

The Impact of International Monetary Policy Shocks on Bank Loans in Egypt: A Non-Recursive SVAR Analysis

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Abstract

This study uses a non-recursive SVAR model and quarterly macro-level data spanning from 1991 to 2015 to investigate the propagation of international monetary policy shocks upon bank loans and other macroeconomic indicators in Egypt. The main findings reveal that foreign monetary policy shocks significantly affect loans, inflation, interest rates, and output in Egypt. This finding indicates that the international bank lending channel operates in Egypt. In addition to foreign monetary policy, foreign output and inflation shocks also significantly impact Egypt's domestic loans, output, interest rates, and inflation. European monetary policy has a greater impact on Egypt's economy than United States' monetary policy. These findings suggest that Egypt's monetary authority needs to closely monitor the development of international monetary policy and other external variables (output and inflation) in order to formulate prudent monetary policy that can mitigate adverse effects of overseas shocks on the Egyptian economy.

Keywords: foreign monetary policy, bank loans, international bank lending channel, non-recursive SVAR.

1. Introduction

Central banks use monetary policy to influence intermediate targets, namely interest rates in developed countries and the money supply in most developing countries, to ultimately influence output, employment, exchange rates, and prices (Handa, 2009). Monetary policy can influence these macro-level variables through traditional interest rate, exchange rate, credit, and asset price channels (Mishkin, 1995). However, the credit market is a crucial component of monetary policy and contains two essential channels. Therefore, this paper's focal point is to identify the two major channels in the transmission of monetary policy via the credit market. The first channel is related to the supply of credit, in which contractionary monetary policy, via an increase in interest rate, will decrease bank reserves and afterwards reduce deposits and reduce bank loans. The bank cannot substitute the lost deposits due to imperfections in the credit market; hence, the bank needs to reduce the supply of credit. This channel is related to the relationship between the supply of loans and monetary policy and is renowned as the bank lending channel (BLC). The second channel is related to the demand for credit, in which the tightening of monetary policy will raise the cost of capital and then decrease firms' cash flow, harming investment through firms' balance sheets. The second channel, which relates to the relationship between loan demand and monetary policy, can be categorized under the balance sheet channel (BSC).

International monetary policy affects domestic bank loans through its international bank lending channel (IBLC). The transmission of international bank lending channels is similar to the transmission of the domestic bank lending channel. Contractionary monetary policy through an increase in the interest rate will reduce the reserves and deposits in banks, which raises funding costs of banks and, therefore, negatively affects both domestic and foreign bank lending activities. For example, an increase in the United States'

(US) federal funds rate decreases bank reserves and therefore decreases bank loan supply in the United States and external loans from US banks to Egyptian banks, which consequently reduces the bank loan supply in Egypt.

The United States and Europe can affect Egypt's real and financial sectors through many channels, such as foreign monetary policy, foreign prices, and foreign output. First, US and European monetary policy can impact Egypt's domestic loans through the international bank lending channel. US and European monetary policy have significant spillovers to credit markets in emerging markets and have indirect adverse effects on the stability of emerging financial markets (Morais et al., 2017). Second, US and European monetary policy also influences Egypt's domestic variables through the exchange rate channel. For example, US expansionary monetary policy decreases the value of the US dollar, which negatively impacts Egyptian exports and positively affects Egyptian imports from the United States. The decrease in Egyptian exports harms Egypt's macroeconomic indicators, such as output, total demand, and loans. Third, US and European monetary policies impact Egypt's foreign investment, which affects domestic investment, output, total demand, and loans in Egypt. Fourth, an increase in foreign output boosts Egyptian goods demand, increases Egyptian exports, and raises domestic production and total demand in Egypt. This is because the United States and Europe are Egypt's most important trade partners. Fifth, increases in US and European inflation rates lead to increases in imported goods prices, input prices in Egypt, and the cost of production, which harms output, aggregate demand, and inflation in Egypt.

The crucial aspect of measuring the impact of the international bank lending channel in Egypt is that the Egyptian government began economic reforms and a structural adjustment program (ERSAP) in 1991.¹ The ERSAP incorporated developments in monetary policy tools and had the objective to improve the effectiveness of monetary policy channels. First, in 1991, the Central Bank of Egypt (CBE) liberalized interest rates and eliminated interest

¹ The ERSAP in Egypt comprised three programs; stabilization, structural adjustment, and social programs.

rate and credit ceilings. Thus, the Egyptian banks had the liberty to determine interest rates on deposits and loans that can improve the transmission mechanism of monetary policy. Second, in 2003, the Central Bank of Egypt floated the exchange rate of the Egyptian pound.² This is because the exchange rate channel was not effective during the fixed exchange rate regime. Third, since 2005, the operational target for monetary policy has been changed from banks' excess reserves to the overnight interest rate on interbank transactions. Fourth, CBE depended more on indirect tools to conduct monetary policy, such as discount rates and open market operations (Central Bank of Egypt, 2005).

This study contributes to the existing literature on the effectiveness of the international bank lending channel in three ways. First, the study uses macro-level data and a non-recursive SVAR model to examine the impact of monetary policy of the United States and European countries (together and separately) on domestic bank lending in Egypt.³ Previous empirical studies of the international bank lending channel use micro-level data, such as Temesvary et al. (2018) and Buch et al. (2019). Second, the study examines the effect of external output and inflation shocks on Egypt's domestic bank loans. Existing empirical studies do not highlight this issue, such as Zaidi and Karim (2014) and Shokr, Abdul Karim, and Zaidi (2019). Third, the responses of domestic output, inflation, interest rate, and bank loans in Egypt to US and European monetary policies are employed in order to determine whether US or European monetary policy has a more significant impact on aggregate variables in Egypt.

There are three main differences between this present study and the earlier study by Shokr et al. (2019) in Egypt. First, this current study's focal point is to examine the international bank lending channel of monetary policy by focusing on US and European monetary policy on domestic bank lending in Egypt. In contrast, Shokr et al. (2019) investigated the effect of domestic monetary policy and foreign variables (world oil price, foreign output, and

² The Egyptian pound was fixed against the US dollar from 1991 to 2002.

³ The European countries considered include Germany, France, the United Kingdom, and Italy.

foreign interest rate) on domestic output, inflation, and the exchange rate in Egypt, and did not address the role of international monetary policy on the bank lending channel in Egypt. Second, this study also examines the effect of foreign output and inflation of the United States and Europe on domestic bank loans in Egypt, whereas Shokr et al. (2019) did not highlight this issue. Third, this study illustrates whether US or European monetary policy has a more significant impact on Egypt's aggregate economic variables, which was not previously considered.

