock Market Index. We primarily calculate the HP-detrended EGX-30 series using a monthly dataset covering the period 2007Q1-2018Q4. We then design the uncertainty indicator which 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 consist with the Egyptian uncertainty-inducing events 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 COVID19 shock (Figure 3).

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

[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 US 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 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 Table 2 in the Appendix). 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% confidence level 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 . Figures 4 show 95% confidence bands for the impulse responses computed from our structural VAR model estimated over the sample. The nature of 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). Now 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; both 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 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 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 then it stabilizes. Contemporaneous fiscal policy response to a shock in 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 budget balance as highlighted earlier. On the other hand, monetary policy seems to be more reactive to countercyclical effect of output shocks.

Results are intuitive under New-Keynesian assumptions on sticky prices, 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). Also, 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 (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 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 a 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 a 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 re-affirms the result that fiscal dominance and the longrun procylical fiscal behavior in Egypt has played a role in impeding monetary policy effectiveness 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% of its own variation which confirms the finding in Alshawarby and Elmosallamy (2018) regarding the "inertia" in the fiscal policy in the sense that past values of fiscal instruments determine to a great extent future ones. Output gap explains about 8% of changes in the budget balance, 30% of the fluctuations in the discount interest rate and 31% of the fluctuations in the stock market index. Whereas inflation explains about 24% of changes in the budget balance and only 7% of the fluctuations in the discount interest rate.

Figure 4: Uncertainty, monetary-fiscal policies and welfare outcomes in Egypt, Impulse-Response Functions

