The Impact of Exchange Rate Volatility on Economic Growth in Egypt

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Abstract:

The exchange rate is a key macroeconomic factor thatplays a vital role in the external economic activities carried out by all countries. The recent developments in international trade would appear to have exacerbated fluctuations in exchange rates. The liberalization of capital flows in the last two decades and the enormous increase in thescale of cross-border financial transactions have increased exchange rate movements.Currency crises in emerging market economies are special examples of high exchange rate volatility. The purpose of this paper is to Addressing the impact of exchange rate volatility on economicgrowth in Egypt. The empirical analysis is based on data spanning the period 1992–2018. Exchange rate volatility calculation is based on the Generalized Autoregressive Conditional Heteroskedasticity (GARCH). Using the corresponding Mixed Data Sampling (MIDAS) regression models, we found that exchange rate volatility have a significant negative impact on economic growth in Egypt.

Keywords: Exchange Rate Volatility, Economic Growth, MIDAS, Egypt.

1. Introduction:

Exchange rate is the price of a nation's currency in terms of another currency. It considered an important economic factor that affects international trade and the real economy of every country. The development of international trade leads to the emergence of fluctuations in exchange rates making financial forecasting more difficult and have a noticeable impact on unit sales, prices and costs.

In the past decades, financial innovation and competitiveness have imposed changes in the structure and institutions of the exchange market. The volume of trade in the foreign exchange markets is constantly growing,.Companies must take into account the fluctuations in exchange rates and their impact on their performance (Sequeira,et.al, 2004).

In an ideal world where changes in exchange rates could be predicted, volatility would not have significant effects even if these changes were very large. Traders may take into account the expected changes by adjusting the agreed rate, and as such, the observed movements in exchange rates will not impede trade with floating systems, however, the movements in exchange rates were largely unpredictable and thus often result in some unwanted and / or unexpected impacts on the trade balance (Aliyu, 2010).

Balance of payments difficulties in developing countries go back to the 1970s, and reached a climax in 1982. Efforts to reform exchange rates despite external shocks, with no support for fiscal and monetary policies, resulted in higher exchange rates with dire consequences for the economy. In the 1980s and 1990s, in the face of severe macroeconomic imbalances, it embarked on reforms to liberalize its economies, including reforms that were undertaken in the exchange rate and liberalization of international trade, in conjunction with structural reforms (Maehle et al., 2013).

Economists have long known that poorly managed exchange rates can be disastrous for economic growth. Avoiding currency overvaluation is one of the strongest imperatives that can be drawn from diverse experiences with economic growth around the world, and it appears to be strongly supported by statistical evidence across countries. (Razin and Collins, 1997, Johanson et.al, 2007).

The role of exchange rate volatility in economic growth is still largely debated, and there are two central and interlinked issues of exchange rate policies in the economic growth literature, the role that the exchange rate plays in facilitating or hindering economic growth, including through promoting diversification, and the extent to which the exchange rate regime and capital account management help manage cyclical swings in external financing and terms of trade fluctuations.

In this paper we investigate the impact of exchange rate volatility on economic growth in Egypt. Section 2 illustrates some literature reviews regarding the relation between exchange rate volatility and economic growth. Section 3 presents the methodology and data employed in this research. Section 4 discusses the empirical analysis results. Finally, policy recommendations follow.

2. Literature Review:

Theoretical literature on the impact of exchange rate volatility on economic growth is still a big debate among economists. The academic literature generally predicts a negative effect of exchange rate volatility on economic growth and international trade, although some evidence indicates a positive relationship. Olamide et.al, (2022) examined the influence of exchange rate and inflation on economic growth for SADC countries for the period of 2000 to 2018. Three major techniques of analyses, Pooled Mean Group (PMG), Generalized Moments (GM) and Dynamic Fixed Effect