The main findings from this study are summarized as follows. First, the results disclose that US and European monetary policy significantly impact domestic output, inflation, interest rates, and bank loans in Egypt. Therefore, the study supports the effectiveness of the international bank lending channel in the country. Second, European nations and the United States have a significant relationship with domestic output, interest rates, and Egypt's inflation. However, foreign output does not have a significant relationship with bank loans in Egypt. Third, US and European inflation has a significant negative impact on Egypt's domestic output and bank loans. On the other hand, there is a significant and positive relationship between Egypt's external inflation and the domestic interest rate. Fourth, output, interest rates, inflation, and bank loans in Egypt have a stronger relationship with European monetary policy than with US monetary policy. Thus, European monetary policy impacts on domestic variables in Egypt dominate US monetary policy effects.

2. Literature Review

Several empirical studies in developed and developing countries using micro-level data to highlight the importance of the international bank lending channel (IBLC). For instance, Temesvary et al. (2018) have studied the foreign bank lending channel's effectiveness by examining the impact of monetary policy on US banks' foreign financial flows through external capital markets from 2003 to 2016. They discuss the effectiveness of the international bank

lending channel by investigating the impact of changes in the US federal funds rate and quantitative easing on US banks' bilateral cross-border and foreign affiliate flows before and after the global financial crisis. They find that the response of constrained banks to changes in monetary policy is stronger than the response of unconstrained banks. Moreover, US monetary easing significantly increases US banks' cross-border flows in the pre-crisis period, and its effect is more substantial for constrained banks. In the post-crisis period, monetary easing in the United States has a positive and significant impact on US banks' bilateral cross-border flows. An empirical study by D'Avino (2017) on the United States also supports an international bank lending channel.

Buch et al. (2019) used bank-level data for 17 countries to examine international bank lending channels (IBLC) for the United States, Euro area, Japan, and the United Kingdom. The main findings indicate that foreign monetary policy's influence on local non-financial lending of resident banks is statistically significant. The international transmission of foreign monetary policy is mainly predominant for US monetary policy. International transmission occurs in conventional and unconventional monetary policy, but it is more significant during the unconventional period. Auer et al. (2019) studied the international transmission of monetary policy through banks in small open economies using Switzerland's and Canada's bank-level data. The results on the outward transmission of domestic monetary policy indicate that foreign lending by Canadian banks is affected by domestic monetary policy in Canada, which supports the international bank lending channel's presence.

Also, IBLC is operative in developing countries. For example, in Hungary, Ongena, Schindele, and Vonnák (2014) found that domestic monetary policy significantly impacts bank lending in domestic currency but not in foreign currency. On the other hand, foreign monetary policy significantly affects bank lending in foreign currency but not in domestic currency. Thus, they find IBLC important in the context of Hungary. In Bolivia, Ioannidou, Ongena, and Peydro (2015) find that changes in the US federal funds rate have a significant impact on the supply of credit denominated in US dollars in

Bolivia. Thus, they provide evidence of the importance of the IBLC in Bolivia. In Mexico, Mora (2013) finds that the impact of external monetary policy on bank loan supply is significant, especially for banks with a larger share of foreign currency deposits. Also in Mexico, the empirical study by Morais et al. (2017) finds that European monetary policy has a significant impact on bank loans provided to Mexican banks by European banks, again supporting the importance of IBLC. In Peru, Schnabl (2012) finds adverse effects of Russian liquidity shocks on bank lending to Peruvian banks. Thus, these empirical studies support the importance of the international bank lending channel in developing countries.

Besides the micro-level studies, several empirical studies in both developed and developing countries have used macro-level data to examine the impact of foreign shocks on domestic macroeconomic variables, such as Kim and Roubini (2000), Brischetto and Voss (1999), Zaidi and Fisher (2010), Wulandari (2012), Ono (2013), Zakir and Malik (2013), Jain-Chandra and Unsal (2014), Zaidi and Karim (2014), Karim and Karim (2014), Zaidi, Karim, and Zulkefli (2018), Civeir and Varoglu (2019) and Shokr et al. (2019). For example, Zaidi and Karim (2014) find that foreign output, inflation, and monetary policy in the United States, Japan, and Singapore have significant effects on domestic output, inflation, interest rates, and exchange rates in Malaysia. Domestic monetary policy has a significant impact on output, inflation, and exchange rates in Malaysia. In Turkey, the empirical study by Civeir and Varoglu (2019) finds that domestic industrial production, inflation, real effective exchange rates, and interest rates respond to changes in monetary policy in the United States and the Euro area. Also, global commodity price shocks have a significant influence on these macroeconomic variables in Turkey. Nevertheless, the importance of commodity price shocks on the macroeconomic variables in Turkey is less powerful than the importance of US monetary policy.

Although there are several previous macro-level empirical studies, none of the studies mentioned above examine the effect of foreign monetary policy on domestic loans through the international bank lending channel. Moreover,

the previous studies do not highlight the impact of foreign variable shocks, like foreign output and inflation, on domestic bank loans. Therefore, this study will fill this gap by using macro-level data to investigate the impact of foreign monetary policy, output, and inflation in the United States and Europe on Egypt's bank loans.

Empirical Studies in Egypt

Some empirical studies in Egypt examine the effect of external variable shocks on internal macro-level variables, such as Moursi et al. (2006), Al-Mashat, and Billmeier (2008), Awad (2011), and Shokr et al. (2019). For example, using a recursive SVAR model, the study by Awad (2011) finds a significant effect of foreign output, inflation, and US interest rates on local output, exchange rates, and inflation rates in Egypt. Also, the empirical results introduced by Shokr et al. (2019) reveal that variations in monetary policy variables (money supply and interest rates) have significant relationships with the exchange rate, inflation, and output in Egypt. Moreover, world oil prices and output in the United States, Italy, and Germany positively impact inflation, the exchange rate, and output in Egypt. Similarly, the US, German, and Italian foreign interest rates have significant and negative relationships with domestic inflation and output in Egypt.

On the other side, the existing studies by Shokr et al. (2014), Shokr and Al-Gasaymeh (2018), and Shokr (2020) in Egypt employed micro-level data. They support the effectiveness of the domestic bank lending channel (BLC). For example, Shokr and Al-Gasaymeh (2018) postulate a negative and significant relationship between monetary policy and bank loans in Egypt. Moreover, the bank lending channel is more effective during crises, i.e. the Egyptian revolution and the global financial crisis. Furthermore, they report that bank loans are negatively attributed to the global financial crisis. Also, Shokr's (2020) study confirms a significant effect of real interest rates (as a monetary policy variable) on bank loan supply in Egypt, which highlights the importance of the bank lending channel in Egypt.

Existing studies in Egypt have not examined the importance of the international bank lending channel. Thus, this study fills this gap by using macro-level data with a non-recursive SVAR model to explore the effect of US and European monetary policy on bank loans in Egypt. This study also compares the relative importance of US and European monetary policies on the Egyptian economy. Studying the effects of US and European monetary policy and other foreign factors (output and inflation) can help the monetary authority in Egypt to precisely formulate its monetary policy by considering all relevant external shocks that can influence the economy, and therefore can mitigate the negative effects of external shocks on the Egyptian economy.

3. Research Methodology

The study uses a non-recursive SVAR model to examine international bank lending channels. Also, it employs the small open economy identification scheme, as proposed by Cushman and Zha (1997), where foreign variables are exogenous variables in contemporaneous and lagged restrictions.