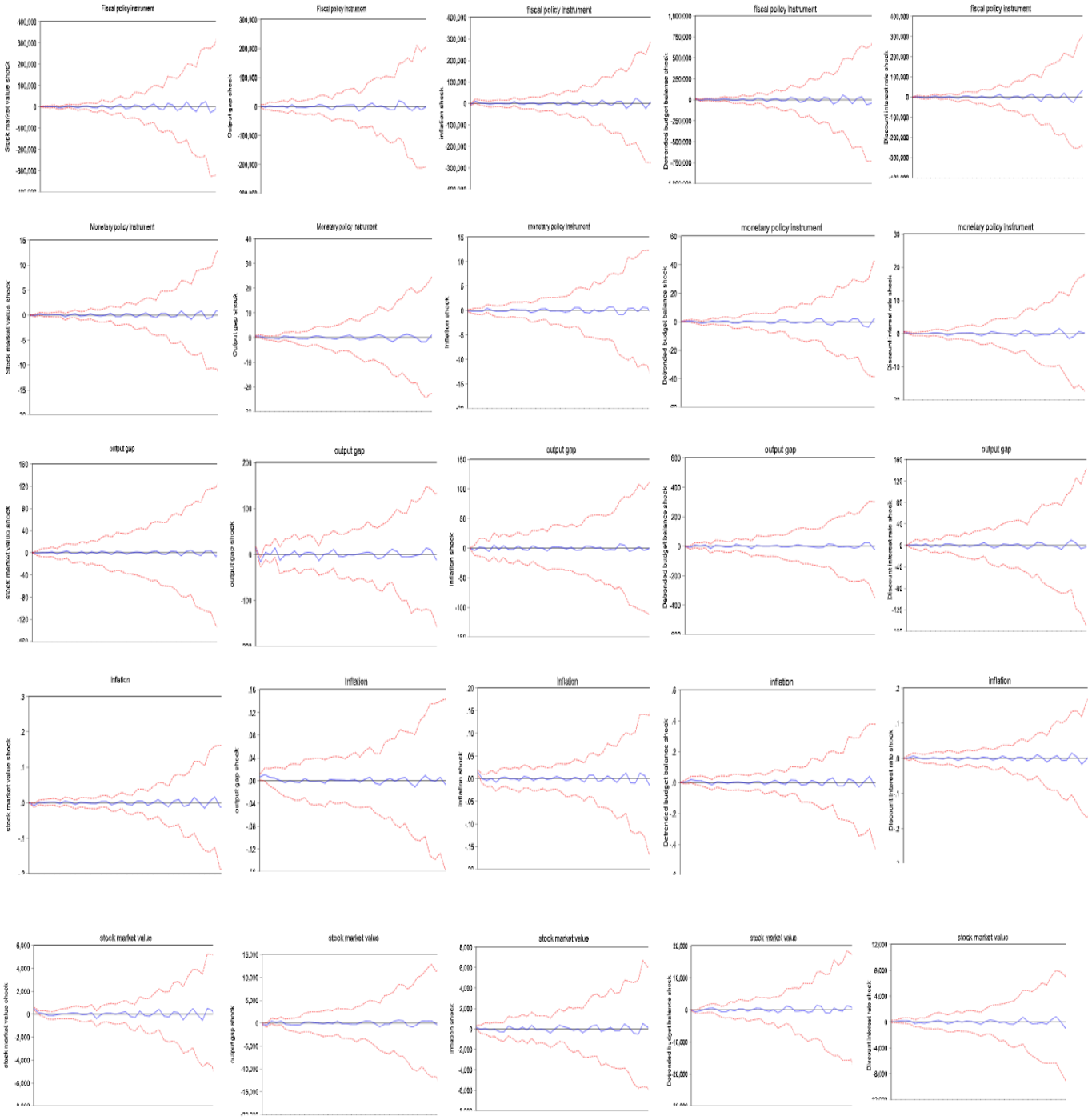


Table 2: Variance decomposition of the VAR model (%)

	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) explained by the row variable. D. denotes the first differences.

IV. Monetary-Fiscal Coordination in Egypt: Narrative Evidence

The process of monetary-fiscal policy coordination in Egypt has developed over time within the broader context of the economic transition process that Egypt has been enduring since late 1970s. In this section, we complement the empirical evidence presented the next section with some narrative evidence to explain the changing dynamics in the interaction between monetary and fiscal policies in Egypt and their implications on macroeconomic outcomes. We spotlight periods of implemented structural adjustment programs (1990s ERSAP - 2004 National reform program and the 2016 IMF-supported SAP) as well as periods of political and economic uncertainty (January 2011 through 2015) and the recent COVID19 crisis. Throughout the analysis, we discuss the evolving role of fiscal, monetary, financial and political institutions. We address issues such as the degree of fiscal dominance, central bank independence, rules versus discretion in policy interactions and how de jure institutions compare to de facto practices in Egypt.

De-jure Institutions versus de-facto practices in Monetary-Fiscal Policy Coordination

During the 1990s, including the ERSAP phase through the 1997 shock, monetary and fiscal policies were coordinated under the centralized political authority. CBE prime objective was maintaining exchange rate stability even during periods of external shocks and credit crunches (1997-2000). CBE interventions were relatively passive during this period (only buying foreign currency). Nominal exchange rate, being pegged to dollar, was generally stable during that period and was linked to inflation rate differentials while interest rate on three-month EGP treasury bills was kept stable until the early 2000s with the initiation of the National Structural Reform Program (Figure) and the lending interest rate was relatively at high rates.

During this period, the legal and institutional framework governing the Egyptian monetary authority granted the CBE a *de-jure* acceptable level of autonomy in conducting monetary policy. However, *de-facto*, CBE didn't have the appropriate instruments to exercise this autonomy in light of the weak monetary transmission mechanism. The poor institutional setup of the banking system and the dominance of state-owned banks weakened the transmission mechanism of monetary policy to macroeconomic environment in the 1990s and significantly contributed to the credit crunch that took place in the end 1990s (Al-Mashat and Billmier, 2008).

