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Investigating the Impact of Foreign Portfolio Investment on Macro-Economic Stability: Empirical Evidence from Egypt

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ABSTRACT

Foreign Portfolio Investment (FPI) flows have fluctuated significantly in the Egyptian stock market from 1993 to 2020. This high volatility of FPI has drawn attention to assess its possible effects on the Egyptian economy in terms of macroeconomic stability. Therefore, this study aims to empirically investigate the relationship between FPI flows and the inflation rate, which is a critical indicator of macroeconomic stability. For this purpose, the study applies a vector autoregressive (VAR) model to test the short-run dynamics among the variables of interest. Also, it conducts the granger-causality test to check the causalities among variables. Additionally, it applies the auto-regressive distributed lag (ARDL) model to examine the long-run relationships among these variables. An error correction (ECM) can then be applied by analyzing both the short-run and long-run relationships among the model variables. Empirical results showed that FPI flows increase the inflation rate in Egypt in both the short-run & long run, thereby negatively impacting the macro-economic stability of the Egyptian economy.

Keywords- Foreign Portfolio Investment; VAR; ARDL; Inflationary Pressures; Economic Stability.

I. INTRODUCTION

Since the 1980s and 1990s, both domestic and international financial liberalization have been introduced in developing countries. Accordingly, developing countries adopted various financial liberalization programs, to develop their financial sector; thus increasing opportunities for international capital flows. International capital flows have two main forms: governmental (official) flows and private flows. Private flows consist of foreign direct investment (FDI), foreign portfolio investment (FPI), and bank loans. This study mainly focuses on FPI as an important form of private capital flows.

FPI is defined as "Capital that countries receive through issuing financial securities (stocks and bonds) in international financial markets, or when foreign investors (retail or institutional investors) buy securities in the domestic stock market of the countries". Since the mid-1989s, the magnitude of international FPI flows, specifically from developed to developing countries has increased significantly. Hence, the volume of FPI inflows to developing countries grew from $ 6.2 billion in 1987 to $ 46.9 billion in 1993 (World bank, 1997).

FPI flows benefit host countries in various aspects. They help in dealing with the savings-investment gap, maintaining economic growth, and improving the performance of the financial system. Furthermore, they are the source of foreign exchange to host countries, which in turn finance the current account deficit. In addition, high FPI flows to host countries increase the domestic capital markets' liquidity, which in turn facilitates access to financing at a lower cost of capital. This easier access to financing contributes to an efficient allocation of capital and thus greater economic outputs. Nevertheless, large amounts of FPI flows might induce volatility in exchange rates, boost inflation rates, and cause financial vulnerabilities to recipient countries accordingly (Rashid, 2010). Also, they might lead to currency appreciation, thus lowering the international

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competitiveness of the country (Duasa and Kassim, 2008; Kim and yang, 2011).

In addition, FPI flows are always criticized for their high volatility and sharp reversals. Portfolio investors can easily pull their investments out of the country in a very short time. This sharp reversal of FPI flows can lead to the destabilization of the economy. This is due to the easy liquidation of these investments and their short-term horizon. This in turn can cause fluctuations in asset prices, returns, and interest rates, which eventually may lead to a liquidity crunch in the banking sector, thereby increasing opportunities for both financial and economic crises (UNCTAD, 1999).

This changing and volatile nature of FPI flows induced researchers to empirically investigate the potential effects of these flows on developing countries, particularly its possible influences on macroeconomic stability (measured by inflation rate). Some studies concluded that this type of capital flows tends to increase the inflation rate in host countries, thereby worsening economic stability However, other studies concluded that FPI flows decrease inflation rates.

Egypt, like many other developing countries, has moved towards a liberalized economy since the 1990s.

FPI flows have started to enter the Egyptian stock market since 1993 and showed a volatile nature. In 2017, Egypt emerged as one of the most important destinations for portfolio investors. The volume of net FPI flows recorded about $16 billion in the reporting year. This happened mainly due to the issuance of treasury bills by the central bank of Egypt (CBE) with an interest rate exceeding 22%, thus attracting a lot of portfolio investors to invest in the Egyptian stock market. The CBE increased the interest rate to curb the rising inflation in the Egyptian economy after liberalizing the exchange rate at the end of 2016 (The Egyptian Institute for Studies, 2018).

To this end, this study focuses on one of the most important aspects, which is how macroeconomic stability is affected by FPI Flows. It's worth mentioning that steady levels of prices can promote the economic performance of any country and correspondingly maintain economic stability (Samuelson, 1948). Accordingly, this study aims to empirically investigate the effect of net FPI flows on the inflation rate, which is s significant measure of macro-economic stability by using empirical evidence from the Egyptian economy. Empirical findings showed that FPI flows increase the inflation rate in Egypt in both the short-run & long run, thereby negatively impacting the macro-economic stability of the Egyptian economy. Therefore, controlling such a form of capital flow is necessary.

In addition to the introduction, the study is composed of three other sections: literature reviews, Data and Methodology, and Conclusion & policy implications.