(DFE), were employed, but the Pooled Mean Group estimator of the Panel Autoregressive Distributed Lag was favored by the Hausman test as the main instrument. The GARCH model was also employed to generate exchange rate instability. The findings of the study showed that exchange rate instability and inflation have a negative relationship with economic growth of the region. Morina, et.al, (2020), examine the impact of real effective exchange rate volatility on economic growth in the central and eastern European countries. The study addresses the effect through three channels of influence on economic growth which vary on the measurement of exchange rate volatility. The study based on the annual data for 14 CEE countries for the period 2002–2018. The empirical findings using the fixed effects estimation for panel data reveal that the volatility of the exchange rate has a significant negative effect on real economic growth. Hussaini, et.al, (2019), examine the effects of exchange rate volatility on economic growth of West African English speaking countries. Macroeconomic data used for this study were obtained from World Bank Data Stream between 1980 until 2017 and analyzed using panel data regression analysis. The results obtained showed that real exchange rate volatility is statistically significant and negatively related to the dependent variable (GDP). Adjei, (2019), investigate the effect of the exchange rate volatility on economic growth in Ghana. The study covers the period between 1983 and 2010.The variables included Exchange rate volatility and Trade Openness, GDP per capita and Physical capital stock and Human capital stock. The ARCH and GARCH were used to model the volatility of the exchange rate using monthly data. The Autoregressive Distributed Lag Approach has been employed. Results show that exchange rate volatility exerted significant negative effect on economic growth during the period both in the short and long run. Olofsson (2019), explore how exchange rate volatility affects

growth for the OECD countries. The study conducted a quantitative methodology, investigating a sample of 36 countries over 17 time periods from 2000-2016. The effect of exchange rate volatility on growth is analyzed through a content analysis and four panel-data regressions. Results show that exchange rate volatility have a negative effect on economic growth. Barguellil, et.al, (2018), examine the effect of exchange rate volatility on economic growth. An empirical investigation based on a sample of 45 developing and emerging countries over the period of 1985-2015 is conducted using the difference and system generalized method of moments estimators. Findings suggest that the nominal and real exchange rate volatility has a negative impact on economic growth. Also, the effect of exchange rate volatility depends on the exchange rate regimes and financial openness. Alagidede and Ibrahim (2016), investigate the causes and effects of exchange rate volatility on Economic Growth. The study relies on the GARCH model to measure volatility and utilizes the generalized methods of moments (GMM) to address the relation. Results reveal that excessive volatility is found to be detrimental to economic growth; however, this is only up to a point as growth-enhancing effect can also emanate from innovation, and more efficient resource allocation.

Sanginaba and Heidari, (2012), investigate the effects of exchange rate volatilities on economic growth in Iran over the flexible exchange rate regime period (1988:Q12007:Q4). The study generalized autoregressive conditional heteroscedasticity (GARCH) family models to generate time varying conditional variance of exchange rate as a standard measure of exchange rate volatility. The ARDL test approach was employed to test the relationship. Our results show a significant relationship between Iranian growth volume and real exchange rate volatility. The longrun results of ARDL model show that the effect of exchange rate volatility one economic

growth is negative. Adu – Gyamfi, (2011), measures the impact of exchange rate volatility on economic growth in Ghana both in short and long run. The study concluded that there is a negative relationship between growth and exchange rate volatility and the result was significant in the short run but insignificant in the long run due government interventions. Schnabl (2007) investigates the impact of exchange rate stability on growth for a sample of 41 mostly small open economies at the EMU periphery. It identifies international trade, international capital flows and macroeconomic stability as important transmission channels from exchange rate stability to more growth. Panel estimations reveal a robust negative relationship between exchange rate volatility and growth for countries in the economic catch-up process with open capital accounts.

Katusiime, et.al, 2016), develop an autoregressive distributed lag model to investigate the effect of exchange rate volatility on economic growth in Uganda. Using data spanning the period 1960--2011, the study found that exchange rate volatility positively affects economic growth in Uganda in both the short run and the long run. However, in the short run, political instability negatively moderates the exchange rate volatility--economic growth nexus. Verheuvel (2016), uses a three-dimensional vector auto regression model to analyze the effect of exchange rate volatility on economic growth and international trade for South Korea, before and after the Asian financial crisis of 1997. The study examined the case of South Korea and additionally analyzed whether there has been a change in the relationship following the Asian financial crisis of 1997. The results of the empirical research indeed indicate a negative relationship, although only in the short run. After a year, a shock to exchange rate volatility has a positive effect on economic growth, and this effect is permanent.

Based on the previous studies, A few studies have confirmed that exchange rate volatility can positively affect economic growth through. Most of the studies have rather proved the presence of negative effects of exchange rate volatility on economic growth. We next move to address the effect of such relation on economic growth in Egypt.

3. Methodology and data.

The exchange rate is a key indicator of the competitiveness of a country's products, If the exchange rate is undervalued, domestic products are relatively less expensive than foreign products, this may increase domestic as well as external demand for lower-priced domestic products, this will lead to higher exports and lower imports, the trade balance will improve and the domestic economy will grow.