Fragile domestic financial market in the 1990s, pronounced in high dominance of state-owned banks, volatile inter-bank rates, limited discount of TBs in addition to closed international markets all made it hard for monetary instruments to be properly transmitted in the economy; thus emphasizing the weak role of monetary policy at that time. Moreover, CBE depended massively on international reserves to support the stability of nominal exchange rate. This resulted in a speedy depletion in international reserves by

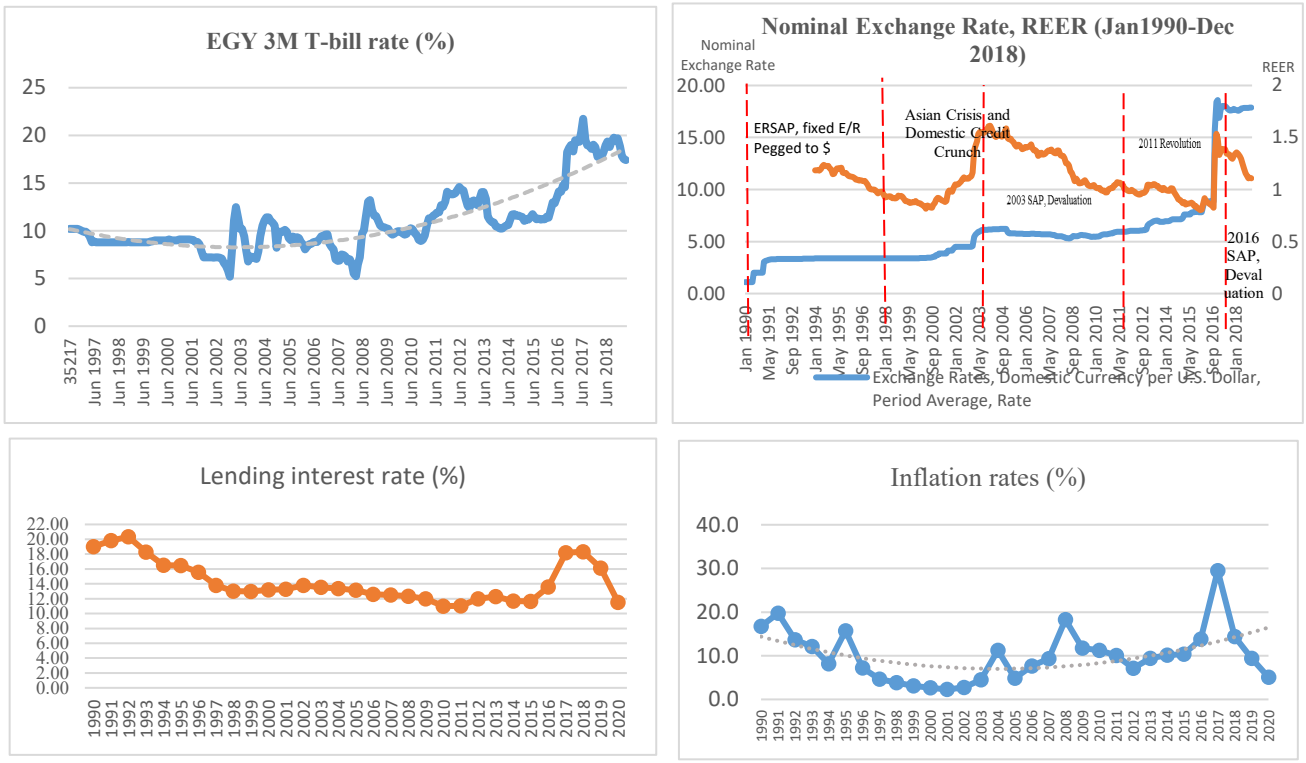
around 25% during the period 1990-1997 (Hassan, 2003). Most importantly, although limits on government borrowing from CBE existed since the presidential decree no. 59, 1993, debt practically exceeded those limits and was usually not settled in their due dates. In the absence of immature financial markets, CBE financed growing government expenditure massively during this period which reflects a very high political dependence (El-Refai, 2001)[7]. In 1997, Luxor terrorist attacks and the Asian financial crisis on one side as well as the domestic credit crunch on the other side all together formed a severe economic shock. Under the noted weak monetary authority, the shock magnified the fiscal supremacy over the scene. However, fiscal authorities could not typically *sustain* the same conservative pattern adopted during the ERSAP. Under a relatively weak monetary authority, the shock resulted in increased budget deficit; inflated public debt as a result of borrowing from the banking sector along with a shortage in liquidity, depreciation in the domestic currency. Towards the end of 1990s, the stabilization outcomes could not be sustained to face the domestic and external factors. The result was an overvalued exchange rate, an increase in budget deficit to reach around 6 percent, a deterioration in the current account and international reserves; as well as an overall slowdown in macroeconomic performance.