II. LITERATURE REVIEW

The theoretical literature has stipulated that capital flows do influence the price levels in host countries. Robert Solow (1956), developed the new classical growth model, which illustrated that capital account liberalization leads to moving resources from developed countries where capital is plentiful and its return is low, to developing nations in which capital is rare and its return is high. This movement of resources from developed to developing countries decreases their cost of capital; thereby causing a temporary rise in investment and growth, which in turn increases the aggregate demand and thus the price level in recipient economies. Then, Bossone (2019) came up with the portfolio theory of inflation (PTI) to link a specific type of capital flows; FPI to the inflation rate. This theory clarifies how the decisions of international investors in choosing their portfolios can determine the exchange rate and inflation dynamics. It indicates that the country's credibility gap, changes in the relative dynamics of domestic versus foreign capital and public debt stocks, interest rate differentials, and foreign inflation cause variations in the domestic inflation rate. The PTI modifies the portfolio balance approach to exchange rate determination and includes the optimal inter-temporal choices from global investors who rely on the perceived policy credibility of the national authorities and their policies in distributing resources globally. This theory predicts that both the monetary and fiscal policies might be effective if the country's undertaking them enjoy strong credibility (in the eyes of the market). However, if the country's credibility is low and has a large debt, both monetary and fiscal policies might be ineffective and lead to capital outflows, thereby depreciating the exchange rate and increasing the inflation rate.

On the other hand, the asset prices channel and exchange rate channels illustrate the indirect relationship between FPI flows and the inflation rate. The asset prices channel indicates that large amounts of portfolio inflows contribute to variations in asset prices in capital-receiving countries. Since asset prices are considered leading indicators of inflation at the retail level, so portfolio inflows affect the inflation rate indirectly via their effect on asset prices. Channels through which FPI affects asset prices are: assets demand, interest rates, credit expansions, and exchange rates (Kim and Yang 2011; Aoki et al 2007; Olaberría, 2012 Cardarelli et al, 2009).

Furthermore, Taylor (1997) illustrated that Portfolio inflows affect the exchange rate in recipient economies; which in turn transmits to the domestic price level through the exchange rate pass-through (ERPT). Exchange rate pass-through is defined as" the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing countries. The exchange rate passes through to prices and works through both direct

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and indirect channels. The direct channel works through two alternatives. The first alternative occurs when exchange rate fluctuations influence import prices of production inputs; thus affecting the level of producers' prices, and accordingly the level of consumers' prices. The second one happens when exchange rate changes affect the import prices of finished products and hence the level of domestic consumer prices. Concerning, the indirect pass-through exchange rate channel, is related to product competitiveness in foreign markets. Correspondingly, there are two alternatives to the indirect transmission channel. One happens when domestic products are the main factors of production. In this situation, both levels of consumer and producers' prices are subjected to increase. The second alternative happens when the locally produced goods are finished products. Subsequently, local producers and retailers can therefore raise their selling prices to respond to price increases in foreign markets to sustain their profit margin.

Many empirical studies; including Karimo and Tobi (2013), Gumus (2013), Davis (2015), Bulut and Karluk (2016), and Aragwal (1997) showed that FPI flows had a direct positive significant effect on the inflation rate.

Nevertheless, Concerning the indirect transmission channels of asset prices and exchange rates, some empirical studies; such as Kim and Yang (2008), Taguchi et al (2014), Olaberria (2011), Ruíz (2012), and Shabbir & Mohammad (2019) concluded that FPI flows had a positive significant effect on asset prices, thereby transmitting to inflation rates. However, studies such as; Jongwish(2010), Compes et al (2012), Coparale et al (2016), Quedraogo (2017), and Erdal & Pinar (2015) found that portfolio inflows played a pivotal role in appreciating the real exchange rate, thus lowering the inflation rate. However, other studies; including Mountasir (2015), Bukovašak et al (2017), and Yeśin (2016) revealed that FPI flows had no significant impact on the exchange rate in host countries.

III. DATA AND METHODOLOGY

Data

For empirical investigation, data consists of quarterly observations, covering the period from Q_1-2004/2005 to Q_4-2019/20209since the last availability of the data ended in 2020). This time span includes the structural break that happened to the nominal exchange rate in Egypt following the exchange rate floatation adopted by the Central Bank of Egypt in November 2016.

The VAR model includes four main variables. The first variable is ***foreign portfolio investment (FPI)***. Foreign portfolio investment in Egypt includes "net transactions in foreign currencies (sales and purchases) of Egyptian securities (less than 10 %) by non-residents as reported by the Egyptian Financial Supervisory Authority (EFSA), net purchases of treasury bills by non-residents drawn from the CBE general department for securities, and non-residents' investments in Egyptian bonds issued abroad by the Egyptian government, as recorded by External Debt Statistics Dept." This variable is collected from the central bank of Egypt. FPI is measured in US$/MN.

The second variable is ***the consumer price index (CPI)***, which is a proxy for the inflation rate. It is collected from the international financial statistics database of the IMF. The CPI is the headline consumer price index to provide a comprehensive measure of inflation at the consumer level. CPI measures the changes in the prices paid by consumers for a basket of goods and services. It includes items like food & non-alcoholic beverages, clothing & footwear, health, etc. Foreign portfolio investment (FPI) and the Consumer price index (CPI) constitute the main variables in our analysis. CPI is expressed in its logarithmic transformation.

