Examining Monetary Policy Cyclicality in Egypt during Crisis Time: Global Financial Crisis versus COVID-19 Pandemic

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ABSTRACT

Egypt has been exposed to two recent shocks: The global financial crisis of 2008 and the COVID-19 Pandemic of 2020. Though the origin and the implications of the two shocks are quite different, they bear some similarities in terms of the sharp decline in global economic growth and negative implications on the Egyptian economy. The present study attempts to assess the cyclicality of monetary policy in Egypt during the two crises. To this end, both descriptive and econometric techniques are employed in this study to reveal the cyclicality of monetary policy. On the descriptive side, the correlation between the cyclical component of policy rate and that of real GDP is calculated. Moreover, both an ARDL and NARDL approach are estimated to derive the augmented Taylor rule for the cyclical component of policy rate. Two dummy variables reflecting the two crises along with their interaction with the output gap are incorporated in the model to disentangle the impact of the two crises upon monetary policy cyclicality. The study concludes that monetary policy in Egypt is more a cyclical and that its response to changes in output gap is statistically insignificant, during both normal times and crisis times.

Keywords: Monetary Policy Cyclicality, Central Bank of Egypt, Global Financial Crisis, COVID-19 Pandemic, ARDL
JEL Classifications: E42, E52, E58

1. INTRODUCTION

Macroeconomic policies are geared toward stabilizing business cycle fluctuations, i.e. countercyclical policies. A typical central bank adopting countercyclical monetary policy would resort to contractionary (expansionary) policy during booms (busts). In emerging markets with relatively weak institutional setups, the cyclical properties of monetary policy are disputed. As crises are usually accompanied by capital flight, currency depreciation, and higher inflation, central banks endeavor to hike interest rates to defend their currency (i.e. procyclical monetary policy) which further deepens the crisis (Calderón et al., 2012; Emam, 2012; Kinya, 2019).

Egypt has been vulnerable to two recent shocks; the global financial crisis of 2008 and the COVID-19 Pandemic of 2020. Though the origin and the implications of the two shocks are quite

different, they bear some similarities in terms of the sharp decline in global economic growth and the negative repercussions on the Egyptian economy.

Before the global financial crisis of 2008, Egypt has achieved high GDP growth rates averaging around 7%. At the onset of the crisis, the Central Bank of Egypt (CBE) affirmed its guarantee to all deposits in the banking sector, cut its corridor spread rates by 250 basis points in 2009, and facilitated banks' financing to SMEs. Thanks to Egypt's limited integration into international financial markets, its solid economic fundamentals, and policy responses, Egypt's growth prospects have not been severely affected by the crisis (Ministry of Finance Egypt, 2009).

More than a decade after the crisis, the outbreak of the COVID-19 pandemic has resulted in severe economic fallout that is even greater than its predecessor. Before this pandemic, Egypt succeeds

in implementing a comprehensive economic reform program and records one of its highest growth rates. Thus, Egyptian authorities respond proactively to the pandemic, with various countermeasures implemented to mitigate the potential negative repercussions. On the monetary front, The CBE has eased monetary policy by increasing liquidity, lowering key policy rates by 300 basis points, and providing subsidized loans and debt relief to sectors that have been hit hardest like tourism, industry, and SMEs. Moreover, the CBE has launched, for the 1st time in its history, a stock purchase program of 20 billion Egyptian pounds to support the domestic stock market (CBE, 2020; El-Khishin, 2020).

The present study attempts to analyze monetary policy cyclicality in Egypt during the two crises. To this end, Egypt's monetary response to the global financial crisis of 2008 and the COVID-19 pandemic is analyzed. Besides, the assessment of monetary policy cyclicality is carried out by calculating the correlation between the cyclical component of policy rate and that of real GDP. Moreover, both an ARDL and NARDL approach are employed to identify the behavior of monetary policy during the two crises.

The study is divided into five sections, besides introduction and conclusion. The first two sections present the theoretical framework and empirical review. Section three portrays monetary policy in Egypt and its responses to offset the two crises. Section four tackles the econometric methodology and variables incorporated in the empirical analysis. While section five pinpoints the main empirical findings of the study.

2. THEORETICAL FRAMEWORK

Macroeconomic policies are geared toward stabilizing business-cycle fluctuations (Calderón et al., 2012). During crisis time, macroeconomic policies could be designed in a procyclical or countercyclical manner. Countercyclical policies refer to policies that can stabilize the business cycle by reining in economic activity during booms and bolstering it during downturns. For monetary policy, this means hiking the real policy rates during booms while reducing it during recessions. On the other hand, procyclical policies refer to policies that are positively correlated with business cycles, i.e. those that actually accelerate business cycles. A procyclical monetary policy implies cutting real interest rates during booms while increasing them during downturns (Emam, 2012; Takáts, 2012).

Notably, the effectiveness of monetary policy on short-run stabilization has been subject to debate among the two opposing views of the new classical school. Whereby, the the real business cycle school led by Kydland and Prescott (1982) argues that monetary policy has no role in the business cycle as the business cycle reflects rational decisions by economic agents. On the contrary, the New Keynesian school finds a significant short-run effect of monetary policy on real variables and hence business cycle stabilization (Kinya, 2019). Fischer (1977) and Phelps and Taylor (1977) recommend that in the presence of nominal rigidities in settling prices and wages, monetary authority tends to stabilize output by adjusting money supply to counter the repercussions of any exogenous shocks on output (Ireland, 1996).