The weakened monetary position during this period resulted in several monetary distortions; top of which was the sound development of a black market 1997 and the divergence between the official exchange rate and the parallel market rates. The rather underdeveloped private banking sector and the dominance of state banking sector during that period also contributed to the weakened role of monetary policy and weak transmission mechanism. By the end of 1990s, several actions started to be implemented to improve monetary performance; of which were imposing rather prudential regulations in the banking sector. The credit crunch and other prevailing problems in the banking sector, which reflected on the overall monetary performance during that period, called for applying rather prudential regulations to protect the banking sector from the shortcomings of the laissez-faire banking system (Bahaa El-Din and Mohieldin, 1998). This was the main theme of the following period. Starting the 2000s the Egyptian financial sector started to witness drastic developments and monetary policy started to have a more active role in the economy.

Starting 2003, the Egyptian government implemented a second round of structural reforms and stabilization policies in a relatively stable economic and political environment (compared to both the 1990s and the post-2011 periods). We argue that macroeconomic policies during that period were designed under a fiscal leadership model; that is, fiscal dominance but with some degree of empowerment of monetary authorities. Three main reasons are behind this transition from a centralized authority set up to a fiscal leadership setup: (1) The strengthened monetary transmission mechanism resulting from the abovementioned improvements in the financial sector, (2) the institutional reform measures that were adopted to improve CBE independence and (3) the increased openness of the Egyptian economy on global financial and economic markets.

[7] Government securities covered more than 85% of issued currency at that time (El-Refai, 2001).

Figure 1: Monetary Policy Indicators-Trends and Milestones (1990-2020)



Sources: Central Bank of Egypt, The World Bank, GEM Database, Al-Nashar (2019).
*A decrease in REER is interpreted as appreciation in the Egyptian currency.

Sources: Central Bank of Egypt, The World Bank, GEM Database, Al-Nashar (2019).

CBE law no. 88 of 2003 was issued to regulate the operation of the central bank. The law came as part of a broader reform in the monetary and financial sector in the economy which clearly reflected positively on the monetary transmission mechanism as highlighted earlier. The announced objectives of the new law clearly stated the objective of having a more independent central bank that adopts a clear inflation targeting objective and policy framework. Nevertheless, the operating and institutional amendments that followed the law actually established for a more dependent of CBE and the continuation of the low de facto autonomy. The soundest institutional amendment was the establishment of the "monetary coordinating council" by the presidential decree no. 17 of 2005. According to the executive regulations of the law, the council is chaired by the prime minister; that is, the head of the executive authority.

"The Coordinating Council stipulated in Article (5) of the aforementioned Law of the Central Bank, the Banking Sector, and Money shall be established under the chairmanship of the Prime Minister….", (Official Journal, 2005)

"The Coordinating Council shall determine the targets of the monetary policy in a way that realizes price stability and banking system soundness, within the context of the general economic policy of the State. The Prime Minister shall determine the issues to be referred to the Council"[8]*. (Official Journal, 2005)*

[8] The coordinating council on monetary policy was established to coordinate between the government and the monetary authority. The Monetary policy committee Consists of seven members; the Governor of the CBE, the two Deputy Governors, and four members of the Board of Directors. The committee meets every six weeks, decides on key policy rates and other monetary policy tools.