Furthermore, the study uses two control variables; the ***nominal exchange rate (N. EXCH),*** which is the (LE / US$) exchange that represents the number of units of domestic currency that are needed to purchase a unit of a given foreign currency. This variable is compiled from the Financial Monthly Statistical Bulletin of the Ministry of Finance. The nominal exchange rate is used instead of the real exchange rate for two reasons. First, this depends on the literature review that employed the nominal exchange rate instead of the real exchange rate in their VAR analysis {i.e.; Gumus (2013) & Karimo and Tobi (2013)}. Second, the study mainly aims to investigate the relationship between foreign portfolio investment and the inflation rate; therefore, using the nominal exchange rate is essential to see the effect of changes in prices over years. Moreover, since the adoption of exchange rate floatation in Egypt at the end of 2016, both the exchange rate and prices have been affected significantly. Therefore, using the real exchange rate means neglecting the prices of 2016 and using another base year. For these reasons, the model uses the nominal exchange rate instead of the real one.

It's worth noting that the model employs the regression of the nominal exchange rate on a constant, a time dummy variable, and a deterministic trend. Then, the residuals of this regression are used as the new adjusted series of the nominal exchange rate. The analysis uses this method to account for the structural break that occurred in 2016 due to the floatation of the exchange rate which resulted in devaluing the Egyptian pound against the US dollar.

The other control variable is the ***budget deficit (B.D)***. This variable is compiled from the Monthly Statistical Bulletin of the Central Bank of Egypt. It is the summation of the cash balance and the net acquisition of financial assets. Cash deficit is calculated as the (government revenues - government expenditures). B.D

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is calculated as a ratio of the gross domestic product (GDP).

Choosing budget deficit and nominal exchange rate as the control variables in the VAR model is based on the study of Gumus (2013) & Karimo and Tobi (2013). It also depends on the economic theory, as there is a linkage between these two variables and both foreign portfolio investment and the inflation rate. Capital inflows affect the budget deficit, which in turn affects interest rate; thereby affecting the production cost and eventually inflation rates. For the nominal exchange rate, it's clear that large amounts of foreign portfolio inflows lead to fluctuations in the nominal exchange rate. These fluctuations influence import prices of production inputs; thus, affecting the level of a producer's price, and accordingly the level of a consumer's price (the Exchange-Rate Pass Through (ERPT) to inflation) (Helmy, 2018).

Methodology

Unit Root Test

Before empirical estimation, it's pivotal to conduct the univariate analysis in order to determine the level of integration of the variables under study. A unit root test is a statistical test for the proposition that in an autoregressive statistical model of a time series, the autoregressive parameter is one. Augmented Dickey Filler (ADF) test is applied to test the stationarity of such variables (Pindyck & Rubinfield, 1998). ADF takes the following specification form:

$$\Delta Y_t = \propto + \beta t + (\rho - 1) Y_{t-1} \sum_{j=1}^{\rho} \gamma_j \, \Delta Y_{t-1} + \varepsilon_t \quad (1)$$

$\propto$ is a constant and t represents the time trend. We replace Y_t with the variables included in the model; which are:

- FPI_t, net foreign portfolio investment in Egypt.
- $B.D_t$, the ratio of budget deficit to GDP.
- $N.EXCH_t$, log Nominal exchange rate.
- CPI_t, log consumer price index.

J indicates the lag numbers and t refers to the time trend. The lag order selection is based on the criteria of choosing the optimal number of lags that minimizes the Scwarz-Beysian Criterion (SBC), Akaike Information Criterion (AIC), Hanna-Quinn information Criterion (HQC), Final Predictor error, or Sequential Likelihood Ratio Criterion. This model uses the log transformation of two variables; nominal exchange rate and consumer price index.

The null hypothesis (H_O) of the ADF test is $\rho = 1$ which denotes the non-stationarity of the variable. The alternative hypothesis (H_A) is < 1, which indicates the stationarity of the variable. The ADF statistic is compared with the tabulated critical value. If the absolute ADF statistic appears to be greater than the critical value, the null hypothesis will be rejected; indicating the stationarity of the series (stationary in levels). Another way is comparing the P-value with the 5 % level of significance. If the P-value is less than a 5 % significance level, the null hypothesis will be rejected, which means that the variable is stationary. On the other hand, if the P-value is greater than the 5 % significance level, the null hypothesis won't be rejected; thereby meaning that the series is more likely to be non-stationary. In this case, differencing should be applied for the series to convert it to a stationary one.

Vector Autoregressive Model (VAR)

After conducting the ADF test to check if the data is stationary or not, the vector autoregressive (VAR) model can be estimated. VAR is a system of equations in which each variable is expressed as a function of its own lagged values and the lagged values of the other variables in the model. It considers all the variables as endogenous ones (Pindyck & Rubinfeld, 1998). VAR takes the following matrix notation form:

$$Z_t = A_o + A_1 Z_{t-1} + A_2 Z_{t-2} + \cdots + A_p Z_{t-p} + \varepsilon_t \quad (2)$$

Z_t represents the vector of the endogenous variables in the model. It's replaced by CPI_t, $N.EXCH_t$, $B.D_t$, and FPI_t in the same order. A_o represents the vector of intercepts. A_1, A_2,…, and A_p are coefficient matrices that relate the current values of the variables with the lagged values. P is the lag order that minimizes one of the information criteria. ε_t is the vector of innovations(shocks) to the variables under study.