3.1 SVAR Model

There are three essential reasons to use a non-recursive SVAR model and block exogeneity approach in investigating the importance of the international bank lending channel in Egypt. First, the SVAR model gives enough restrictions on the contemporaneous structural parameters and allows non-recursive restrictions based on economic theory (Bernanke, 1986; Kim & Roubini, 2000). Second, the price puzzle solution is partial in the recursive restrictions (Kim & Roubini, 2000). Therefore, the non-recursive SVAR restrictions are better than the recursive SVAR restrictions in solving the price puzzle. Third, the study uses the block exogeneity approach because foreign variables affect domestic variables through many channels, such as capital markets, exchange rates, loans, investment, exports, and imports. Hence, the external variables should be included in the small open economy model as exogenous variables (Cushman & Zha, 1997).

The following equation gives the dynamic relationship between the selected variables in the SVAR model:

$$BY_t = (T_1L + T_2L^2 + \dots + T_kL^k) Y_t + \varepsilon_t \tag{1}$$

In equation (1), B represents a matrix (n x n) that shows the contemporaneous relationship between the selected variables. Y_t represents a vector (n x 1) of the selected variables [$Y^*, \pi^*, R^*, Y, \pi, R, L$]. These variables are foreign output (Y^*), foreign inflation (π^*), foreign interest rate (R^*), domestic output (Y), domestic inflation (π), domestic interest rate (R), and domestic bank loans (L). TL represents the K^{th} order matrix polynomial in the lag operator (L). ε_t represents a vector (n x 1) of structural innovations [$\varepsilon_{y^*}, \varepsilon_{\pi^*}, \varepsilon_{R^*}, \varepsilon_y, \varepsilon_\pi, \varepsilon_R, \varepsilon_L$]. The mean of the structural innovations is equal to zero ($E(\varepsilon_t)$).

The restrictions assumed in the contemporaneous structural parameters (B) in the non-recursive SVAR model are explained in equation 2. The restrictions on the diagonal are normalized to unity. The number of zero restrictions is 22, and the number of B's restrictions is twenty. Since the number of zero restrictions is higher than the number of B's restrictions, the contemporaneous matrix in the SVAR model is over-identified.

$$BY = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ B_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ B_{31} & B_{32} & 1 & 0 & 0 & 0 & 0 \\ B_{41} & B_{42} & B_{43} & 1 & 0 & 0 & 0 \\ B_{51} & B_{52} & B_{53} & B_{54} & 1 & 0 & 0 \\ 0 & B_{62} & B_{63} & B_{64} & B_{65} & 1 & 0 \\ B_{71} & B_{72} & B_{73} & B_{74} & B_{75} & B_{76} & 1 \end{pmatrix} \begin{pmatrix} Y^* \\ \pi^* \\ R^* \\ Y \\ \pi \\ R \\ L \end{pmatrix} \tag{2}$$

In the contemporaneous matrix, B_{ij} represents the impact of variable (j) on variable (i). For instance, (B_{73}) describes the effect of US and European monetary policy on bank loans in Egypt. Also, the non-recursive SVAR model includes one dummy variable that is treated as an exogenous variable in contemporaneous and lagged restrictions. The dummy variable represents the

global financial crisis. This variable takes the value one during the period from 2007 (Q3) to 2009 (Q2) and zero otherwise.

3.2 Variables

The seven variables used in the non-recursive SVAR model [$Y^*, \pi^*, R^*, Y, \pi, R, L$] are divided into exogenous and endogenous groups. The exogenous group includes the three foreign variables: foreign output, inflation, and interest rate. Foreign output (Y^*) is trade-weighted real gross domestic product; foreign inflation (π^*) is trade-weighted inflation; and foreign interest rate (R^*) is trade-weighted interest rates for the United States and European countries.⁴

The endogenous group contains the four domestic variables: output, inflation, interest rate, and bank loans in Egypt. First, Egypt's real gross domestic product (Y) represents domestic activities in Egypt and denotes the output in Egypt. Second, domestic inflation of Egypt (π) is represented by the percentage change in the consumer price index (CPI). Third, the interest rate in Egypt (R), as a monetary policy variable, is represented by the discount rate because the interbank interest rate and discount rate show the same trend (Abdel Baki, 2010; Shokr et al., 2019). The discount rate is also used to represent monetary policy in some empirical studies in Egypt (Awad, 2011; Shokr et al., 2019). Additionally, the data for the interbank interest rate is not available from 1991 to 1997. Fourth, Egypt's bank loans (L) are included to examine the effectiveness of the international bank lending channel in Egypt.

⁴ The trade-weighted output is estimated by multiplying the percentage of trade for the country with its output and totaling all together. The output for European countries is represented by the sum of gross domestic products for four countries: Germany, France, the United Kingdom, and Italy. Trade-weighted inflation is estimated by multiplying the percentage of trade for the country with its inflation rate and totaling all together. The inflation in European countries is represented by the average inflation over the four countries. The trade-weighted interest rate is estimated by multiplying the percentage of trade for the country with its interest rate and totaling all together. European monetary policy is represented by the average interbank interest rate in the four countries.

3.3 Identification Scheme

This study uses the identification scheme for a small open economy that is introduced by Cushman and Zha (1997). According to this scheme, the three foreign variables [Y^* , π^* , R^*] influence the four domestic variables [Y , π , R , L]. First, foreign output (Y^*), has a contemporaneous effect on all domestic variables, except the monetary policy variable (Cushman & Zha, 1997). Based on Cushman and Zha (1997), monetary policy depends on the information available to the monetary authority during the study period. The central bank has immediate access to information related to domestic and foreign interest rates, commodity prices, and exchange rates. In contrast, the central bank cannot observe foreign output. Based on the augmented Phillips curve, foreign output impacts foreign inflation (Roberts, 1995; Shokr et al., 2019). According to Taylor's rule, foreign output impacts foreign interest rates. Second, foreign inflation (π^*) influences all variables contemporaneously because changes in foreign prices influence exports, imports, and input prices that affect domestic inflation, output, interest rates, and bank loans (Kim & Roubini, 2000; Zaidi & Karim, 2011). Third, foreign interest rates (R^*) affect all domestic variables contemporaneously. The foreign interest rate affects domestic output and inflation as changes in foreign interest rates influence the exchange rate, which affects Egyptian exports and input prices, which impact domestic output and inflation. Based on Mundell-Fleming's model with rational expectations, domestic monetary policy is affected by foreign monetary policy through capital markets.