The formation of the council, in addition to other practices, reflect the profound institutionalization of a fiscal-leadership setup during this period and more empowerment to the government in influencing CBE decisions and hence further diminishes monetary autonomy. Even after the council became ineffective, monetary policy continued to be politically dominated by fiscal authorities which was evident by the outcomes of monetary and fiscal interventions during the mentioned period. The year 2005 marked a milestone in changing monetary and fiscal policy framework. First, in 2005, a new Monetary Policy Framework was introduced that involved changing CBE operational target from Bank reserves to overnight interest rates under what was known as the Corridor System (Morsi, El-Mosallamy, and Zakareya 2007). The year also marked a milestone in the fiscal policy since it witnessed the implementation of the new Budget law of 2005 which involved many positive changes towards budget governance and transparency. However, it also implicitly involved the abolishment of the Golden Rule in 2005 as wil be highlited in the next section. Banking sector reforms, exchange rate floatation measures and the more openness of the economy contributed to more effective transmission mechanisms of designed policies as well as more sound outcomes. While nominal exchange rate was allowed to float in 2004, floatation resulted in a *relatively* mild/contained devaluation in the Egyptian currency, compared to the both ERSAP program and the 2016 program (Figure 2). This can be attributed to several reasons related to both the dynamics of interaction between monetary and fiscal policies in Egypt as well as the presence of the uncertainty factor as a key player as we will show in the next section of this paper.

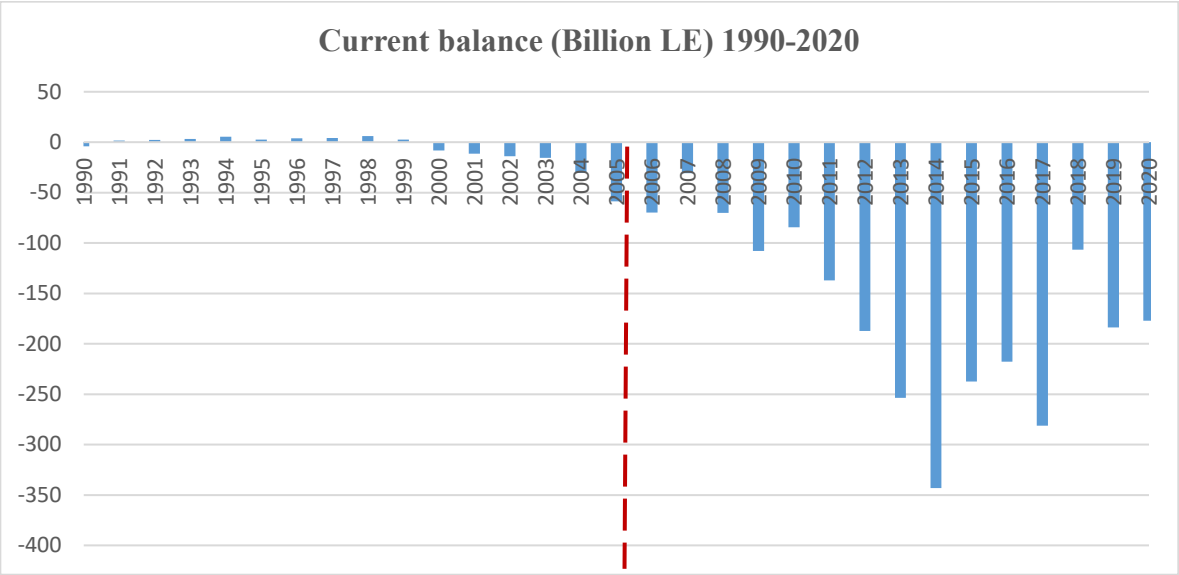
Rules versus discretion in Monetary-fiscal policy interactions

Fiscal reform measures also resulted in higher tax revenues and better fiscal performance as a result of improved institutional performance of the tax system as well the overall improved macroeconomic performance. The relatively strong external position at that time, evident in the increased FDI, high tourism and Suez-Canal inflows, increased credibility of the Egyptian economy, growing domestic business as well as the global favorable conditions all together constituted a supporting environment for the stabilization measures and have made the short-term outcomes of this reform relatively contained until 2008.