In order to shed light on the link between fluctuations (shocks) of foreign exchange rates and economic growth in Egypt, with search Asymmetric Effects price shocks Exchange On Growth, in addition to describing the motor behavior of the growth model. We will initially rely on the model used inking& Levine (1993a, 1993b) And Levine &Zervos (1998) To put the general model in the framework of the growth equation in logarithmic form as shown in the function (1) next:

$$\boldsymbol{lnGROWTH_t = C + \beta Volatility_t + \gamma X_t + \epsilon_t} \qquad (\mathbf{1})$$

Where ($GROWTH_t$) represents the level of economic growth over time *t*, where (*t=1, 2,…,n*), *C* represents the constant of the function, ($Volatility_t$) represents the level of fluctuations in foreign exchange rates, while (X_t) is the vector of controlling variables affecting economic growth, Finally (ϵ_t) represents the error limit.

In this regard The study relationship between exchange rate fluctuations and output growth will be examined within the framework of the expanded Solo

model (Augusted Solow Model) The suggested by Mankiw et al. (1992). The role of human capital in long-term growth has emerged, highlighting the contribution of human capital to the acceleration of conditional economic convergence between countries with a common natural quota.

We relied upon the model because it is more appropriate with the data, unlike the original Solo model (1957), It is suitable for the Egyptian case as a developing country that suffers from a low accumulation of factors. Where the model asserts that the source of growth is the continuation of the accumulation of factors with dependence on the common imported global technology. This is in contrast to internal growth models, which emphasize that the source of growth is internal technological progress when the country reaches a steady-state growth path. Thus, function (1) can be developed into the following form:

$$\boldsymbol{Y_t = A_t^{\gamma} H_t^{\alpha} K_t^{\beta}} \qquad (\mathbf{2})$$

Where (Y_t) represents the output at time t, (K_t) represents the level of accumulation of physical capital (the stock of physical capital at time t), while (H_t) represents the level of accumulation of human capital (that is, the stock of human capital at time t). It expresses the stock of skills, education, competencies and other characteristics that enhance the productivity embedded in workers, while (A_t) refers to the total factor productivity (TFP), which represents the contribution of all other factors (including technology) to production except for physical and human capital.the value of the parameters (α) ،(β) ،(γ) represent the share of each productive factor in the final product.

It should be noted that function (2) a generalized function, and in order to be more specific/determined in favor of the study objective, we rely on the

idea that (TFP) Includes the effect of all other factors on the output, with the exception of physical and human capital. Since exchange rate fluctuations are among the factors that the current study proposes to affect economic growth, exchange rate fluctuations will be entered into the expanded Solo model as one of the variables of total factor productivity (TFP). Thus, the function can be assigned to be more suitable to achieve the goal of the current study in the following logarithmic form:

$$\boldsymbol{lnGrowth_t = \beta_0 + \beta_1 lnPhysicalCapital_t + \beta_2 lnHumanCapital_t + \beta_3 lnTFP_t + \varepsilon_t (3)}$$

Where; $\boldsymbol{lnTFP_t = ExchangerateVolatility_t + \chi_t}$

Where ($lnGROWTH_t$) represents the level of economic growth in Egypt at time t, where t expresses the study period (2020-1990) with a total of 31 annual observations based on the availability of data. β_0Represents the constant of the function, β_1 expresses the coefficient of physical capital accumulation in Egypt, $\beta_2$represents the coefficient of human capital accumulation, while β_3 expresses the coefficient of total factors productivity, and finally $\beta_3$which represents the random error.

The total factor productivity is modeled to represent fluctuations in foreign exchange rates ($Volatility_t$), in addition to a vector of other variablesχ_t, which represent (inflation, foreign direct investment, current account, and finally the budget deficit). A wide range of previous studies confirmed that these variables represent a transmission channel through which exchange rate fluctuations can affect economic growth.

- **Data**

The study relied on a wide range of data for Egypt, which comes from multiple databases. As for the dependent variable, which is economic

growth; the study expressed it as the real GDP variable in US dollars. As for the independent variables, production factors were expressed using indicators; Physical capital stock at constant dollar prices for the year 2017 The human capital stock index (which is calculated based on the average years of schooling and the return on education), and the total factor productivity at constant prices for the year 2017. These variables were obtained from a database (Penn world table, version 10).

In order to model the total factor productivity (TFP); in calculating fluctuations, the study relied on the average foreign exchange rate index (in the local currency against the US dollar). It represents the official foreign exchange rate contained in the International Financial Statistics of the International Monetary Fund. As for transmission channels, the study relied on the following variables obtained from the World Bank's global development database, namely;

- Index of net inflows from foreign direct investment (as a percentage of total output).
- Current account balance indicator (as a percentage of GDP).
- consumer price inflation index% annually).
- The overall budget deficit indicator (as a percentage of GDP).