The identification scheme for domestic variables include: output, inflation, interest rates, and bank loans in Egypt. The four domestic variables do not affect the foreign variables in contemporaneous or lagged restrictions because Egypt is a small economy and unlikely to impact other countries. First, domestic output affects inflation, based on the augmented Phillips curve (Roberts, 1995). Additionally, changes in output affect interest rates because monetary policy reacts to output, inflation, and exchange rate, based on Taylor's

rule (Taylor, 1993; Taylor & Williams, 2010). On the other hand, domestic output responds to foreign output, foreign inflation, and foreign interest rates, as explained in the previous paragraph. Second, domestic inflation responds to foreign output, foreign inflation, and foreign interest rates because they are treated as exogenous variables. Further, inflation in Egypt reacts to domestic output, based on the augmented Phillips curve.⁵ On the other hand, inflation affects interest rates, based on Taylor's rule (Taylor, 1993; Taylor & Williams, 2010). Also, inflation affects Egypt's bank loans, based on the loan equation introduced by Ehrmann et al. (2002).⁶

Third, the identification scheme for monetary policy is that the Central Bank of Egypt reacts to domestic output and inflation because the interest rate is determined by the real interest rate, inflation, inflation targets, and the output gap, based on Taylor's rule.⁷ Besides the two domestic variables, the Central Bank of Egypt responds to foreign prices and foreign interest rates. On the other hand, interest rate impacts bank loans, based on Ehrmann et al. (2002) model. Fourth, bank loans in Egypt respond simultaneously to the three foreign variables based on its status as a small open economy. Besides the three foreign variables, bank loans in Egypt react simultaneously to domestic output, inflation, and interest rates, based on the loans equation introduced by Ehrmann et al. (2002).

⁵ In the new Keynesian theory, the inflation equation is: $\Delta P_t = C_0 + E\Delta P_{t+1} + C_1 Y_t + \varepsilon_t$. Where: P_t is the log of actual price at time (t), $E\Delta P_{t+1}$ is the expected price at time t+1 and Y_t is output at time t.

⁶ Based on Ehrmann et al. (2002) model, the loan equation is as follows: $L_{it} = ay_t + b inf_t - c_1 i_t + c_2 i_t \chi_{it} + d \chi_{it} + const$. Output is y, inflation is *inf*, interest rate is i and bank characteristics are X.

⁷ Based on the Taylor rule, the simple equation of short term interest rates is: $i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5y_t$, where r^* is the equilibrium real interest rate, π_t is the inflation rate at time t, π^* is the inflation target, and y_t is the output gap (the percent deviation of real GDP from its potential level).

3.4 Data Sources

This research uses quarterly data from the International Financial Statistics, the Central Bank of Egypt, and Data Stream, spanning from 1991 to 2015. The gross domestic product of Egypt is not available on a quarterly basis from 1991 to 2002. Thus, the gross domestic product's annual data is converted to reflect quarterly data using the Chow-Lin procedure in the RATS software. Similarly, the yearly data of bank loans is transformed to reflect quarterly data. The study transforms foreign output data, domestic output, and domestic bank loans into natural logs. However, the study uses the data of foreign inflation, foreign interest rates, domestic inflation, and domestic interest rates in percentages. Table A.1 shows detailed descriptions of the variables used in the analysis.

4. Empirical Results and Discussion

The previous section summarized the theorized impact of US and European foreign output, foreign inflation, and foreign monetary policy on domestic output, inflation, interest rates, and bank loans in Egypt. The following results are reported in three sections: foreign monetary policy, foreign output, and foreign inflation. This study uses the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) to select the optimal lag length. The optimal lag of the SVAR model is identified by minimizing the criterion. Table A.2 shows the lag length test results for AIC and SBC from lags one to four. The AIC and SBC test results indicate that lag two is best because it has the minimum value (the highest negative value). For example, the value of lag two in AIC test is (-2298.3), and this value in the SBC test is (-2243.9), approximately. Therefore, the study selects two lags for the non-recursive SVAR model. Two lags are also adequate to capture the dynamics of the variables without losing many degrees of freedom. In addition to the lag length test, the stability test results in the non-recursive SVAR model are shown in Table A.2.

The stability test in the RATS software is employed to determine whether the SVAR model is stable or not. Since all eigenvalues in absolute value are less than one, the non-recursive SVAR model is stable. Table A.3 shows the estimation of the contemporaneous matrix (B) in the non-recursive SVAR model.

4.1 The Effects of Foreign Monetary Policy on Bank Loans and Other Domestic Variables

The impact of foreign monetary policy shocks from the United States and European countries on bank loans, output, inflation, and interest rates in Egypt can be captured from the four domestic variables' impulse response functions to foreign interest rate shocks over 24 quarters. Like the domestic bank lending channel, contractionary foreign monetary policy should reduce domestic loans, consumption, investment, and total demand in Egypt by increasing the foreign interest rate. Thus, the decreasing aggregate demand harms gross domestic product and inflation in Egypt.

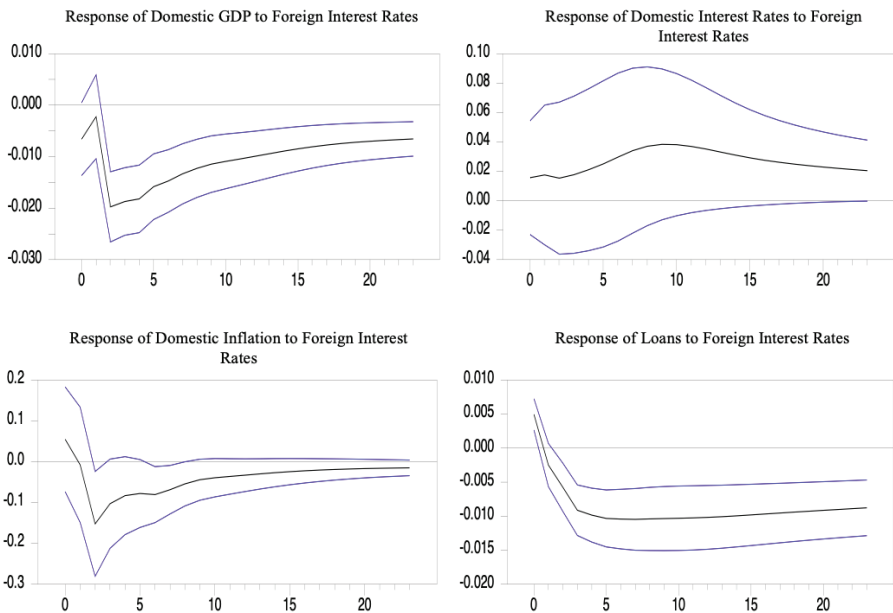
Figure 1 shows the responses of gross domestic product, domestic interest rates, domestic inflation, and domestic loans to a one standard deviation positive shock in foreign interest rates (foreign monetary policy variable).⁸ The foreign interest rate shock has a significant negative impact on gross domestic product, bank loans, and Egypt's inflation. There is also a substantial positive relationship between domestic interest rates in Egypt and foreign interest rates.⁹ Therefore, the study supports the hypothesis that US and European monetary policy affect domestic gross domestic product, inflation,

⁸ The relationship between the variables in the SVAR model is explained using impulse response functions. The relationship is significant when both upper and lower confidence intervals are above or below the zero line. The relationship is positive if the two confidence intervals are above the zero line, whereas, the relationship is negative if the two confidence intervals are below the zero line.