The empirical analysis of the VAR model depends on the tools of impulse response functions and variance decompositions. Impulse response functions rely on measuring the time profile of the effect of a shock on the future values of the variables in the system. Variance decompositions express the amount of information each variable contributes to the other variables in the model as a result of a shock. They indicate how the variable is important in expressing the variation of the other variables in the model (Pindyck and Rubinfeld, 1998). Moreover, the study applies the granger causality test in order to investigate causalities among the model variables.

Co-integration/ Error-Correction Model

The study also seeks to investigate the long-run relationships (co-integration) among the variables under analysis by using the Autoregressive distributed lag (ARDL) bound testing co-integration approach. Co-integration means that non-stationary time series tend to have a long-run relationship (co-integrated), if there exists a certain linear combination between them, which is stationary, I(0) (Nkoro & Uko, 2016).

There exist different co-integration techniques, which are used to test the existence of long-run relationships among the series as well as parameterize the relationships between the variables into the error correction model (ECM). These techniques include the Granger (1981), Engle and Granger (1987), Johansen and Juselius (1990) and the Autoregressive Distributed Lag (ARDL) co-integration technique or bound test of

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co-integration (Pesaran and Shin 1999 and Pesaran et al 2001). The two most widely used tests of Co-integration are the Engle & Granger two steps residual-based procedure (1987) and the Johansen Co-integration approach (1990). The Johansen co-integration approach requires all series under study to be integrated in the same order. If they are not integrated in the same order, the dependent variable should be integrated into an order less than the explanatory variables. Furthermore, there should be at least 2 independent variables that are integrated in the same order. For the multivariate time series analysis, the Johansen approach is regarded as more convenient, because it introduces all the possible co-integrating vectors (Pindyck & Rubinfeld, 1998).

Another approach suggested by Pesaran and Shin (1999) and further extended by Pesaran et al (2001), is the Autoregressive distributed lag (ARDL) approach to co-integration or bound testing co-integration technique. The advantage of this technique over the Engle & Granger (1981) and the Johansen approach (1990) is that it can be applied whether the series are I (1) or I (0), or a combination of both. Moreover, we can derive the error correction model (ECM) from the ARDL with a simple linear transformation, which combines both the short-run dynamics and long-run equilibrium adjustments without losing long-run information. Unlike traditional models, ARDL can take varying numbers of lags. The ARDL (p,q) model for two variables takes the following specification form:

$$\Delta Y_t = \mu + \delta_1 Y_{t-1} + \delta_2 X_{t-i} + \sum_{i=1}^{p-1} \alpha_i \Delta Y_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta X_{t-i} + \nu_t \quad (3)$$

μ is the intercept. Y_t is the dependent variable, X_t is the independent variable, p & q are the ARDL model lag order chosen to minimize any of the information criteria, and ν_t is the error term. δ_1 & δ_2 express the long-run relationships between variables. α_i & θ_i represent the short-run dynamics of the model.

In order to examine the presence of the long-run relationships (Co-integration) among the model variables, equation 3.3 is estimated by using the method of the ordinary least squares (OLS), and the Wald test is then used to check the joint significance of the parameters of the lagged level variables, expressing the long run relationships δ_1 and δ_2. The null hypothesis expresses the non-existence of the long-run relationship between variables relative to the alternative hypothesis.
H_0: $\delta_1 = \delta_2 = 0$ (the long-run relationship doesn't exist)
H_A: $\delta_1 \neq \delta_2 \neq 0$ (the long-run relationship exists)

This hypothesis is tested by the F- statistic (Wald test). There are two sets of critical values proposed by Pesaran et al (2001). The first one is the lower critical bound, which supposes that all variables are I (0); thereby indicating the absence of Co-integration. The other set is the upper critical bound that considers all variables are I (1), which means the existence of Co-integration among the variables under study. If the computed F- statistic is greater than the upper bound critical value, the null hypothesis will be rejected, which means that variables are co-integrated. However, if the F-statistic is less than the lower bound critical value, the null hypothesis won't be rejected, which indicates that there is no co-integration among the series under study. If the F- statistic lies between the upper and lower bounds, the co-integration test will be inconclusive (Nkoro & Uko, 2016). In addition, Nayeran (2005) introduced a set of some critical values to suit a small data set, which ranges from 30 to 80 observations.

So, if there exist long-run relationships among the variables, this means that we can apply the error correction model (ECM). ECM brings together both the short-run dynamics and the long-run relationships of the variables under study. The ECM of the ARDL is specified as follows:

$$\Delta Y_t = \pi_0 + \sum_{i=1}^{p} \pi_{1i} \Delta Y_{t-i} + \sum_{i=0}^{q} \pi_{2i} \Delta X_{t-i} + \pi_3 EC_{t-1} + \varepsilon_t \quad (4)$$

$$\widehat{EC_{t-1}} = Y_{t-1} - \hat{\mu} - \widehat{\delta_2} X_{t-1} \quad (5)$$

π_0 is the intercept, and π_3 is the adjustment parameter, which denotes how much of the disequilibrium is being adjusted. This means the extent to which the disequilibrium in the last period (Y_{t-1}) can be corrected in the current period (Y_t). π_{1i} & π_{2i} are the parameters that show the short-run dynamics of the model. ε_t represents the error term.