- **exchange rate volatility:**

Exchange rate volatility calculation is based on the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model proposed by Bollersleg (1986)

$$dln(Exchangerate)_t|_{i_{t-1}} = \alpha + \beta X_t + u_t$$

$$\begin{cases} \alpha + \beta X_t & \text{Conditional mean equation} \\ \delta_t^2 = \lambda_0 + \lambda_1 u_{t-1}^2 + \lambda_2 u_{t-1}^2 & \text{Conditional Variance Equation} \end{cases}$$

Where:

- $dln(Exchangerate)$; The logarithm represents the first difference in exchange rates, in order to show fluctuations more accurately. It is also conditional (i_{t-1}) with the information in the previous period.
- α,X_t; Represents the equation constant (the average series of exchange rates), and the set of variables affecting exchange rates, respectively.
- u_t; Error limit *iid* (It is represented in the level of fluctuations of the exchange rate series around its average) where. $\alpha u_t|_{i_{t-1}} \sim idN(0, \delta_t^2)$ Here we note that the error*i* variance (δ_t^2) is not fixed for the observations (*Variance heteroscedasticity*).
- $\lambda_2 u_{t-1}^2 \lambda_1 \lambda_2$,; The squared constant of the error term in the previous period, and the variance of the error in the previous period, respectively. And here if it is λ_1 أو $\lambda_2$equal to zero, then the variance of the error here will be constant, that is, there is no effect ARCH. Therefore, the coefficients of the conditional variance equation must be positive, and it must be$0 < \lambda < 1$ so there (ARCH effect).

Table (1): Estimation of Exchange rate Volatility using GARCH (1, 1) model:

Dependent Variable: (Exchange rate, Average)

Method: ML - ARCH

Variable		*Coefficient*	*std. Error*	*z-Statistic*	*Prob.*
Constant	α	0.001135	0.001838	0.617333	0.5370
Variance Equitation					
C	λ_0	3.66e-05	3.69e-06	9.906921	0.0000**
RESID(-1)^2	λ_1	0.892097	0.135006	6.607846	0.0000***
GARCH(-1)	λ_2	0.806535	0.015704	51.35712	0.0000***

***Note*: ***, **, * indicate at 1%, 5% and 10% respectively.**

It is clear from the previous table that the coefficients of the conditional variance equation $\lambda_1\lambda_2$ are statistically significant and positive (less than the correct one); so there is an ARCH effect. Fluctuations can be obtained through the residuals

Unlike the orthodox time series and econometric models that operate with the assumption of constant variance, GARCH as a model is useful in the modeling of inflation and variability in the exchange rate. Table 1 shows the estimation of exchange rate volatility.

Figure (1): Exchange rate volatility through the study period.

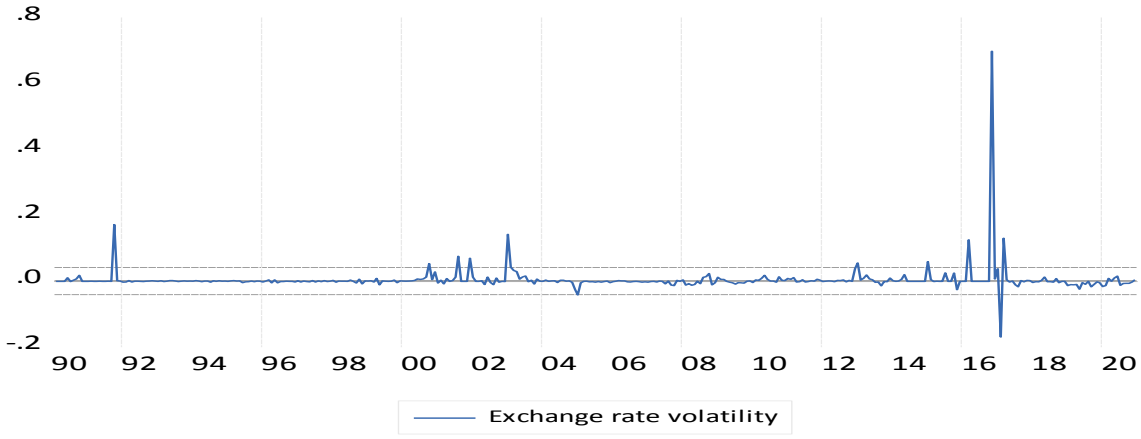


Figure (2): Conditional standard deviation for Exchange rate volatility.