⁹ The negative relationships among domestic output and bank loans in Egypt and foreign interest rates are significant after one quarter because the upper and lower confidence intervals are below the zero line. Also, the negative relationship between inflation in Egypt and foreign interest rates is significant after two quarters because the two confidence intervals are below the zero line.

interest rates, and bank loans in Egypt, meaning that the international bank lending channel is effective in Egypt.

Figure 1. The effect of foreign monetary policy on domestic output, inflation, interest rates, and bank loans in Egypt



Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in standard deviation of domestic output, inflation, interest rates, and loans in Egypt to one standard deviation increase in foreign monetary policy. The confidence intervals are estimated by using the bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

Source: Authors' calculations.

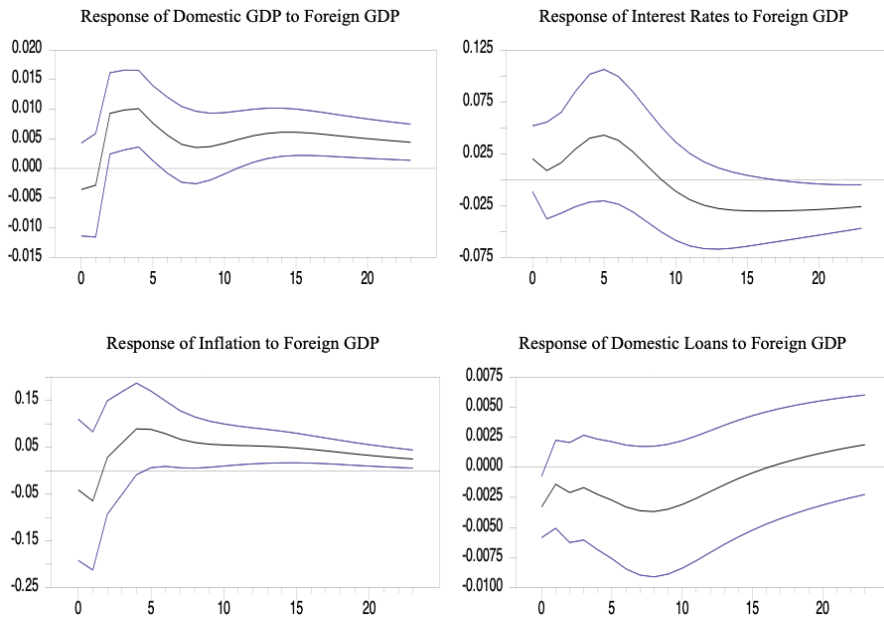
For instance, a one standard deviation increase in US and European foreign interest rates reduces domestic gross domestic product significantly, which reaches the lowest point approximately after two quarters. Also, a one standard deviation increase in the foreign interest rates reduces domestic inflation after one quarter and roughly reaches the lowest point after two quarters. However, a one standard deviation increase in the foreign interest rates boosts the domestic interest rate, which reaches the highest point after

approximately nine quarters. Finally, a one standard deviation increase in foreign interest rates has a significant negative effect on Egypt's domestic bank loans after one quarter, which reaches the lowest point after around five quarters. Thus, the non-recursive SVAR model results show the international bank lending channel is in effect in Egypt. The significant impact of foreign monetary policy on domestic output, inflation, and the interest rate is in line with previous studies, such as Cushman and Zha (1997) in Canada, Awad (2011) in Egypt, Zaidi and Karim (2014) in Malaysia, Civcir and Varoglu (2019) in Turkey, and Shokr et al. (2019) in Egypt.

4.2 The Effects of Foreign Output on Bank Loans and Other Domestic Variables

Figure 2 shows the responses of domestic gross domestic product, inflation, interest rates, and bank loans in Egypt to foreign output shocks. The impulse response functions in Figure 2 reveal that a one standard deviation increase in foreign output in the United States and Europe has a significant positive effect on Egypt's gross domestic product, inflation, and the interest rate. Nevertheless, a one standard deviation rise in foreign output has no impact on bank loans in Egypt. The positive relationship among foreign output and domestic output, inflation, and the interest rate in Egypt can be explained as follows: the growth of US and European foreign production leads to an increase in exports and foreign investment in Egypt. The increase in exports and investment in Egypt positively impact total demand and gross domestic product in Egypt. The increases in total demand and gross domestic product, in turn, have a positive influence on price levels (inflation) in Egypt. Also, the growth in gross domestic product and the inflation rate positively impact the domestic interest rate in Egypt, based on Taylor's rule.

Figure 2. The effect of foreign output on domestic gross domestic product, inflation, interest rate and bank loans in Egypt.



Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in the standard deviation of domestic output, inflation, interest rates, and loans in Egypt to one standard deviation increase in foreign output. The confidence intervals are estimated by using a bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

Source: Authors' calculations.

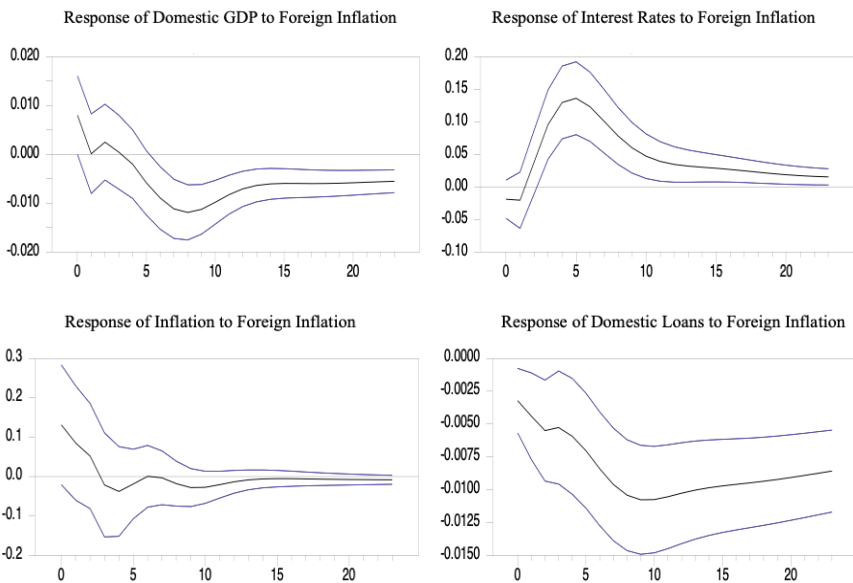
According to the impulse response functions in Figure 2, a one standard deviation increase in foreign output increases gross domestic product significantly, reaching the maximum point after five quarters. Also, a one standard deviation rise of foreign production boosts domestic inflation after one quarter and roughly reaches the highest point after four quarters. Moreover, a one standard deviation increase in foreign output raises domestic interest rates, which reaches its highest point after approximately two quarters. However, a one standard deviation increase in foreign output does not have a significant effect on bank loans in Egypt. The results support the hypothesis that US and European external output impacts domestic gross domestic product, inflation, and interest rates in Egypt, and is in line with some previous empirical studies

by Cushman and Zha (1997) in Canada, Awad (2011) in Egypt, Zaidi and Karim (2014) in Malaysia, and Shokr et al. (2019) in Egypt.