IV. ESTIMATION PROCEDURES AND RESULTS

Unit Root Test

Before checking for unit roots, the series of log nominal exchange rates appears to have a seasonal component. Hence, to account for the seasonal pattern in such a series, Us Census Bureau X-13 is used to perform X-11 seasonal adjustment. Therefore, this analysis uses the seasonally adjusted series of nominal exchange rates.

After accounting for the seasonal component, we find that the seasonally adjusted series of nominal exchange rates suffers from a structural break in the second quarter of the financial year (2016/2017) due to the adoption of the free-float exchange rate regime resulting in devaluing the Egyptian pound against the U.S dollar. To account for this structural shock in the series, a time dummy variable is incorporated. This study uses the regression of the seasonally adjusted series of nominal exchange rates on a constant, a time dummy variable, and a deterministic trend. Then, the residuals of this regression are used as the new adjusted series of nominal exchange rates.

After de-seasonalizing the series of the nominal exchange rate, and accounting for the structural break in

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the seasonally adjusted series of nominal exchange rate series (Adjusted N. EXCH), unit root tests are conducted using the Augmented Dickey filler (ADF) test of stationarity for the model variables. This test indicates that the series of consumer price index and the newly adjusted series of nominal exchange rates are integrated into order 1. However, budget deficit and foreign portfolio investment are stationary in levels as shown in Table 1.

Table 1: ADF test results

Variable	ADF Statistic in Levels	ADF 1% CV in levels	ADF Statistic in 1st Diff.	ADF 1% CV in 1st Diff.	Order of integration
CPI	0.736377	-3.540198	-4.791311	-3.540198	I (1)
Adjusted N. EXCH	-2.127990	-3.540198	-5.057214	-3.540198	I (1)
B. D	-6.668216	-3.538362	-6.918221	-3.546099	I (0)
FPI	-5.914061	-3.538362	-12.14407	-3.540198	I (0)

Source: Author Estimation

VAR

The VAR is estimated twice. The first time is by using the data in levels to select the suitable number of lags that minimizes one of the information criteria. According to the sequentially modified likelihood ratio criterion, the optimal number of lags is 2. Then, VAR is estimated for the second time using stationary data.

The dynamic interactions among the variables in the VAR system are investigated empirically through VAR granger causality, impulse response functions, and variance decompositions as will be analyzed through the analysis.

VAR Granger Causality

Granger causalities are estimated between the model variables using the granger causality test. As represented in table 2, results show that the series of FPI doesn't granger cause the series of CPI. In addition, CPI doesn't granger cause FPI. However, the nominal exchange rate does granger cause CPI. This means that by relying on the lagged values of the series of the nominal exchange rate, the series of CPI can be predicted. But, the opposite scenario is not correct, as CPI doesn't granger cause the nominal exchange rate.

Table 2: Granger Causality test results

Null Hypothesis	Observations	F-statistic	Probability
Net FPI doesn't granger cause D(CPI) D(CPI) doesn't granger cause Net FPI	61	1.00799 0.57274	0.3715 0.5672
D (Adjusted N. EXCH) doesn't granger cause D(LCPI) D (LCPI) doesn't granger cause D (Adjusted N.EXCH)	61	5.99790 0.97830	0.0044 0.3823
D (Adjusted N. EXCH) doesn't granger cause Net FPI Net FPI doesn't granger cause D (Adjusted N.EXCH)	61	2.18857 0.54022	0.1216 0.5856

Source: Author Estimation

Impulse Response Functions (IRFs)

Impulse response functions measure the time profile of the effect of a shock on the future values of the variables in the system. The importance of multivariate time series analysis through VAR estimation comes from the use of impulse response functions (IRFs). The impulse response function is performed using Cholesky decomposition.

In the VAR system, the results of the impulse response indicate how a one standard deviation shock to one variable affects the other variables in the system. Figure 1 shows the response of CPI to a 1 standard deviation shock to all model variables.

The examination of the IRFs indicates that the response of CPI is mainly due to its own innovations. Then, as time passes, this effect dissipates gradually. A positive shock to FPI has an insignificant effect on CPI. In addition, a positive shock to B.D has no significant effect on CPI.

However, results reveal that a positive shock to N. EXCH turns out to have a significant effect on CPI. It is clear that a positive shock to N. EXCH starts to have a significant effect on CPI after the second period of the shock. This positive shock to N. EXCH increases CPI till the third period, and then it decreases again.