Nevertheless, the short-run monetary stabilization policies are not consistently effective, given the various sources of uncertainty that central banks are facing. Namely, lack of accurate information about the impact of monetary policy decisions upon the economy and the length of time needed for this effect to be realized, the inability to forecast accurately the future path of the economy, lags in the availability of data and measurement error in existing data (Ireland, 1996; Chatterjee, 2001; Rasche et al., 2007). Such uncertainty questions the benefit of having a countercyclical monetary policy, yet, Chatterjee (2001) claims that even if countercyclical monetary policy could only eliminate a very small likelihood of the occurrence of economic crises, such benefit is considered as an adequate justification for pursuing it.

In contrast to advanced economies, the adoption of countercyclical monetary policy has been a bit problematic for emerging economies. Historically, macroeconomic policies in emerging economies have been rather procyclical. As emerging central banks used to relax monetary policy during booms while adopting contractionary policies during busts, which further amplifies economic upswings and deepens downturns (Calderón et al., 2012; McGettigan et al., 2013). Such procyclical property is mainly related to the weak monetary institutions and the absence of central bank independence and credibility. As distress periods are typically coincided with heavy capital flight and loss of credibility which triggers substantial currency depreciation and inflation. Thus, policymakers are left with no choice other than raising interest rates to preserve the attractiveness of holding domestic assets and hence support the domestic currency. This phenomena of raising interest rates during the downturn to support the currency has been referred to as "fear of free falling"[1] (Calderón et al., 2012; Vegh and Vuletin, 2012; Vegh and Vuletin, 2016).

Lately, with emerging economies strengthening their monetary institutions and their central banks acquiring greater independence and credibility, various economies succeeded in graduating from "procyclicality" to "countercyclicality" of macroeconomic policies. As central bank independence boosts credibility, also, stringent macroprudential measures reduce large currency mismatches, thus, domestic currency depreciations become less harmful, which allows central banks to lower policy rates in bad times and hence adopt countercyclical monetary policy[2] (Vegh and Vuletin, 2012).

3. EMPIRICAL REVIEW

Notwithstanding the numerous empirical studies that endeavor to assess the cyclical properties of fiscal policy, systematic empirical work on monetary policy cyclicality, especially in emerging economies, is sparse. This could be attributed to the notorious

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1. The fear is that a rapidly depreciating currency would plunge the economy into a deeper crisis by encouraging further capital outflows and leading to widespread bankruptcy of firms indebted in dollar terms. Thus, policymakers focus on raising interest rates to defend the currency and preclude using monetary policy tools to spur the economy.
2. Vegh et al. (2012) document a strong negative correlation between fear of free falling and measures of institutional quality. Thus, as institutional quality improves, the fear of falling decreases.

difficulty in depicting the accurate stance of monetary policy, even for advanced economies. Literature on cyclicality of monetary policy in emerging markets could be split into two groups; the first group attempts to study the behavior of monetary policy in general in emerging economies while the second group focuses on the cyclical property of monetary policy during crisis time.

About the first group, the initial systematic effort to empirically investigate the cyclical properties of monetary policy in emerging markets is that of Kaminsky et al. (2005). Their study assesses the cyclical properties of capital flows, fiscal policy, and monetary policy for a large set of 104 advanced and emerging countries for the period 1960-2003. The study relies on the correlation between the policy-controlled short-term interest rate and the business cycle, in addition to the estimation of the Taylor rule for each country in the sample to identify the cyclical property of its monetary policy. The study concludes that most OECD countries rely on countercyclical monetary policy while emerging economies, particularly the middle-high income countries, are mostly procyclical or acyclical.

Vegh and Vuletin (2012) try to document the cyclicality of monetary policy in 94 developing and industrial countries throughout the period from 1960 to 2009. The study first relies on correlation among the cyclical components of monetary policy and output to confirm that many developing economies have graduated from "procyclicality" to "counter cyclicality" of monetary policy. Panel regression is also employed for the cyclical components of the short-term interest rate, real GDP, inflation, and exchange rate depreciation to assess the cyclicality of monetary policy. This is in addition to an interaction term for the fear of free falling[3] hypothesis and output to assess whether the presence of the fear of free falling alters the way monetary policy responds to fluctuations in output. The study concludes that around 35% of developing countries resort to countercyclical monetary policy akin to industrial countries during the period from 2000 to 2009. Thanks to the market-friendly reforms and sounder macroeconomic management in developing countries, the fear of free falling subsides, opening the door for policymakers to embark on countercyclical monetary policy. Lastly, the study shows that fiscal policy and monetary policy cyclicality are highly related.

Calderón et al. (2012) attempt to estimate the cyclicality of both monetary and fiscal policy for a large panel of 115 industrial and developing countries for 1984-2008 and to assess the impact of institutions on the cyclical behavior of policy. The study relies on the Taylor rule to estimate monetary policy cyclicality, whereby, the cyclical component of the policy rate is regressed against its lag, the cyclical component of inflation, output gap, cyclical component of nominal exchange rate, and a measure for institutional quality. The study concludes that industrial

economies can adopt countercyclical monetary policy in contrast to developing economies that mostly follow procyclical ones. Yet, developing countries with strong institutions tend to have more countercyclical monetary policy. This is because countries with weak institutions attract fewer foreign investors and hence with external demand shocks policymakers tend to hike interest rates to defend domestic currency.