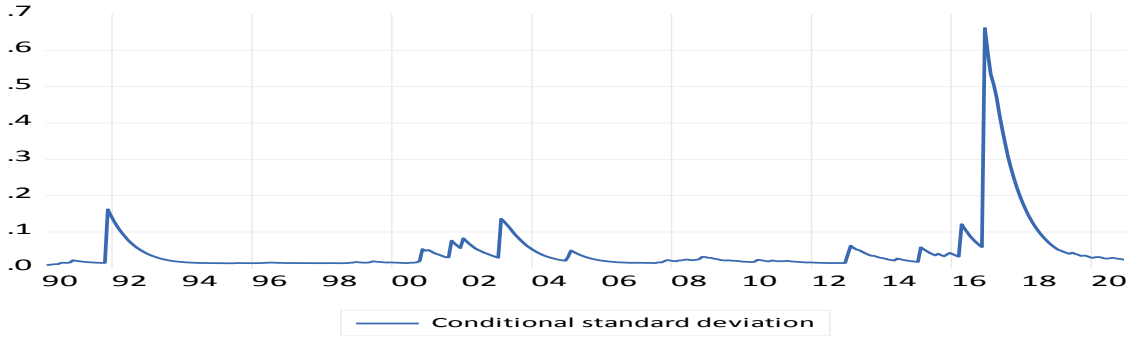


Figure 1 shows fluctuations in the exchange rate in most of the study periods. The largest shock in the exchange rate was in November 2016 as a result of floating the exchange rate. Other shocks have been occurred as for October1991 and January 2003.

- **Descriptive analysis:**

To address the model variables, appropriate descriptive statistics will be used, such as the mean, which is one of the measures of central tendency, and the standard deviation, which is one of the measures of dispersion (Table 2).

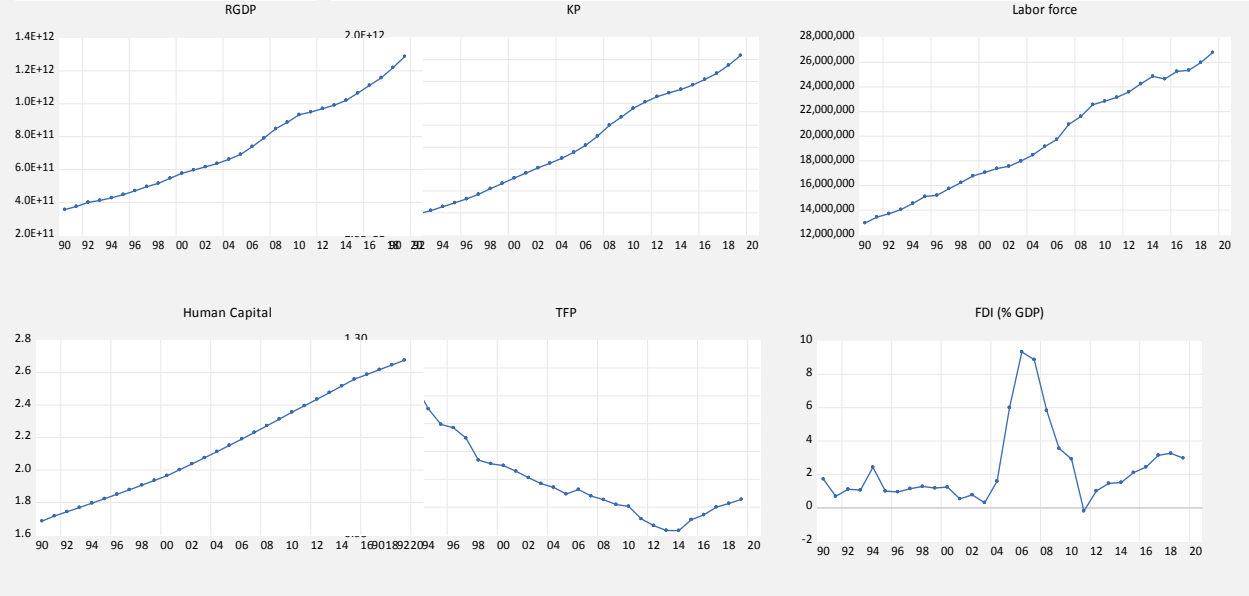
- The analysis reveals that real GDP has increased in Egypt from 87.4 billion dollars in 1990 to 313 billion dollars in 2020, with an average annual growth rate during the period equal to 4.4%. Despite this rise, Egypt is still one of the lowest-income countries in the middle-income countries
- Exchange rate volatility index witnessed only small fluctuations in the Egyptian market, average fluctuations (0.0036). With the exception of some major fluctuations/shocks, the most important of which is the liberalization of the exchange rate in November 2016, with a positive volatility of (0.698). It is followed by a shock in February 2017, with a negative volatility of (-0.17). Also the shock in October 1991 positive volatility (0.17). and the shock in January 2003 positive volatility (0.14). The rest of the fluctuations during the period were less than 1%.
- The exchange rate increase from 2.69 pounds per dollar in 1990 to 15.83 pounds per dollar in 2020 was gradually taking place on a daily basis without feeling any major shocks or fluctuations, with the exception of the aforementioned shocks, which represented major shocks. The number of time periods that witnessed positive fluctuations (i.e. an increase in the actual exchange rates above their average) was 137 time around 36.9% of the total fluctuations. On the other hand, the rest of the study period witnessed 234 of negative fluctuations (i.e. a decrease in exchange rates from their general average), that is, negative fluctuations equal to 63.1% From the total fluctuations, which indicates the relative dominance of