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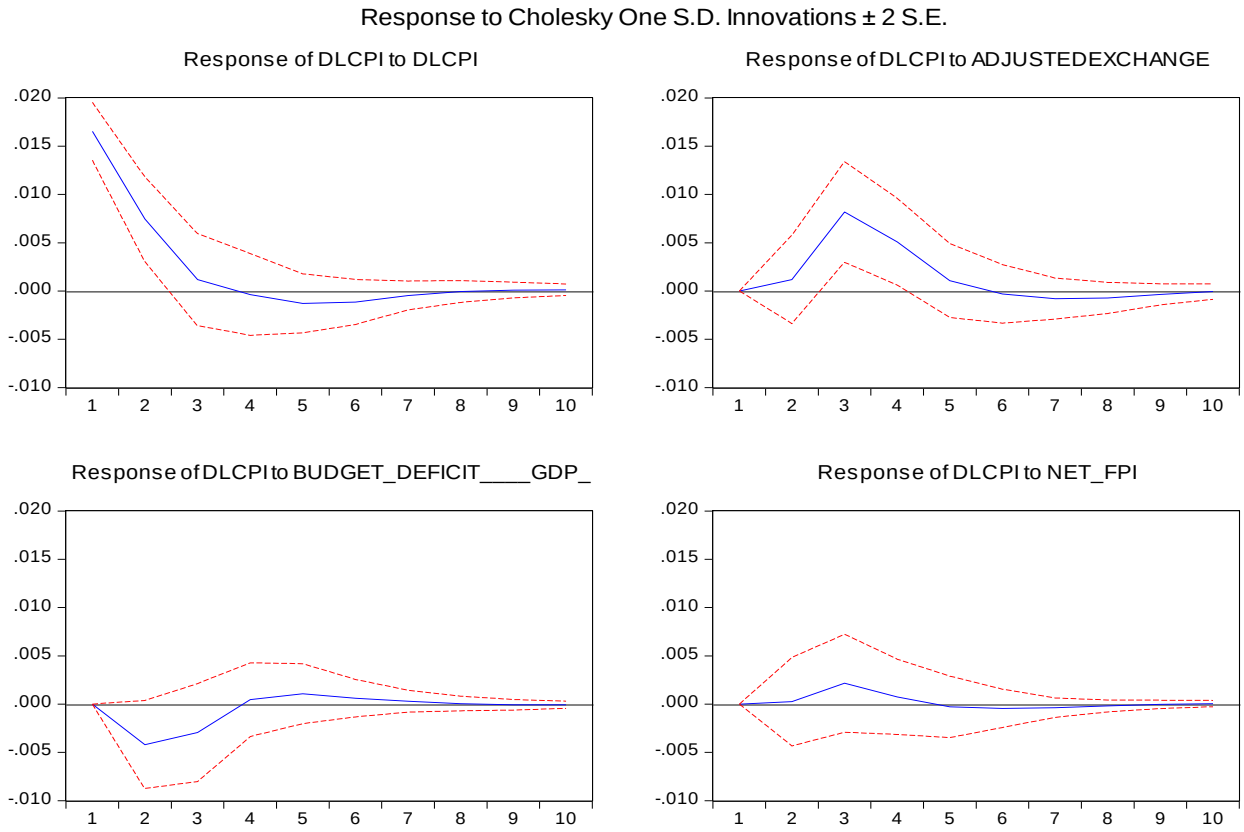

Source: Author Estimation

Figure 1: The response of CPI to 1 standard deviation shock to all model variables

Variance Decompositions

Generally, the results of the variance error decompositions match with the results of the impulse response functions. Variance decompositions give a more detailed analysis of the response of CPI to various innovations. The results of variance decompositions of the forecast error variation of CPI, over ten quarter times are represented in Table 3.

Table 3: Variance decomposition of CPI

Period	S.E	D(LCPI)	D(Adjusted N.EXCH)	B.D	Net FPI
1	0.01	100.00	0.00	0.000	0.00
2	0.01	94.53	0.40	5.04	0.01
3	0.02	76.93	15.86	6.10	1.09
4	0.02	72.44	20.60	5.79	1.15
5	0.02	72.16	20.67	5.99	1.16
6	0.02	72.14	20.60	6.04	1.20
7	0.02	72.02	20.69	6.05	1.22
8	0.02	71.93	20.78	6.04	1.23
9	0.02	71.91	20.80	6.04	1.23
10	0.02	71.91	20.80	6.04	1.23

Source: Author Estimation

As represented in Table 3, the variance decomposition of the forecast error for CPI within the unrestricted VAR shows that almost 72% of it is explained by its own innovations. The remaining 28% is explained by changes in other explanatory variables in the model. The results indicate a limited effect of FPI on CPI; because it accounts for only 1.3% of the short-run changes in CPI. Moreover, B.D represents about 6.5% of

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the forecast error variation in CPI. Yet, among the explanatory variables, N. EXCH affects greatly the changes in CPI accounting for about 21% of the forecast error variation in CPI.

Co-integration/Error Correction model

This study further uses the autoregressive distributive lag (ARDL) bound test to co-integration. The ARDL bound test to co-integration is characterized by involving a series of different orders of integration in the model compared to the Johansen approach to co-integration (Pesaran, Y, & Richard, 2001). An ARDL (2, 4, 7, 1) minimizes the Akaike Information Criterion (AIC), with 2 lags for CPI, 4 lags for N. EXCH, 7 lags for FPI, and 1 lag for B.D. Table 4 represents the ARDL bounds test's results.