Using a large sample of 35 advanced economies and 49 emerging economies during the period 1960-2011, McGettigan et al. (2013) attempt to investigate monetary policy cyclicality in emerging markets. The study constructs a new measure for the Cyclicality of Monetary Policy (CoMP) that is calculated as the 10-year window of backward rolling correlation between the cyclical component of real GDP and the cyclical component of the real short-term interest rate. Although the analysis confirms that monetary policy in advanced economies is generally more countercyclical than in emerging economies, emerging economies have become more countercyclical over time. To further identify the main drivers for this shift, the variable of interest (CoMP) has been regressed against potential explanatory variables like monetary policy regime, exchange rate regime, financial market development, and institutional strength. Both monetary policy regime (i.e. inflation targeting) and institutional quality are significant triggers of monetary policy cyclicality. In other words, countries that managed to shift to inflation-targeting regimes and/or improved their institutions tend to adopt more countercyclical monetary policy. The exchange rate regime, on the other hand, is significant only in the presence of a deep and developed financial sector that promotes monetary institutions and allows policymakers to alter monetary policy freely without any fear of depreciation. Moreover, the study argues that more countercyclical monetary policy is accompanied by lower output volatility.

Among the second group of empirical studies that attempt to document the cyclicality of monetary policy during episodes of financial and economic crises is Hutchison et al. (2010). They assess the impact of monetary and fiscal policy in 66 emerging and developing countries during 83 episodes of the balance of payments crisis. The study relies on a baseline empirical model for determinants of output loss during those crises, in addition to proxies for changes in fiscal and monetary policy. They claim that fiscal expansion is usually associated with small output loss during crisis with no obvious effect on monetary policy. Yet, monetary tightening and fiscal contraction are correlated with large output loss following a sudden stop. Thus, it is advisable to adopt a discretionary fiscal policy along with a neutral monetary policy during financial crisis.

With emerging economies shifting towards countercyclical monetary policy to cushion the repercussions of the global financial crisis, Coulibaly (2012) attempts to identify the factors behind this remarkable shift. First, the author constructs a large dataset for 188 advanced and emerging countries from 1970 to 2009 where he identifies 1462 periods of financial and economic crisis and tries to examine the behavior of monetary policy during these crises. The findings assure the difference in monetary policy response between advanced and emerging economies. Nevertheless,

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3. The fear of free falling is empirically calculated by computing the correlation between the cyclical component of the short-term interest rate and the rate of depreciation of the exchange rate. Whereby, a positive correlation implies that the short-term policy rate increases when the domestic currency is depreciating, indicating the presence of fear of free falling. While zero correlation implies that the monetary authority does not systematically respond to exchange rate movements.

emerging economies tend to adopt countercyclical monetary policy during the global financial crisis, in line with advanced economies. Second, the author estimates a logit model to identify the main drivers for this shift in policy response. Results indicate that the adoption of an inflation-targeting regime, stronger macroeconomic fundamentals, lower vulnerabilities, and more openness to trade and international capital flows are among the main drivers.

Li and Tang (2013) investigate the effectiveness of monetary and fiscal policy in 57 emerging and developing countries for 72 episodes of banking and currency crises from 1977 to 2010. The study argues that fiscal policy does not affect the duration of a crisis, while a slight monetary expansion is effective in reducing the duration of a crisis, yet, over-expansionary monetary policy loses its effectiveness.

Moreover, Fetai (2013) examines the relative effectiveness of monetary and fiscal policies during 83 episodes of financial crises in 66 developing and emerging countries using both the OLS technique with robust standard errors and GMM estimators. He first estimates the output cost (or loss) associated with a financial crisis[4], which is then regressed against a set of explanatory variables, trade openness, inflation, and capital account openness. In addition, the study employs four binary variables to account for fiscal expansion, fiscal contraction, monetary expansion, and monetary contraction. It is notable that for estimating monetary policy, the study relies on both discount rate and changes in international reserves to reveal the monetary stance. The findings show that both fiscal and monetary contractions are matched with larger output loss during crises. Fiscal expansion, on the other hand, is associated with smaller output loss while monetary expansion has an insignificant effect.

Regarding Egypt, some recent studies attempt to thoroughly characterize the behavior of monetary policy in Egypt. Al-Shawarby et al. (2019) assess the interaction between monetary and fiscal policy in Egypt and their impact on economic stabilization from 2004 to 2016. This is done by estimating a New Keynesian small open economy dynamic stochastic general equilibrium (DSGE) model for Egypt using Bayesian techniques. The estimates of the Taylor reaction function indicate that monetary policy in Egypt tends to be countercyclical. Moreover, Emam (2021) investigates the main drivers of interest rate setting in Egypt during the period from 2005 to 2019. The study employs both an ARDL and NARDL techniques to estimate the backward-looking augmented Taylor monetary policy reaction function. The NARDL model for the whole period of analysis shows that monetary policy in Egypt has been more countercyclical.
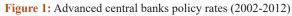
To this end, there is a relative scarcity of empirical studies assessing the cyclical properties of monetary policy in Egypt during crisis time. Some of the relevant empirical cross-section studies incorporate Egypt among the used datasets (like, Calderón et al., 2012; Vegh and Vuletin, 2012), hence ignoring country-

specific effects. Other studies attempt to characterize monetary policy in Egypt in general. Thus, the present study endeavors to fill this gap in the literature.
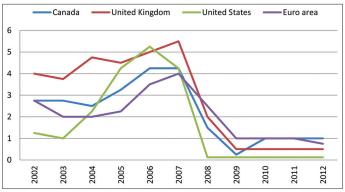
4. ANALYSIS OF MONETARY POLICY CYCLICALITY IN EGYPT DURING CRISES