In 2008, the Egyptian economy was forced into an anticipated business cycle as part of the global recession. After a period of evident high growth rate and stable macroeconomic performance, growth started to slowdown. The Egyptian economy continued to perform under a fiscally-led setup and looser fiscal rules which started to result in unfavorable outcomes. Discretionary interventions continued even during the recession wave which resulted in some unwanted macroeconomic outcomes such as the spiking inflation following the partial liberalization of fuel prices that took place in January 2008. Economic growth rates started to slow down and fiscal aggregates started to inflate together with signals of growing public discontent towards deteriorating social conditions. Most importantly, the repercussions of the earlier abolishment of the Golden rule in 2005 became extravagant starting 2008 (Figure 2).[9]

[9] The Golden Rule implies that the Egyptian government is not allowed to borrow except to finance investment, while current spending should be covered through fiscal revenues; that is, current deficit should be minimal. Egypt adopted the Golden rule until 2005.

Figure 2: Illustration of Golden Rule violation in Egypt



Source: Ministry of Finance.

Precisely, this violation is considered one of the core causes of the persistently deteriorating fiscal performance for three main reasons: first, it allowed more space for fiscal discretionary interventions which resulted in more pressures on fiscal aggregates. Second, it opened the door for an endless loop of political rent-seeking behavior during subsequent political cycles and episodes of political disruptions as we will show in the coming lines[10]. Third, as argued earlier in El-Khishin and Zaky (2019), political concentration of power and weak political competition within the Egyptian political institutions during this period induced a strong voracity effect[11] and contributed to widening the scope of political influence over the budget during all the stages of the budget process through unmanaged discretionary interventions. Such evident *politically-driven* discretionary interventions combined with the strong political influence over the budget and the evidently weakened monetary control, altogether again prove a fiscal dominance over the scene. This has promoted pressures on the Egyptian budget and took fiscal policies back again towards inflated and uncontained public deficit and debt levels.

Policy coordination during uncertainty shocks

In 2011, a sudden political and economic shock took place and led the Egyptian economy into an almost six-year wave of economic slowdown. Fiscal and monetary variables continued to deteriorate under the continued politically-driven fiscal leadership, continued rent-seeking behavior of political authorities, massive discretionary fiscal interventions and the lack of appropriate monetary interventions[12]. Egyptian authorities resorted intensively to international reserves which, together with excessive borrowing, led to a

[10] During the 2008 political cycle of the presidential elections, a sharp increase in current spending as a result of an announced public wage rise and an increase in the ration cards resulted in a sound increase in the current deficit. It is worth noting that these announced increases took place during the start of the 2008 recession wave and hence resulted in a massive pressure on the overall deficit. For more information about Golden Rule violation and other developments in Egyptian fiscal rules and institutions, revise El-Khishin and Zaky (2019), Zaky and El-Khishin (2016).

[11] Voracity effect is when high political concentration of power and poor political competition - particularly in the legislature – negatively affect the budget process (Tornell and Lane, 1999).

[12] For example, decisions to resume the previously stopped public employment policies to calm down the public.

severe deterioration in both monetary and fiscal aggregates. Shy reform attempts implemented during this period – for example fuel prices partial liberalization in 2014 – were not met with proper monetary control measures to counter their impact on monetary aggregates and macroeconomic outcomes.

Under this fiscal dominance, CBE tools in the market during that time were limited to interventions in the auctions market, while no significant interventions in key policy rates were made. Exchange rates were generally fixed at rates higher than equilibrium rates which allowed for the wild expansion of the parallel market and again proving the dominance of the fiscal authorities over the scene during a period characterized by severe economic and political uncertainty (figure 1). This behavior clearly illustrate Huang and Wei (2006) argument that while fixed exchange rate systems are often used to solve lack of credibility problems, however, in countries with weak institutions, such systems often fails to give the proper signals and they are often end up in currency crises. In 2016, Egyptian authorities announced the intention of implementing another structural adjustment program supported by an IMF $12 billion loan. With the launch of this reform program, monetary-fiscal interaction setup clearly shifted from a fiscal leadership model to more of a benevolent coordination setup. Both monetary and fiscal authorities played equally during this period under a broad clearly-defined set of macroeconomic objectives and targets as they both had the *intention* of undergoing a structural reform program with the known conventional toolkit. Both fiscal and monetary authorities implemented independent decisions.