Table 4: ARDL bounds test to Co-integration results

F-Test Statistic	Number of regressors	Critical value bounds		
	K	Significance level	I (0) Bound	I (1) Bound
11.90	3	10%	2.72	3.77
		5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Source: Author Estimation

From the results represented in table 4, the F statistic falls above the upper bound critical values at 1%, 2.5%, 5%, and 10% significance levels. Thus, the null hypothesis of no co-integration will be rejected. This in turn implies that there exist some equilibrium relationships in the long run among the model variables.

The estimated long-run equation from the ARDL estimation is given as:

$$CPI_t = \underset{(0.67)}{0.07} + \underset{(5.7)}{0.06}FPI_t + \underset{(2.7)}{0.5}N.EXCH_t + \underset{(3.01)}{0.01}B.D_t \quad (6)$$

The numbers in parenthesis are t-statistics. The t-statistic of FPI is greater than 2, which means that this variable is significant. Therefore, FPI has a positive significant effect on CPI in the long run. This result is consistent with the neoclassical theory that large capital inflows directed to steward economies boost their economic growth, but eventually can cause inflationary spells.

Both N. EXCH and B.D have a significant positive effect on CPI in the long run. This means that an increase in N. EXCH and B.D lead to increasing CPI, thereby increasing the inflation rate.

Once the long-run relationship is established, the short-run dynamics in an ECM can be discussed. The estimated results of the ECM are presented as follows:

$$\begin{aligned}\Delta CPI_t = {} & \underset{(-5.7)}{-0.820}\ddot{e}_{t-1} + \underset{(3.5)}{\Delta 0.44}CPI_{t-1} - \underset{(-2.4)}{\Delta 0.3}CPI_{t-2} + \underset{(1.2)}{\Delta 0.089}N.EXCH_t + \\ & \underset{(1.5)}{\Delta 0.1}NEXCH_{t-1} + \cdots + \underset{(2.01)}{\Delta 0.15}N.EXCH_{t-4} - \underset{(-0.22)}{\Delta 1.92}FPI_t + \cdots + \underset{(3.2)}{\Delta 3.24}FPI_{t-7} - \\ & \underset{(-2.5)}{\Delta 0.002}B.D_t - \underset{(4.6)}{\Delta 0.006}B.D_{t-1}\end{aligned} \quad (7)$$

From the results of the ECM, it's obvious that the error correction term is significant and less than 1. This in turn emphasizes that there exists a long-run relationship among the model variables. The error correction term displays that about 82% of the disequilibrium in the previous period is corrected in the current one. Results reveal that lag 1 and 2 of CPI have a significant effect on current CPI. Also, both FPI and N. EXCH have a positive significant influence on current CPI. FPI has a significant positive effect on CPI at lag 7. N. EXCH affects CPI positively at lag 2 and 4. However, B.D appears to have a negative significant effect on CPI at the level and lag 1. Both the short-run and long-run analysis of the ARDL confirms that both FPI and N. EXCH have a positive significant effect on CPI.

The ARDL results indicate that FPI positively affects CPI in both the short-run and the long run in the Egyptian economy. Yet, it's worth mentioning that FPI still affects CPI through the indirect channel of the exchange rate. This occurs through the effect of FPI on N. EXCH, which is transmitted to the domestic price levels through the exchange rate pass-through (ERPT) as mentioned before in chapter 1 (Taylor, 1997). However, this indirect channel of the impact of FPI on CPI is not reflected in our analysis.

V. CONCLUSION AND POLICY IMPLICATIONS

This study undertook an empirical analysis of the possible effects of FPI flows on macroeconomic

stability in the Egyptian economy by testing the influence of FPI flows on the inflation rate during the period 2004/2005- 2019/2020. The empirical results revealed that FPI flows tended to raise the inflation rate, thus worsening the macroeconomic stability of the Egyptian economy. These findings are consistent with both the theoretical and empirical backgrounds, which disclosed that large volumes of short-term volatile capital flows cause high vitalities in the exchange rates and support inflationary spells. This in turn eventually leads to financial vulnerabilities and economic instability in recipient countries.

The empirical investigation of the impact of FPI on the inflation rate showed that net FPI flows led to inflationary pressures, thus causing economic instability in the Egyptian economy. At the same time, Egypt nowadays tends to adopt an inflation-targeting framework as one of the operational frameworks of monetary policy for the purpose of achieving price stability. This in turn means that this type of foreign capital flows seems to hinder the goal of the central bank of Egypt to maintain the stability of prices. Nevertheless, it's not possible to restrain FPI inflows to the Egyptian stock market due to the compliance of the Egyptian economy with the liberalization process and international standards. Consequently, managing and controlling FPI inflows is a must.

As mentioned before, the empirical results showed that net FPI flows had a positive significant effect on the inflation rate, thus causing instability in the Egyptian economy. Results suggest that these flows should be managed in such a way that they shouldn't fuel inflationary spells in the economy. Accordingly, the study analyzes some of the policy measures that can be useful for maintaining macroeconomic instances and managing the risks associated with FPI inflows in Egypt. Some of these measures are based on the results of the empirical analysis presented in the study. However, other measures are mainly derived from successful countries' experiences in managing portfolio inflows.