4.1. The Global Financial Crisis

The outbreak of the global financial crisis, known also as the Great Recession, came with the bankruptcy of Lehman Brothers investment bank in the United States (Fernández et al., 2021). By mid-2008, the financial upheaval spread from the United States to Europe and the rest of the world (Abu Hatab, 2009). To deal with the crisis, central banks in advanced economies have implemented unprecedented monetary policy stimulus. This incorporates lowering interest rates to near zero policy rate (Figure 1 below) and forward guidance communication by central banks about how their policy tools are expected to evolve overtime. Unorthodox monetary and credit easing measures like quantitative easing have also been implemented leading to the expansion of central banks' balance sheets (Calderón et al., 2012; Haas et al., 2020; Wullweber et al., 2020; IMF, *2021*). Thus, financial markets have relatively stabilized, deflation was avoided, and inflation expectations hovered around their targets (Bouis et al., 2013). It is notable that emerging economies as well have relatively loosened their monetary policy to cushion the crisis and its repercussions (Coulibaly, 2012).

The Egyptian economy, before the collapse of Lehman Brothers, has suffered from the hike in global food prices that fueled domestic inflation (Al-Mashat, 2011; Mabrouk et al., 2012). Nevertheless, with the outbreak of the global financial crisis the Egyptian economy faced the dual challenge of high domestic inflation and the plunge in global demand undermining domestic growth and elevated unemployment. The Egyptian economy displayed some resilience and immunity at the beginning of the crisis, in contrast to other emerging economies, due to being less integrated with international financial markets and its solid domestic economic fundamentals at the time. Yet, the spillover of the second-round effect took its toll on macroeconomic variables in terms of lower real growth, deteriorating balance of payments, and dwindling of international reserves (Ministry of Finance Egypt, 2009; Al-Shawarby et al., 2019; ECES, 2020).

Figure 1: Advanced central banks policy rates (2002-2012)

Source: Done by the researcher based on BIS data (2022)

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4. It is calculated as the difference between the real pre-crisis average GDP growth rate for a given country across 3 time periods (t-3 to t-1) and the actual real GDP growth rate. Whereas t marks the starting point of the crisis and the crisis ends when GDP growth rate returns to its pre-crisis trend.

Consequently, fiscal, and monetary stimulus package was launched (Kandil, 2011). On the monetary side, the CBE affirmed its guarantees to deposits in the banking sector at the onset of the crisis to avoid potential bank runs. With inflationary pressures subsiding, the CBE decided to cut the overnight corridor spread rates by 250 basis points during the first half of 2009 over three Monetary Policy Committee (MPC) meetings. This is in addition to supplying liquidity to the market (Al-Mashat, 2011; Herrera et al., 2013). CBE decided to exempt banks' deposits, equivalent to the size of the loans extended to finance Small and Medium Enterprises (SMEs) from the 14% legal reserve requirements. The rationale was to facilitate financing to SMEs that were known for being labor-intensive and hence promoting growth and employment. Lastly, the business sector's investment in financial instruments with more than 3-year maturity was banned to support reinvesting the residuals of the sector. Also, CBE carried out direct intervention in the foreign exchange market in the first half of 2009 to defend the Egyptian pound against speculation attacks (Abu Hatab, 2009; Ministry of Finance Egypt, 2009; Emam, 2021).

4.2. The COVID-19 Pandemic

More than a decade after the global financial crisis, the global economy was hit by the COVID-19 pandemic which has not only posed unprecedented challenges to the global health system but also led to economic fallout that was by far greater than its predecessor (AmCham Egypt, 2020; Fernández et al., 2021). The global economy is currently witnessing a severe economic and financial crisis with the sharpest economic downturn since the great depression (Haas et al., 2020). Contrary to the global financial crisis that was prompted by financial practices, the COVID-19 is unique as it has triggered both a demand and supply shock. Large-scale lockdowns and the intensive containment measures have disrupted production and supply chains and derailed consumption (Wullweber et al., 2020; Cantú et al., 2021; Rasheed and Raza, 2021). Such shocks are transmitted to the financial markets marking one of the most turbulent periods with equity indexes plunging heavily throughout the period from February to April 2020 (Coulibaly et al., 2020; El-Khishin, 2020).

Subsequently, the policymakers react forcefully, and massive simulation packages are announced across the globe to avoid the economic meltdown. Central banks advance with unique velocity and breadth into uncharted terrain, relying on both conventional and unconventional toolkits to prevent financial collapse and to revive the economic activity (Haas et al., 2020; Wullweber et al., 2020). Monetary measures incorporate cutting policy rates, liquidity provision through introducing new asset purchase programs and expanding existing ones, providing credit schemes at lower interest rates to support non-financial sector players, relaxing some macroprudential buffers to support business growth, and introducing new electronic and digitalized payment schemes. Moreover, some central banks intervene in the foreign exchange market to offer ample foreign currency liquidity (Cantú et al., 2021; Fernández et al., 2021; IMF, 2021; Rasheed and Raza, 2021).