On November 3rd, 2016, CBE announced a complete floatation of the Egyptian currency. The decision to free float exchange rate was clearly motivated by the failing monetary sector reflected in shortage in foreign currency, severe depletion of international reserves, increased imports bill and the slowdown in the economy as well as the worsened external position. The floatation decision was also seen as a necessity to restore foreign investors' confidence in the economy and get rid of the black market and the consequent failures in the FX market in the economy. On the other hand, the Egyptian government was no longer able to conclude its fiscal obligations and sustain fiscal aggregates. While the reform started with typical monetary actions, the floatation of the foreign exchange coupled with raising policy interest rates, nevertheless, the fiscal components of the program were clearly harmonized in order to mitigate the inevitable implications of the reform on the real side of the economy.

Parallel fiscal measures to protect the budget and the economy from the foreseen future adverse implications of the 'soon-to-happen' devaluation on fiscal balances and mitigate the impact of the devaluation on fiscal aggregates. Subsidies reform measures were aggressively resumed as part of the program, together with the implementation of the value added tax (VAT) and other tariff and tax measures; all together with the intention of restoring fiscal balances at one side and to pursue a contractionary action to slowdown the uncontained inflation rates on the other side.

A benevolent coordination setup during this period is evident through two main aspects: first, the more powerful role of the monetary authorities and more active intervention in the economy. Second, the independent, yet sequential, actions of both monetary and fiscal authorities during this period.

Following the COVID-19 shock, the Egyptian monetary and fiscal authorities followed global advice and implemented countercyclical measures in the form of accommodative monetary policy, fiscal stimulus packages and financial measures to ensure liquidity. This is in addition to targeted measures to protect vulnerable sectors and groups mostly hit by the pandemic. CBE role during the pandemic was evidently active which was reflected in the frequent revisions in key policy rates CBE lowered overnight deposit rate by 300 basis points in March 2020 in response to the crisis. In september and November, further lowering decisions were taken in response to declinnig inflation and to support moentary and finacial ease during the pandemic. This is in addition to the announced exceptional measures to support the banking and business sector liquidity and reslience to the shock[13]. on the other hand, fiscal policy was also active in response of the shock where several expansionary measures were adopted such as the 100 billion emergency budget

[13] For more on the monetary measures in response to the shock, revise (Central Bank of Egypt 2020)

finance and the US$ 1.7 billion 12-month Stand-By Arrangement (SBA) signed with the IMF to support emergency measures. This is in addition to a number of accomodative fiscal policy measures such as tax reliefs, cash support to vulnerable groups and increased spending on the health sector[14].

While it is still too early to provide full conclusive empirical evidence on the impact of the monetary and fiscal countermeasures on welfare outcomes during the shock, the general observations affirm that montary policy has been rather more active monetary during the shock and also was well coordinated with fiscal and finacial measures in Egypt. Accomodative measures are consistent with the global decline in interest rates, stability in domestic inflation rates and short-term expectations, leveraged foreign reserves and improved fiscal aggregates prior to the hit of the pandemic. Liberalized exchange rates contributed to decrease vulnerabilities during the shock. However, in light of the evident presence of a fiscal dominance setup in Egypt and the high relience on discretionary interventions, it is important to be cautious about the continuation of such accomodative measures post the shock under the availaing fiscal dominance in Egypt.

V. 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 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 CBE role in stabilizing the economy, improving monetary policy instruments, developing the financial sector and a more open external sector have given 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 lose a great part of its autonomy.

Since the adoption of the 2016 Structural Adjustment Program, 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 COVID19 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 empowered role of 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 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 COVID19 crisis. While the countercyclical polices to the current COVID19 shock are essential and

[14] For more on the fiscal accomodative measures in response to the shock, revise (International Monetary Fund 2020)

intuitive, institutional measures are crucial to ensure efficient and contained countermeasures and to act as a safeguard against excessive misuse.