Based on the empirical results of this study, some policy measures can be useful for the Egyptian economy; such as:

1. Deepening financial markets and strengthening the financial system supervision and regulation. This can be done by evaluating the creditworthiness of foreign investors as a high level of financial creditworthiness of investors is an indicator of well-functioning financial markets. Also, setting new laws and regulations can help in monitoring financial markets. Furthermore, removing infrastructure obstacles such as transaction settlement delays, legal risks, and asymmetric information problems can help to develop financial markets. In addition, maintaining financial disclosure can help to sustain stable financial systems. These actions can help in increasing the absorptive capacity and resilience of the Egyptian economy and the financial system to the risks associated with FPI inflows.
2. Encouraging institutional investors by developing institutional and regulatory frameworks, specifically the investor protection area. Such investors concentrate their investments on venture capital funds, and private equity funds, which are considered as less volatile types of FPI flows. Therefore, protecting such investors is necessary to have some stable source of FPI flows that can help in reducing instability in the macroeconomic environment. It's worth mentioning that the level of institutional development in Egypt was considerably low. The institutional framework suffered from high levels of corruption, low governance quality as well as low ratings among the world countries. Hence, Egypt should exert many efforts in order to effectively develop the legal institutional framework, in particular ensuring the execution of laws (Bacheer, 2013).
3. Encouraging stable FPI instruments; such as venture capital funds and country funds. This requires stable macroeconomic conditions, improved infrastructure, higher disclosure, and accounting standards.
4. Restricting volatile types of FPI; such as direct retail investments whose high reversals might impose risks on macro-economic stability. This can be performed by imposing some capital controls that can help in changing the composition of these flows towards longer-term types.
5. Supporting the stock market's infrastructure and the regulatory framework by improving settlement, clearance, and depositary systems. The precision of the stock market's infrastructure and the effectiveness of the regulatory framework plays a crucial role in attracting foreign institutional investors to the Egyptian stock market. Accordingly, the effective use of stable types of FPI can be enhanced; such as depositary receipts, country funds, and venture capital funds (Evan, 2002).
6. Optimizing the inflation targeting policy to cope with FPI Flows volatility. This can be pursued by solving the problem of a structural budget deficit that places a burden on the government budget through interest payment. Furthermore, the CBE's technical capabilities should be improved, including its forecasting capabilities and statistical report system. This policy facilitates the control of inflation and delivers an instrument to affect credit growth, which is important. Moreover, it offers more flexibility, including higher resistance to capital flows (Rashid, 2010)
7. Reducing the interest rate as one of the policies of non-sterilized intervention. This, in turn, reduces the volume of portfolio inflows, and accordingly the inflationary pressures associated with them.
8. Encouraging the private sector to use foreign capital in increasing production by providing it with tax exemptions, subsidies, and cost-reduction procedures. This in turn can help to increase production, rather than just add to government foreign reserves (Rashid, 2010).
9. Appreciating the nominal exchange rate. This can help to overcome the problem of overheating associated with large portfolio inflows. This policy might be

pursued when the volume of portfolio inflows is large relative to the capacity of authorities to control them. However, conducting this policy requires developing market-oriented policies to prevent worsening the level of competitiveness (IMF, 1998).

10. Performing some structural reforms measures such as privatization, deregulation, and eliminating bureaucracy. Such reforms are necessary to guarantee that large volumes of portfolio inflows are directed to finance high investment levels instead of current consumer and public spending (IMF, 1998).
11. Promoting macroeconomic stability, such as achieving high economic growth and a stable level of prices. This enables the country to face the risks accompanied by volatile types of capital inflows.
12. Imposing taxation measures as direct disincentives to FPI inflows. Such policies help to discourage short-term portfolio investors. Yet, these measures should be supervised well for countries, as they can be easily circumvented by market participants.
13. Imposing administrative restrictions on capital inflows as well as removing restrictions on capital outflows. These Policies aim at restricting the net inflows of capital whether by restricting gross capital inflows or encouraging capital outflows (Montiel, 2014).
14. Promoting fiscal restraints policies, by decreasing government expenditures or/ and increasing tax rates. Such policies accept monetary expansion but aim at offsetting the expansionary effect on aggregate demand that might result in inflation and exchange rate appreciation (IMF, 1998).
15. Emphasizing the use of policy mixes such as loose monetary- tighter fiscal policy mix, which is important to stabilize the economy and avoid inflationary pressures. This policy mix helps in discouraging portfolio inflows by keeping the domestic interest rate low and improving the exchange rate appreciation by shifting the composition of aggregate demand from the public to the private sector, where it's likely to be less non-traded goods-intensive (Montiel, 2014).

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AVAILABILITY OF DATA & MATERIALS

Data used for this study is derived from the central bank of Egypt and the Financial Monthly Statistical bulletin of the Ministry of Finance. Data is available for registered users at
https://www.cbe.org.eg/en/pages/default.aspx
https://mof.gov.eg/en

ABBREVIATIONS

FPI: Foreign Portfolio Investment; FDI: Foreign Direct Investment; CBE: Central Bank of Egypt; EPRT: Exchange Rate Pass-Through; CPI: Consumer Price Index; N. EXCH: Nominal Exchange rate; B.D: Budget Deficit; VAR: Vector Autoregressive model; ADF; Augmented Dickey Filler; ARDL: Autoregressive Distributed Lag Model; ECM: Error Correction Model.