On the Egyptian front, the economy was attaining one of its highest growth rates of almost 6% before the COVID-19 outbreak, thanks to the comprehensive economic reform program that

Egypt has embarked on in 2016 (Al-shawarby et al., 2019). Yet, the economic repercussions of the pandemic are severe given the heavy reliance on external financing and the vulnerable growth in private consumption, investment, and exports. In line with global responses, macroeconomic policies have been rather proactive (ECES, 2020). During the early days of the pandemic massive comprehensive fiscal and monetary bailout packages are announced.
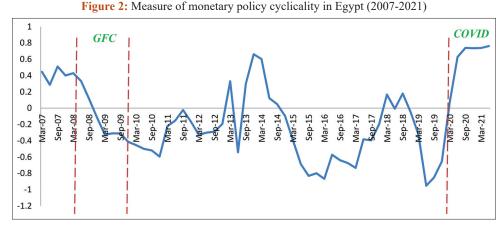
The CBE carries out an exceptional MPC meeting in March 2020, whereby, the overnight corridor rate is cut by 300 basis points, a massive movement in the Egyptian context. The preferential interest rates on CBE credit initiatives related to mortgage, agriculture, industrial and construction sectors are reduced to revive activity within these sectors. The CBE obliges banks to avail the needed credit limits for imports of strategic commodities, especially food items. Being one of the hardest hit sectors by the pandemic, the CBE relaxes some of the conditionalities related to its tourism sector credit initiative to alleviate the burden of the crisis on the sector. Moreover, short-term loans are provided for small firms facing liquidity shortages, and term lending for SMEs is expanded for 6 months. This is in addition to debt relief programs for retail customers facing default risk. To support the stock market that plunged significantly during the pandemic, the CBE launches for the 1st time in its history, a stock purchase program of 20 billion pounds (CBE, 2020; El-Khishin, 2020; Suleiman, 2020). Even though the value of the announced package does not match that of the peer countries, it incorporates the largest interest rate cut and more widespread targeted debt-relief initiatives (AmCham Egypt, 2020).

Further, the Egyptian government and CBE tap international finance for financial assistance from the IMF and World Bank, as well as the issuance of foreign currency bonds to provide foreign currency liquidity (Suleiman, 2020). The CBE also carries out foreign exchange intervention from March 2020 to May 2020 to stabilize domestic currency. On the digitalization side, the CBE issues various decrees to further incentivize e-banking activities and to facilitate electronic means of payments in addition to increasing the number of ATMs across the countries to ensure business continuity during lockdowns (CBE, 2020; El-Khishin, 2020).
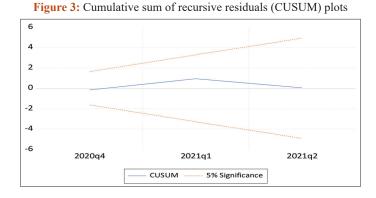
4.3. Monetary Policy Cyclicality in Egypt

Before presenting the econometric procedure, this section visualizes the cyclicality of monetary policy during the two crises through statistical and graphical illustrations. In line with McGettigan et al. (2013), the present study constructs a measure for monetary policy cyclicality which is defined as the 2-year rolling correlation between the cyclical component of policy rate and the cyclical component of real GDP (i.e. output gap). Notably, the cyclical component[5] is derived from the estimated trend using the Hodrick Prescott (HP) filter technique. A positive correlation reveals a countercyclical monetary policy while a negative one indicates a procyclical one. Figure 2 below depicts the evolution of monetary policy cyclicality in Egypt from 2007 to 2021.

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5. As the cyclical component of any variable is derived as the difference between the natural logarithm of the underlying variable and its trend, whereby the trend is estimated through the HP filter technique.

Figure 2: Measure of monetary policy cyclicality in Egypt (2007-2021)

Source: The researcher based on the calculated measure for monetary policy cyclicality

Figure 3: Cumulative sum of recursive residuals (CUSUM) plots

The preliminary visual inspection shows that monetary policy in Egypt has been generally hovering between procyclicality and countercyclicality. During the crisis, the CBE has implemented a relatively more countercyclical monetary policy to offset the COVID-19 pandemic, yet the policy tends to be more procyclical in the face of the global financial crisis. No robust inferences could be derived from graphical illustrations; thus, the coming sections present the econometric findings to reach a more robust conclusion.

5. METHODOLOGY, DATA AND MODEL

5.1. Data and Variables

In light of the aforementioned theoretical and empirical background, this study relies on quarterly data throughout the period from March 2005 to June 2021. The choice of the time frame is based on the availability of consistent and reliable time series for the variables of interest[6]. Table 1 below shows the incorporated variables, description, and source. All incorporated variables are seasonally adjusted.

5.2. Unit Root Tests

Before model estimation, it is essential to carry out the stationarity test for incorporated variables. This assists in selecting the appropriate empirical methodology for estimation. The present study estimates both the Augmented Dickey-Fuller (ADF) and the Phillips and Perron (PP) unit root tests to further validate the

results of the tests. It is worth mentioning that not accepting the null hypothesis within any of the two tests implies that the underlying variable is stationary, otherwise, the variable is nonstationary.