4.3 The Effects of Foreign Inflation on Bank Loans and Other Domestic Variables

The impulse response functions illustrating the responses of Egypt’s gross domestic product, inflation, interest rates, and bank loans to foreign inflation shocks are shown in Figure 3. This Figure shows US and European inflation has adverse effects on Egyptian gross domestic product and bank loans. In contrast, the impact of foreign inflation on Egypt’s domestic interest rates is positive and significant. Foreign inflation has a positive relationship with domestic inflation, but its effect is not significant.

Figure 3. The effect of foreign inflation on gross domestic product, inflation, interest rate and bank loans in Egypt.



Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in standard deviation of domestic output, inflation, interest rates, and loans in Egypt to one standard deviation increase in foreign inflation. The confidence intervals are estimated by using a bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

Source: Authors’ calculations.

Figure 3 shows that, first, the negative relationship between foreign inflation and gross domestic product in Egypt can be explained as follows: an increase in US and European price levels lead to an increase in imported goods prices, which increases the price level or inflation rate in Egypt. The increase in the price level in Egypt boosts input prices and, therefore, increases product costs, which harms gross domestic product in Egypt. Second, the impact of foreign inflation on Egypt's domestic interest rate is positive because increases in foreign prices lead to a rise in foreign interest rates. Therefore, Egypt's central bank responds to an increase in foreign interest rates by raising the domestic interest rate level. Third, the negative relationship between foreign inflation and domestic bank loans in Egypt can be explained as follows: foreign inflation shocks decrease gross domestic product and increase interest rates in Egypt, negatively affecting Egypt's loans. The empirical studies by Cushman and Zha (1997) in Canada, Awad (2011) in Egypt, Zaidi and Karim (2014) in Malaysia, and Shokr et al. (2019) in Egypt supported the essential effect of foreign inflation on domestic output, inflation, and the interest rate.

Overall this study reveals that US and European foreign monetary policy, output, and inflation positively impact domestic bank loans, output, inflation, and interest rates in Egypt. Also, the results support the results of foreign variable shocks by Kim and Roubini (2000), Zaidi and Fisher (2010), Awad (2011), Zaidi and Karim (2014), and Shokr et al. (2019). Therefore, during the period of external adverse shocks, the Central Bank of Egypt should use conventional and unconventional monetary policy tools by adjusting the operational and intermediate targets of monetary policy to moderate the adverse effects of foreign output, foreign inflation, and foreign monetary policy on domestic output, inflation, interest rates, and loans in Egypt.

4.4 Robustness Checks

The previous section shows that combined US and European monetary policy have impacts on Egypt's domestic economy. As a robustness check, this section considers the effects of US and European monetary policy on

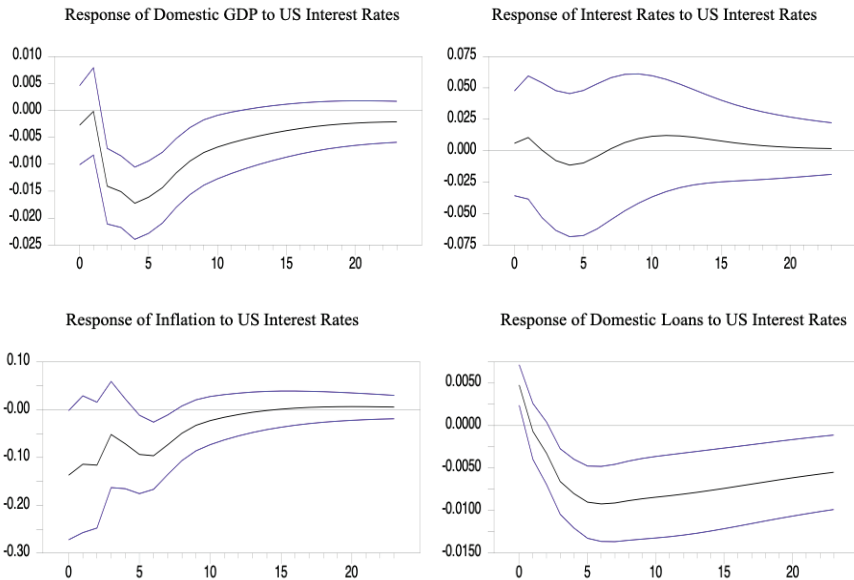
Egypt's domestic economy separately using the same baseline SVAR model described above.

4.4.1 US Monetary Policy

For the US monetary policy model, the study uses the same restrictions as in the SVAR model's baseline. The Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are used to select the US model's optimal lag. Table A.4 shows the results of the lag length test for the AIC and SBC tests. For this model, the AIC test shows that two lags is best because this lag has the minimum value (-2357.3), while the SBC test indicates that one lag is best because this lag has the minimum value (-2303.2). Therefore, the study employs two lags to estimate the US model based on the AIC test. Also, Table A.4 shows the stability tests to examine the stability of the SVAR model. In the US model, the SVAR model is stable because all eigenvalues in absolute value are less than one. Like the baseline model, the study uses the same lag and same restrictions assumed in the contemporaneous parameters to estimate US monetary policy effects on gross domestic product, inflation, interest rates, and bank loans in Egypt.

The relationship among inflation, bank loans, gross domestic product, and the interest rate in Egypt and foreign interest rate shocks in the United States is illustrated in Figure 4. Similar to the combined results, a standard deviation increase in the US interest rate leads to reductions in inflation, bank loans, and gross domestic product in Egypt. However, unlike the combined results, a one standard deviation increase in the US interest rate does not significantly affect the domestic interest rate in Egypt.

Figure 4. The effect of US monetary policy on domestic output, inflation, interest rates and bank loans in Egypt



Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in the standard deviation of domestic output, inflation, interest rates, and loans in Egypt to a one standard deviation increase in the US interest rate. The confidence intervals are estimated by using a bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

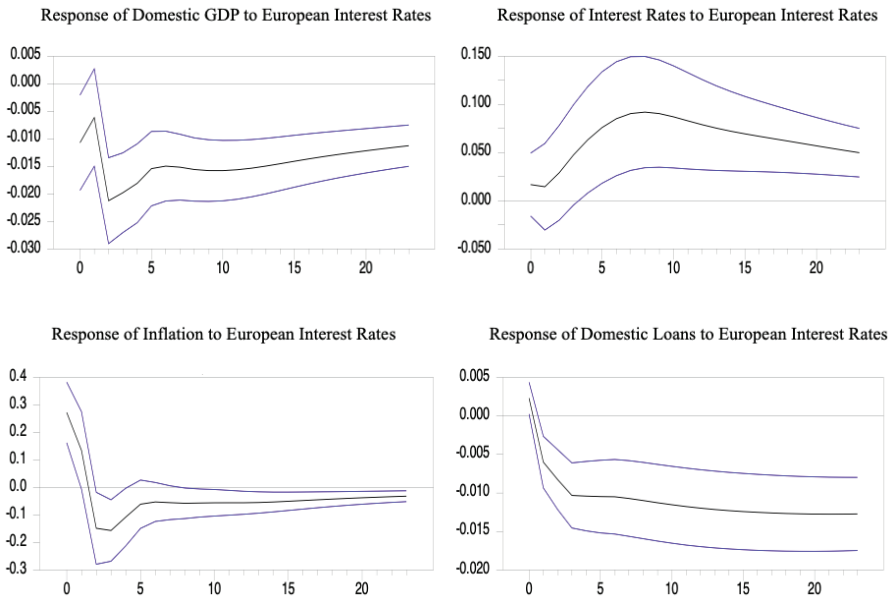
Source: Authors' calculations.