In terms of policy, our results have clear implications regarding the policy-making 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 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 subbstantially benefit from sustaining the improved monetary-fiscal coordination and active monetary policy as one of important outcomes of the 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 realised fiscal and monetary outcomes, but also to avoid the exacerbation of structural imbalances that persist in Egypt regardless of cycles and crisis times.

References

Alshawarby, Sherine, and Elmosallamy, Mai. 2018."Monetary-fiscal policies interactions and optimal rules in Egypt." *Review of Economics and Political Science*, 4(2): 138-157.

Aastveit, Knut Are, James Natvik, and Sergio Sola. 2013. "Economic Uncertainty and the Effectiveness of Monetary Policy Working Paper Norges Bank Research." *Norges Bank Research Working Papers*, 17. www.norges-bank.no.

Caggiano, Giovanni, Efrem Castelnuovo, and Gabriela Nodari. 2017. "Uncertainty and Monetary Policy in Good and Bad Times." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2939377.

Cazacu, Ana-maria. 2015. "FISCAL-MONETARY POLICY INTERACTION: SVAR EVIDENCE FROM A CEE COUNTRY." *European Scientific Journal* 7881 (April): 12–23.

Central Bank of Egypt. 2020. "Central Bank of Egypt ' s Measures to Offset the Impact of COVID-19."

El-khishin, Sarah, and Dina Kassab. 2020. "Monetary-Fiscal Games under Political Uncertainty: The Role of Institutions." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3655641.

El-khishin, Sarah, and Mohamed Zaky. 2019. "The Trinity of Budgetary Institutions, Political Institutions and Fiscal Cyclicality: Evidence from Egypt." *ERF Working Papers*, no. 1351.

Fernández, De Castro, and Hernández De Cos. 2006. "R The Economic Effects of Exogenous Fiscal Shocks in Spain: A SVAR Approach." *Econstor*, no. 647.

International Monetary Fund. 2020. "Arab Republic of Egypt Request for a 12-Month Stand-By Arrangement—Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt." *IMF Country Report No. 20/266*, no. 20.

Kirsanova, Tatiana, Sven Jari Stehn, and David Vines. 2005. "The Interactions between Fiscal Policy and Monetary Policy." *Oxford Review of Economic Policy* 21 (4): 532–64. https://doi.org/10.1093/oxrep/gri031.

Leeper, Eric M. 1991. "Equilibria under 'active' and 'Passive' Monetary and Fiscal Policies." *Journal of Monetary Economics* 27 (1): 129–47. https://doi.org/10.1016/0304-3932(91)90007-B.

Leeper, Eric M, Christopher A. Sims, and TAO ZHA. 1996. "What Does Monetary Policy Do ?" *Brookings Papers on Economic Activity* 2.

Mohieldin, Mahmoud. 2020. “Decisive Moments (in Arabic).” *Al-Awsat*, July 2020. https://aawsat.com/home/article/2314591/د-محمود-محيي-الدين/لحظات-فارقة.

Morsi, Tarek, Mai El-Mosallamy, and Enas Zakareya. 2007. “Effect of Some Recent Changes in Egyptian Monetary Policy: Measurement and Evaluation.” *Egyptian Center for Economic Studies* 122 (122).

Muscatelli, Anton, Patrizio Tirelli, and Carmine Trecroci. 2002. “M ONETARY AND F ISCAL POLICY INTERACTIONS OVER THE CYCLE : SOME EMPIRICAL EVIDENCE.” *CESifo Working Paper*, no. No.817.

Saulo, Helton, Leandro C. Rêgo, and Jose A. Divino. 2013. “Fiscal and Monetary Policy Interactions: A Game Theory Approach.” *Annals of Operations Research* 206 (1): 341–66. https://doi.org/10.1007/s10479-013-1379-3.

ANNEX I : Structural VAR Results

Table 3: 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*

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

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