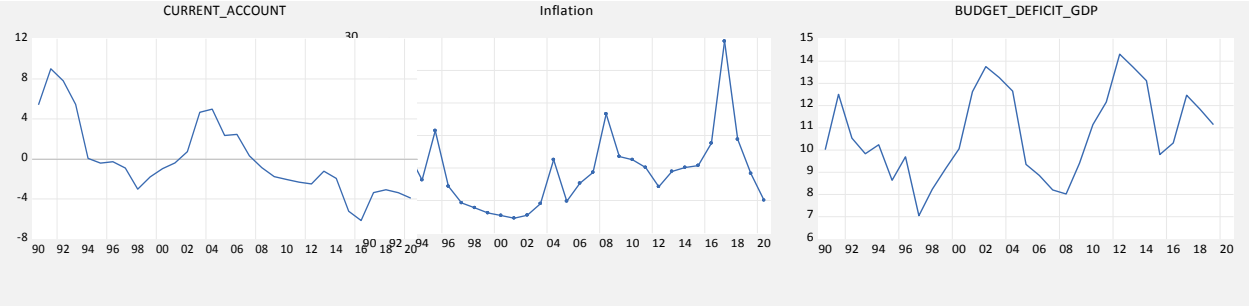
downward fluctuations on the exchange rate chain. Although the average positive volatility (0.0173) It was much larger than the average downside volatility (-0.004).

Table (2): Descriptive summary statistics

	Unit	*Obs.*	*Meaning*	*std. Dev.*	*Min*	*Max*
Dependent Variable:						
RGDP (Y)	*(in Billion 2017US$)*	30	178.00	69.10	87.400	313.00
Independent Variable:						
Real Exchange rate average	*(Local versus US$)*	372	6.5462	4.403	2.6890	18.7
Exchange rate Volatility	*(Local versus US$)*	371	0.0036	0.041	-0.1703	0.6979
Positive Exchange rate Volatility	*(Local versus US$)*	137	0.0173	0.064	3.2e-5	0.6979
Negative Exchange rate Volatility	*(Local versus US$)*	234	-0.0044	0.012	-0.1703	-2.8e-5
Control Variables:						
Physical Capital (K)	*(in Billion 2017$)*	30	243.00	116.0	84.400	447.00
Labor (L)	*(Million labor)*	30	19,568	4.365	12,962	26,795
Human Capital (H)	-	30	2.1577	0.314	1.6856	2.6768
TFP (A)	*(Index 2017=1)*	30	1.0639	0.089	0.9579	1.2569
FDI	*(% GDP)*	30	2.3694	2.325	-0.2045	9.3486
Current account	*(% GDP)*	31	-0.0779	3.708	-6.1647	9.0109
Inflation	*(annual %)*	31	10.018	5.970	2.6698	29,507
Budget current	*(% GDP)*	30	10,738	1.963	7.0477	14,314

Figure 3: Study variables trends during the study period:





- For the control variables (factors of production):The rise in real GDP during the study period resulted from a concomitant rise in direct sources/factors of production; As the stock of physical capital in Egypt increased from84.4 billion dollars in 1990 to 447 billion dollars in 2020. The workforce also increased during the period from12.96 million workers to 26.8 million workers, as well as the level of human capital included in this workforce during the period from 1.686 for each worker in 1990 to 2,678 in 2020. While the total factor productivity was witnessing a general downward trend based on the influence of other factors and business cycles.

Table (3) Correlation matrix between study variables.