4.4.2 European Monetary Policy

For European monetary policy, this study uses the same restrictions assumed in the contemporaneous parameters in equation 2. Again, the AIC and SBC tests are used to select the optimal lag. Table A.5 displays the results of the lag test for the AIC and SBC tests. In the European model, the AIC test demonstrates that two lags are best, whereas the SBC test specifies that one lag one is best. Thus, the study employs two lags to estimate the European model based on the AIC test. Moreover, the stability test is used to examine the SVAR model's stability, as shown in Table A.5. In the European model, since all eigenvalues in absolute value are less than one, the SVAR model is stable.

The responses of gross domestic product, inflation, interest rate, and bank loans in Egypt to European interest rate shocks are exhibited in Figure 5. The European interest rate has a significant negative impact on Egypt’s gross domestic product, inflation, and bank loans, similar to the results for the combined sample and the United States. However, unlike the US case, the European interest rate has a significant positive impact on Egypt’s domestic interest rates.

Figure 5. The effect of European monetary policy on domestic output, inflation, interest rates and bank loans in Egypt



Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in the standard deviation of domestic output, inflation, interest rates, and loans in Egypt to a one standard deviation increase in the European interest rate. The confidence intervals are estimated by using a bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

Source: Authors’ calculations.

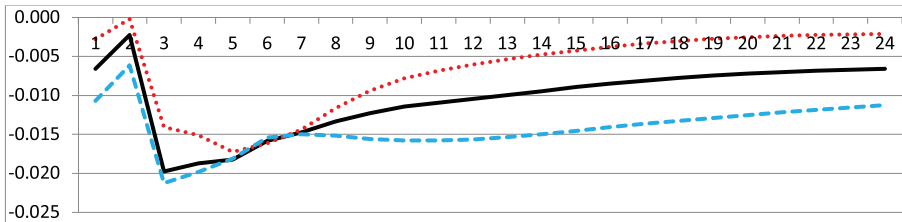
4.4.3 Relative Importance of International Monetary Policy Shocks

Figure 6 compares the impulse response functions for gross domestic product, inflation, interest rates, and bank loans in Egypt to combined, US,

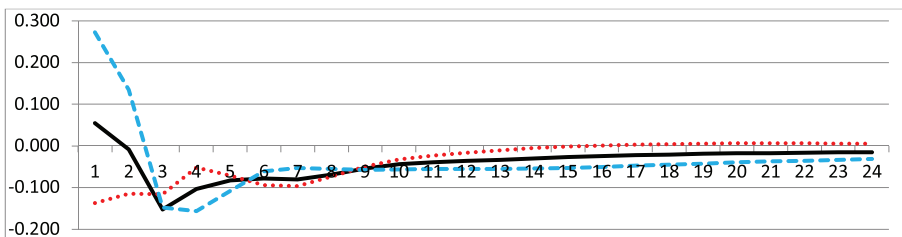
and European monetary policy. In general, the responses of gross domestic product, inflation, interest rates, and bank loans in Egypt to the three foreign monetary policy shocks are quite similar in both the US and the European models. Thus, the results of the SVAR model are robust to the alternative foreign interest rate variables. Moreover, Figure 6 illustrates that gross domestic product, domestic inflation, domestic interest rates, and bank loans are more responsive to European monetary policy than US monetary policy. These results indicate that US and European monetary policy have a significant effect on the gross domestic product, inflation, interest rate, and bank loans in Egypt, which implies that the international bank lending channel (IBLC) is important in the Egyptian context.

Figure 6. The effect of three foreign monetary policies (total, US, and European monetary policies) on domestic output, inflation, interest rate, and bank loans in Egypt.

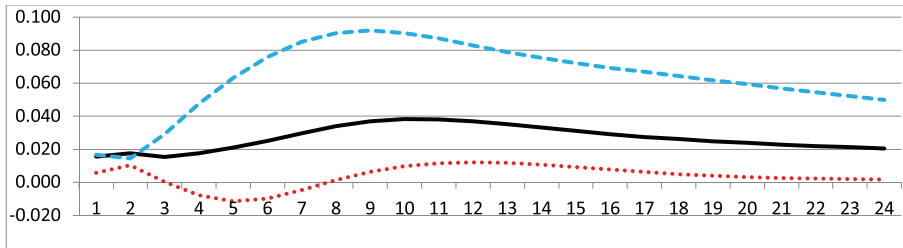
(a) Response of GDP to the Total Foreign, US, and European Monetary Policy Shocks



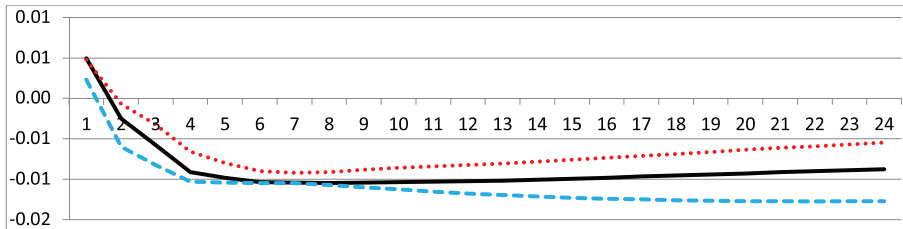
(b) Response of inflation to the Total Foreign, US, and European Monetary Policy Shocks



(c) Response of interest rate to the Total Foreign, US, and European Monetary Policy Shocks



(d) Response of Loans to the Total Foreign, US, and European Monetary Policy Shocks



— Foreign Monetary Policy US Monetary Policy - - - European Monetary Policy

Notes: The horizontal axis is the number of quarters (up to 24 quarters or 6 years). The vertical axis is the change in the standard deviation of domestic output, inflation, interest rates, and loans in Egypt to a one standard deviation increase in foreign interest rates. The confidence intervals are estimated by using a bootstrapping method in the RATS software and have a nominal coverage probability of 0.68 (one standard error).

Source: Authors' calculations.