5.3. Estimated Models

Following Calderón et al. (2012) and Vegh and Vuletin (2012), the present study relies on Taylor rule specification to identify the cyclical stance of monetary policy. Specifically, it estimates three models to examine the cyclicality of monetary policy in Egypt. First, the baseline model (Equation 1 below) that regresses the cyclical component of the central bank's policy rate against relevant variables is estimated. This model reflects the overall stance of monetary policy in Egypt against short-term business cycles.

$$\breve{\imath}_t = \alpha_0 + \alpha_1 \tilde{y}_{t+} + \alpha_2 \breve{\pi}_t^- + \alpha_3 \Delta x\breve{r}_t + \alpha_4 \breve{\imath}_{t-1} + \varepsilon_t \qquad (1)$$

Where; $\breve{\imath}_t$ reflects the cyclical component of the central bank's policy rate, $\breve{\pi}_t$ refers to the cyclical component of the inflation rate, $\tilde{y}_t$ represents the output gap, $\Delta x\breve{r}_t$ reflects the cyclical component of the percentage change in nominal effective exchange rate (NEER) and $\breve{\imath}_{t-1}$ refers to the lagged dependent variable.

Second, the study differentiates between the response of monetary policy during recession period and boom period by estimating an NARDL version of the baseline model (Equation 2 below). This model sheds some light on how monetary policy in Egypt tends to respond during recession times.

$$\breve{\imath}_t = \alpha_5 + \alpha_6 \tilde{y}_t^+ + \alpha_7 \tilde{y}_{t+}^- + \alpha_8 \breve{\pi}_t^- + \alpha_9 \Delta x\breve{r}_t + \alpha_{10} \breve{\imath}_{t-1} + \varepsilon_t \qquad (2)$$

Where; $\tilde{y}_t^+$ reflects positive output gap (boom period) and $\tilde{y}_t^-$ refers to negative output gap (recession period).

Lastly, the study adds two dummy variables and two interaction terms to the baseline model to account for the two crises[7] (Equation 3):

$$\breve{\imath}_t = \alpha_{11} + \alpha_{12} \tilde{y}_{t+} + \alpha_{13} \breve{\pi}_t^- + \alpha_{14} \Delta x\breve{r}_t + \alpha_{15} \breve{\imath}_{t-1} + \alpha_{16} GFC + \alpha_{17} COVID$$
$$+ \alpha_{18} GFC*\tilde{y}_t + \alpha_{19} COVID*\tilde{y}_{t+} \varepsilon_t \qquad (3)$$

6.   CBE has revamped its monetary policy in 2004 and launched its policy rate, for the first time, in 2005.

7.   The study follows a similar approach to that of Vegh (2012) to assess whether each of the underlying crisis alters the way the monetary policy responds to output in Egypt or not.

Where; *GFC* is a dummy variable for the global financial crisis while COVID is a dummy variable for the COVID-19 pandemic[8]. Each of the two variables enters the Equation twice; once as a dummy variable and once as an interaction term with an output gap. The rationale behind their inclusion in the interaction terms is to capture the effect of each crisis on the cyclicality of monetary policy.

Models 1 and 3 are estimated using the ARDL approach while model 2 relies on the NARDL approach. The analysis is derived from quarterly data for the Egyptian economy from 2005 to 2021. Notably, the ARDL bound test for cointegration was formerly introduced by Pesaran and Shin (1999) and Pesaran et al. (2001). The rationale behind employing the ARDL bound test rather than the conventional methods of cointegreation is fourfold. First, the ARDL could be used to examine cointegration for variables with mixed order of integration I(0) or I(1). Second, the ARDL produces a relatively more accurate results in the small sample size than conventional methods. Third, it allows variables of the Equation to have different lags. Finally, it estimates one single Equation that captures both short-run and long-run relations simultaneously (Emam, 2021; Abu and Staniewski, 2022).

For monetary policy in Egypt to be countercyclical, the coefficient of the output gap (α_1) needs to be positive and statistically significant. Besides, for monetary policy to be countercyclical during a recession and the two underlying crises, the coefficients negative output gap (α_7) and that of the two interaction terms (α_{18} and α_{19}) need to be positive and statistically significant. On the contrary, negative and statistically significant coefficients reveal a procyclical monetary policy while statistically insignificant coefficients indicate an acyclical one.

5.4. Diagnostic Checks
Post estimation, various diagnostic tests are carried out to confirm the robustness of the results. Specifically, the Breusch-Pagan-Godfrey heteroscedasticity test and the Breusch-Godfrey serial correlation test are carried out to test for the presence of heteroscedasticity and serial correlation. Ramsey test is also employed to validate that the model is well specified. Finally, cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMS) tests are carried out to assess the stability of the model.

6. EMPIRICAL FINDINGS

6.1. Results of the Unit Root Tests
The results of the unit root tests are presented in Table 2 below.

6.2. Results of the Estimated Models
The findings of the baseline model (Equation 1), models 2 and 3 are presented in Tables 3-5 respectively.

Our variables of interest are the output gap in Equation 1, the negative output gap in Equation 2, and the two interaction terms in Equation 3. The empirical findings from the baseline model show that the output gap has no statistically significant effect on the cyclical component of the policy rate, indicating that monetary policy in Egypt is generally acyclical. However, the inflation coefficient is positive and highly statistically significant which is expected given the CBE's mandate of price stability and its recent efforts to fulfill most of the prerequisites of inflation targeting regime[9]. Moreover, the exchange rate seems to be statistically significant in the short run reflecting the response of the Egyptian monetary authority to exchange rate shocks. The lagged policy rate is also statistically significant, reflecting the interest rate smoothing motive[10].