		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
ln RGDP	**(1)**	1								
Exch Volatility	**(2)**	**0.1256** [0.669]	1							
ln Physical Cap.	**(3)**	**0.9954** [54.86]***	**0.1223** [0.652]	1						
ln Labor	**(4)**	**0.9980** [84.35]***	**0.1268** [0.677]	**0.9955** [55.69]***	1					
ln Humar CaP.	**(5)**	**0.9977** [78.04]***	**0.1433** [0.766]	**0.9914** [40.10]***	**0.9966** [63.95]***	1				
ln TFP	**(6)**	**-0.9200** [-12.4]***	**-0.1236** [-0.65]	**-0.9521** [-16.5]***	**-0.9301** [-13.4]***	**-0.9138** [-11.9]***	1			
ln Inflation	**(7)**	**0.1896** [1.022]	**0.0206** [0.109]	**0.1327** [0.708]	**0.1947** [1.051]	**0.2172** [1.177]	**0.0596** [0.316]	1		
ln FDI	**(8)**	**0.4265** [2.495]**	**-0.2203** [-1.19]	**0.4158** [2.419]**	**0.4292** [2.515]**	**0.4189** [2.441]**	**-0.3332** [-1.87]*	**0.3499** [1.976]*	1	
ln Curren acc.	**(9)**	**-0.6837** [-4.96]***	**-0.4534** [-2.69]**	**-0.6663** [-4.73]***	**-0.6873** [-5.01]***	**-0.6875** [-5.01]***	**0.6171** [4.149]***	**-0.0486** [-0.26]	**-0.2188** [-1.19]	1
ln Budge deficit	**(10)**	**0.2984** [1.655]	**0.1695** [0.909]	**0.3008** [1.669]	**0.2908** [1.608]	**0.3179** [1.775]*	**-0.2836** [-1.56]	**0.0269** [0.142]	**-0.4327** [-2.54]**	**0.0432** [0.229]

***Note*:** ***, **, * indicate at 1%, 5% and 10% respectively.

- The control variables that represent the channels of impact transmission indicate that Egypt is not one of the countries that attract foreign direct investments, as the average incoming investments during the period were equivalent to 2.37% of the domestic product. We also find that the average of the current account is negative and equal to -0.0779, which indicates that commercial openness to the outside world was not in Egypt's interest in most years. Inflation in Egypt is also witnessing great fluctuations. Finally, we find that Egypt's average annual budget deficit is equal to 10.74% of the GDP, however this deficit is taking a downward trend in the recent period.

- Corrolation Matrix

The Correlation Matrix that reveals the correlation analysis between the model variables using bivariate correlations are shown in table 3.

Looking at table 3, many interesting results can be noted, as follows:

- It is clear that there is a weak direct correlation and is not statistically significant (12.6%) between the annual average of the series "monthly exchange rate fluctuations" (as part of TFP) the real gross domestic product in Egypt; Despite the weak correlation between volatility and economic growth, it indicates the dominance of positive fluctuations on price fluctuations, and therefore there is a correlation to some extent between the exchange rate appreciation and the increase in the volume of real output in Egypt.
- As for the correlations between the control variables and the real GDP in Egypt; We find that all of them are consistent with the economic theory and the expected signals.
- Finally the correlation coefficients between the independent variables with each other, most of these coefficients were ranged from weak to medium forces, with the exception of the correlation between the material and human

factors of production. Therefore, these high correlations between production factors may raise the problem of the possibility of the study model being exposed to MultiColinearity problem.

- Based on the correlation matrix results, It can be expected that the impact of exchange rate fluctuations will be positive on economic growth in Egypt. It is also expected that the effect of all production factors and controlling variables on economic growth will be positive, except for the effect of the current account, which is expected to have a negative effect.

- Research methods:

1- ARDL Technique:

To find out if there is a cointegation between the variables, the ARDL technique is employed. Westarted by testing the long-term relationship between the study variables (co-integration) within the framework of the Unrestricted Error Correction Model (UECM), which is estimated by the (OLS) method, after determining the time delay periods for the first differences variables according to the Schwarz Standard (SBC):

$$\Delta lnGrowth_t = \alpha_i + \varphi_i lnGrowth_{t-1} + \delta_i^* lnPhysicalCapital_t + \theta_i^* lnHumanCapital_t + \gamma_i^* lnTFP_t + \sum_{j=1}^{m} \beta_j^{**} lnGrowth_{t-j} + \sum_{j=0}^{m} \delta_j^{**} lnPhysicalCapital_{t-1} + \sum_{j=0}^{m} \theta_j^{**} lnHumanCapital_{t-1} + \sum_{j=0}^{m} \gamma_j^{**} lnTFP_{t-1} + \mu_t$$

where$lnGrowth$ represents the dependent variable, and δ_j^{**}, , $\theta_j^{**}\gamma_j^{**}$ are the short-term coefficients (error correction). $\varphi_i\delta_i^*\theta_i^*\gamma_i^*$refers to long-term coefficients, α represents the fixed term, and the symbol Δ indicates to the first difference for the variables, while m represents the lags for the first difference variables and $\boldsymbol{\mu_t}$represents the random error term.