The effects of US and European monetary policies indicate that the European monetary policy has a more significant impact on Egypt's domestic macroeconomy than US monetary policy. One possible reason is that the volume of trade between the European Union and Egypt is greater than the volume of trade between the United States and Egypt. For example, Egyptian exports to the European Union were 8,119 million US dollars in 2010, representing 29.7% of Egypt's total exports. However, Egypt's exports to North America were 1,696 million US dollars in the same year, which is 6.2% of total Egyptian exports. Also, the Egyptian imports from the European Union were

17,092 million US dollars in 2010, which embodied 32.3% of total imports to Egypt. In contrast, Egyptian imports from North America were 4,950 million US dollars that year, representing 8.7% of aggregate imports. Thus, the volume of trade between Egypt and the European union was 31% in 2010, while the volume of trade between Egypt and North America was 7.5% in the same year (General Agency for Public Mobilization and Statistics, 2013).

The significant effects of foreign variables on Egypt's domestic macroeconomy represent a problem for Egypt's monetary authority because the relationship between monetary policy tools and final objectives is indirect. The foreign shocks can affect the link between monetary policy tools and the final goals and can lead to unpredictable relationships. To lessen the negative influence of foreign shocks on Egypt's macro-level variables, the Central Bank of Egypt should use conventional and unconventional monetary policy tools by enhancing the money supply's role as an intermediate monetary policy target.

5. Conclusions

This study investigates the effect of foreign monetary policy of European nations and the United States on bank loans and other macroeconomic variables in Egypt. The study uses a non-recursive SVAR model and identification scheme for a small-open economy. The study also investigates whether US or European monetary policy has a stronger significant relationship with the Egyptian economy. Therefore, the study compares the impact of US and European monetary policies on Egypt's domestic macro-level variables.

The findings indicate that foreign monetary policy of European countries and the United States have significant impacts on domestic loans, output, inflation, and interest rates in Egypt. Therefore, the study highlights the relevance of the international bank lending channel. In line with this finding, Temesvary et al. (2018) and Ongena et al. (2014) have also reported significant results consistent with the international bank lending channel. Nonetheless,

studies by Shokr (2020), Awad (2011), and Shokr et al. (2019) on Egypt did not consider the importance of international bank lending channels. Also, US and European foreign output impacts Egypt's output, inflation, and interest rate. Inflation in the United States and Europe positively affect domestic interest rates, bank loans, and output in Egypt. Moreover, European monetary policy has a larger impact on bank loans, output, inflation, and interest rates in Egypt compared to US monetary policy, indicating that European monetary policy has a more significant relationship with the Egyptian economy than US monetary policy.

There are several policy implications from the demonstrated importance of the international bank lending channel in Egypt. The Egyptian Central Bank should take necessary steps to respond to changes in US and European monetary policy since it impacts bank loan supply in Egypt. By managing the bank loan supply, the Egyptian Central Bank can affect investment, consumption, and total demand to attain economic growth targets, price stability, a stable financial system, and exchange rate stability. The vital roles of foreign output and foreign inflation on Egyptian macroeconomic conditions suggest that the Central Bank of Egypt could use conventional and unconventional monetary policy tools. This strategy is essential to mitigate the adverse effects of foreign output and foreign inflation on domestic output, inflation, interest rates, and bank loans. For example, during a global crisis, the Central Bank of Egypt should use an expansionary monetary policy by decreasing the interbank interest rate and increasing the broad money supply. This policy is crucial to balance the negative impact of foreign inflation, foreign output, and foreign monetary policy shocks on domestic loans, output, inflation, and interest rates in Egypt.

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Appendix

Table A.1: Variable Descriptions and Sources

Variables	Definition	Sources
Foreign output	Trade-weighted real gross domestic product of the United States and European countries (Germany, France, the United Kingdom and Italy) in US dollars (base year 2005).	Data Stream
Foreign inflation	Trade-weighted inflation rate of the United States and European countries (Germany, France, the United Kingdom and Italy).	Data Stream
Foreign interest rate	Trade-weighted interest rate of the United States and European countries (Germany, France, the United Kingdom and Italy).	Data Stream
Domestic output	Real gross domestic product of Egypt in US dollars (base year 2005).	IMF
Inflation	Percentage change in the consumer price index of Egypt.	IMF
Interest rate	Discount rate of Egypt.	CBE
Bank loans	Real bank loans of Egypt in US dollars.	CBE

Table A.2: Lag Length and Stability Tests

number of lags	AIC	SBC
Lags 4	-2286.1	-2183.8
Lags 3	-2294.2	-2215.5
Lags 2	-2298.3	-2243.9
Lags 1	-2270.8	-2241.4

stability test						
0.98670	0.88548	0.88548	0.79152	0.65294	0.65294	0.67527
0.35908	0.35908	0.12895	0.12895	-0.46288	0.09915	-0.05646

Source: Authors' calculations.

Table A.3: Estimation of Contemporaneous Matrix (B)

Variable	Coeff.	Std Error	signif
B21	25.58689538	5.30471773	0.0000014***
B31	16.82731921	5.53899337	0.0023817***
B32	0.43960720	0.11155941	0.0000812***
B41	2.36982362	1.36937333	0.0835249*
B42	-0.01622679	0.02785274	0.5601677
B43	0.03345698	0.02647346	0.2063041
B51	-0.92754810	18.89061201	0.9608388
B52	0.51615679	0.36929007	0.1622031
B53	-0.34794241	0.35318789	0.3245512
B54	2.49420068	1.41275316	0.07748156*
B62	-0.24742557	0.14760857	0.09369361*
B63	0.09603704	0.13950708	0.49119927
B64	0.65893793	0.61364641	0.28290910
B65	0.14514821	0.04578152	0.00152201***
B71	-0.07210878	0.38038476	0.84964766
B72	0.02428849	0.00741824	0.00105977***
B73	-0.01818477	0.00685136	0.00795002***
B74	-0.15039588	0.02845414	0.00000013***
B75	0.00002814	0.00225679	0.99005029
B76	-0.01065324	0.00554496	0.05470060*

Source: Authors' calculations.

Table A.4: Lag Length and Stability Tests (US model)

number of lags			AIC		SBC	
Lags 4			-2350.3		-2247.9	
Lags 3			-2356.1		-2277.4	
Lags 2			-2357.3		-2302.9	
Lags 1			-2332.6		-2303.2	
stability test						
0.98738	0.88489	0.88489	0.74317	0.74317	0.63623	0.63623
0.35063	0.35063	0.14777	0.14777	-0.44158	0.07154	-0.05199

Source: Authors' calculations.

Table A.5: Lag Length and Stability Tests (European Model)

number of lags			AIC		SBC	
Lags 4			-2350.5		-2268.1	
Lags 3			-2354.2		-2290.5	
Lags 2			-2356.1		-2301.7	
Lags 1			-2355.7		-2326.3	
stability test						
0.98413	0.88127	0.88127	0.74309	0.61113	0.61113	0.63447
0.23200	0.23200	0.29598	0.29598	-0.41891	0.04218	-0.03754

Source: Authors' calculations.