Regarding the second model, findings imply that neither positive nor negative output gaps are statistically significant, implying that monetary policy response to the output gap is symmetric across booms and busts. Moreover, the findings of the second model are in line with the baseline model as it confirms the acyclical response of monetary policy to business cycles. The same conclusion is further validated by the third model that accounts for the two crises in particular. As the coefficient of the interaction term tackling the global financial crisis, is not statistically significant both in the short run and long run, implying that monetary policy in Egypt does not effectively rely on interest rates to mitigate the repercussions of the global financial crisis. Such a finding could be attributed to the fact that at the onset of the crisis monetary policy was suffering from both the global surge in food prices which resulted in higher domestic inflation, as well as the global financial crisis. Hence, monetary authorities could not respond to the global financial crisis by severe cuts in interest rates. Similarly, the COVID-19 pandemic coefficient is not statistically significant indicating the adoption of acyclical monetary policy in the face of the COVID-19 pandemic as well. Although inflation did not pose a significant risk for the Egyptian economy at the outbreak of the pandemic, the acyclical response of monetary policy recorded could be explained by the various toolkits of conventional and unconventional monetary instruments, aside from altering interest rates, that the CBE relies upon to revive the economy. In other words, relying on the policy rate changes in the analysis could not reveal the actual stance of monetary policy in Egypt during the COVID-19 pandemic.

Finally, the coefficient of the lagged error correction term of the three models is negative and statistically significant implying that the three models are robust and converge to the equilibrium path in the long run. Besides, the F-bound test displays a statistically significant coefficients within the three models indicating that incorporated variables are cointegrated in the three models.

6.3. Results of the Diagnostic Checks
As displayed in Table 6 below, diagnostic checks validate the robustness of model (3) that incorporates the dummies for the two

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8. The study follows Fetai (2013) to identify the crisis period, which is defined by comparing in real terms pre-crisis to post-crisis average GDP growth rate trends. The crisis ends when the GDP growth rate returns back to its pre-crisis trend. In the Egyptian case, the global financial crisis spans from June 2008 to September 2009, while that of the COVID-19 pandemic spans from June 2020 to March 2021.

9. Refer to Emam (2021) for further details on the CBE's efforts to fulfil the prerequisites of inflation targeting.

10. Interest rate smoothing reflects the central bank's desire to smooth interest rate changes, through introducing minor changes in the policy rate to achieve the required changes in the long run. For more elaboration on interest rate smoothing, please refer to Emam (2021).

Table 1: Incorporated variables description and source

Variable	Description	Source
$\breve{i}_t$	Cyclical component of the log of CBE's overnight corridor deposit rate. It is expressed in percent deviations from trend, and the trend is estimated using the HP filter technique	CBE
$\tilde{y}_t$	Cyclical component of the log of real GDP. It is expressed in percent deviations between actual real GDP and potential GDP. Potential GDP is estimated using the HP filter technique	Ministry of Planning and Economic Development in Egypt
$\breve{\pi}_t$	Cyclical component of the log of the headline CPI inflation rate (year on year). It is expressed in percent deviations from trend, and the trend is estimated using the HP filter technique	CBE
$\Delta x\breve{r}_t$	Cyclical component of the log of the quarterly percentage change of the nominal effective exchange rate (NEER) for the Egyptian pound against 120 trading partners. It is expressed in percent deviations from trend, and the trend is estimated using the HP filter technique	Bruegel Database
$\breve{i}_{t-1}$	One period lag of the Cyclical component of the log of CBE's overnight corridor deposit rate.	CBE
$\tilde{y}_t^+$	Positive output gap (i.e. boom period)	
$\tilde{y}_t^-$	Negative output gap (i.e. recession period)	
GFC	A dummy variable for the global financial crisis. It takes the value of 1 from the period from June 2008 to September 2009. As this is the period that witnessed the deterioration of real GDP growth rate in response to crisis before returning to its pre-crisis trend	
COVID	A dummy variable for the COVID-19 pandemic. It takes the value of 1 from the period from June 2020 to March 2021. As this is the period that witnessed the deterioration of real GDP growth rate in response to crisis before returning to its pre-crisis trend[11].	
GFC* $\tilde{y}_t$	GFC multiplied by the estimated output gap	
COVID* $\tilde{y}_t$	COVID multiplied by the estimated output gap	

Source: Done by the researcher

Table 2: Results of the unit root tests

Acronym	ADF test		PP test	
	ADF test statistic (levels)	ADF test statistic (first difference)	PP test statistic (levels)	PP test statistic (first difference)
$\breve{i}_t$	−2.326 (0.072)	−8.141*** (0.127)	−2.498 (0.072)	−8.141*** (0.127)
$\tilde{y}_t$	−4.704*** (0.110)	------	−4.752*** (0.110)	------
$\breve{\pi}_t$	−3.455** (0.092)	------	−3.687*** (0.092)	------
$\Delta x\breve{r}_t$	−8.829*** (0.125)	------	−8.806*** (0.125)	------

, * refer to being statistically significant at 5% and 1% respectively. Numbers in parentheses represent standard errors

Table 3: Results of the baseline model

Variable	Short run coefficients	Long run coefficients
$\breve{i}_{t-1}$	−0.241*** (0.065)	------
$\tilde{y}_t$	−0.273 (0.591)	−1.135 (2.518)
$\breve{\pi}_t$	0.130*** (0.027)	0.539*** (0.155)
$\Delta x\breve{r}_t$	−0.193* (0.104)	−0.804 (0.513)
F-bounds test	9.467***	
ECT	−0.241***	

*, *** refer to being statistically significant at 10% and 1% respectively. Numbers in parentheses represent standard errors

Table 4: Results of the NARDL model (model 2)

Variable	Short run coefficients	Long run coefficients
$\breve{i}_{t-1}$	−0.240*** (0.066)	------
$\tilde{y}_t^+$	−0.278 (0.600)	−1.156 (2.562)
$\tilde{y}_t^-$	−0.272 (0.596)	−1.129 (2.542)
$\breve{\pi}_t$	0.130*** (0.027)	0.539*** (0.156)
$\Delta x\breve{r}_t$	−0.193* (0.105)	−0.804 (0.518)
F-bounds test	7.449***	
ECT	−0.240***	
LR Wald Test ($\tilde{y}_t$)	0.005	

*, *** refer to being statistically significant at 10% and 1% respectively. Numbers in parentheses represent standard errors. Insignificant coefficient of the LR wald test implies that the response of monetary policy to output gap is symmetric

Table 5: Results of the ARDL model with dummy variables (model 3)

Variable	Short run coefficients	Long run coefficients
$\breve{i}_{t-1}$	−0.224*** (0.069)	------
$\tilde{y}_t$	−0.219 (0.590)	−0.979 (2.679)
$\breve{\pi}_t$	0.111*** (0.027)	0.494*** (0.164)
$\Delta x\breve{r}_t$	−0.225** (0.009)	−1.005* (0.580)
GFC	0.038 (0.004)	−0.137 (0.110)
COVID	−0.0003 (0.004)	−0.015 (0.164)
GFC* $\tilde{y}_t$	−0.006 (0.004)	0.263 (0.256)
COVID* $\tilde{y}_t$	0.001 (0.005)	0.005 (0.226)
F-Bounds test	5.307***	
ECT	−0.224***	

*, **, *** refer to being statistically significant at 10%, 5% and 1% respectively. Numbers in parentheses represent standard errors

Table 6: Results of the diagnostic checks

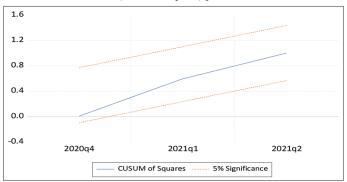| Test	Results
Serial correlation: χ^2	1.145 (0.214)
Heteroscedasticity: χ^2	0.162 (0.997)
Functional form (Ramsey test): F-statistics	0.229 (0.634)

Numbers in parentheses represent probability values

crises. Particularly, the residuals of the models are homoscedastic and serially uncorrelated. Moreover, the Ramsey test confirms that the model is well-specified.

Moreover, the CUSUM and CUSUM square tests have been carried out and both validate the stability of the model as neither

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11. Though the COVID-19 pandemic still has its toll on both the global and the Egyptian economy in 2021, real GDP growth rate in Egypt returns to its pre-pandemic trend in June 2021. Thus, for the sake of analysis the study considers that the last quarter that is negatively affected by the pandemic is March 2021.

Figure 4: Cumulative sum of square recursive residuals (CUSUM square) plots

the CUSUM nor CUSUM of Square plots break out the lower and the upper bounds, as shown in Figures 3 and 4 below.

7. CONCLUSION

The present study attempts to study the cyclicality of monetary policy in Egypt during crisis time, with a special focus on the two recent global shocks faced by the Egyptian economy; the global financial crisis and the COVID-19 pandemic.

Both descriptive and econometric techniques are employed to reveal the cyclicality of monetary policy. On the descriptive side, the correlation between the cyclical component of the policy rate and that of real GDP is calculated. It reveals that monetary policy in Egypt is generally moving between procyclicality and countercyclicality. Whereas, the CBE has implemented a relatively more countercyclical monetary policy to offset the COVID-19 pandemic, yet the policy tends to be more procyclical during the global financial crisis.

On the econometric front, an ARDL and NARDL approach are estimated to derive the augmented Taylor rule for the cyclical component of the policy rate. Specifically, three models are estimated. The baseline ARDL model that regresses the cyclical component of the central bank's policy rate against its lag, the output gap, the cyclical component of inflation, and the cyclical component of percent change in NEER. This model reveals the cyclicality of monetary policy in Egypt in general. The second model employs a NARDL approach to the baseline model to identify whether the cyclicality of monetary policy in Egypt is asymmetric or not. In other words, whether the response of monetary policy to output differs between recession and boom. While the third model estimates the baseline model after incorporating two dummy variables to account for the two underlying crises, as well as their interaction terms with output gap to disentangle the impact of the two crises upon monetary policy cyclicality.

The three models yield similar results that monetary policy in Egypt is more acyclical and that its response to changes in output gap is statistically insignificant, during normal times and crisis times. Regarding the global financial crisis, Egypt was not severely affected by the crisis due to being less integrated with international financial markets and solid macroeconomy. Moreover, with the

outbreak of the crisis Egypt was suffering from high inflation fueled by the hike in world food prices. Thus, the CBE could not engage heavily in a countercyclical policy until 2009 when domestic inflationary pressures subsided.

On the contrary, while the impact of the COVID-19 pandemic on the Egyptian economy is undeniable and the fact that the CBE reacts proactively given the relatively contained inflationary pressures, the monetary response has proven to be acyclical due to the CBE's reliance on various conventional and unconventional measures to stir the economy rather than only policy rates. In other words, the magnitude of the monetary intervention and the actual degree of cyclicality in response to the crisis could not be tackled only by changes in policy rates.

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