2- MIDAS Technique.

MIDAS technique is the regression of mixed data samples (Mixed-Data Sampling Suggested by Ghysels et.al, (2006) And Andreou et.al (2010). MIDAS is a technique that allows data to be used with different frequencies in the same regression. It allows interpreting a variable with a certain frequency (let's say annual) as a function of the current and lagged values of variables measured with higher frequencies (let's say quarterly), and of course we can also include other interpreted variables with lower frequencies, in addition to the lagging values of the dependent variable itself. MIDAS could be considered a very important type of autoregressive distributed lag where data with a high frequencies is used to help predict a variable with a low frequencies.

Specifically, the regression model MIDAS It takes the following form:

$$y_t = X_t \cdot \beta + \mathcal{f} \left(\left\{ X_{\frac{t}{s}}^{H} \right\}, \theta, \lambda \right) + \epsilon_t$$

where:

- y_t; It represents the dependent variable with low frequency in time$t$.
- X_t; It represents the set of explanatory variables with the same low frequency as the dependent variable in time$y_t t$.
- $\left\{ X_{\frac{t}{s}}^{H} \right\}$; It is the set of explanatory variables with the highest frequency.
- $\mathcal{f}$; It is a function that describes the effect of variables with higher frequency on the regression of lower frequency.
- θ, λ, β; It is the vector of parameters to be estimated.

MIDAS technique offers several different weighting functions. These weighted functions reduce the number of parameters in the model by placing

constraints on the effect of higher-frequency variables with different lags. These weights are :(step weighting), (Almon (PDL) weighting, (Exponential Almon weighting), (beta weighting), (U-MIDAS). We rely here on (Almon PDL weighting) for the estimation purposes.

Almon PDL weighting (also known as polynomial distributed lag or weighting PDL) was widely used to set constraints on the lagged coefficients in autoregressive models. So that it can be used for weighting data with different frequencies. For each lagged variable with a frequency greater than *k*, the regression coefficients are modeled as polynomial decelerated parameters. Therefore, the resulting constrained regression model can be written as:ρθ

$$y_t = X_t \cdot \beta + \sum_{\tau=0}^{k-1} X_{\frac{t-T}{S}}^{H} \cdot \left[\sum_{J=0}^{\rho} \tau^J \theta_j \right] + \epsilon_t$$

Where P is the polynomial system, the number of selected lags k could be more than or less than S.

4. Empirical evidence

In order to investigate the impact of exchange rate volatility on economic growth in Egypt, we estimate 5 models (results are shown in table 4). The first model representsthe expanded Solo model (Function 2). It includes the factors of production only, which are represented in the accumulation of physical and human capital, in addition to the total productivity of the worker. The results of this model are consistent with the economic theory, where the effect of all direct factors of production is positive on real GDP.

In order to answer the research, we estimate function (3) (regressions 2-5) where we have excluded the TFP variable a variable from the expanded

Solo model with the exchange rate fluctuations and the variables that represent transmission channels.. By moving from one regression to the next, more transmission channels are controlled. It should be noted that these regressions are estimated using MIDAS method.

Regression (2) represents the study model without transmission channels of impact. The results show that exchange rate fluctuations, have a positive effect on economic growth.

Regression (3) includes flows of foreign direct investment, and the current account as control variables.. Regression (4) expanded the model by controlling the level of inflation, and finally regression (5) which also controlled the budget deficit. It is clear from all these regressions that the impact of exchange rate fluctuations on economic growth is constant and stable regardless of the control variables. Foreign direct investment flows have positive impact on economic growth, since foreign investments supports the accumulation of factors, especially physical capital. On the other hand, we find a negative impact of inflation and the budget deficit on economic growth in Egypt. The effect of the current account on economic growth was also negative.

Table (4): Estimating the effect of Exchange rate volatility on economic growth*:*

Dependent Variable:ln RGDP

Method: MIDAS [PDL/Almon (polynomial degree: 3)]

	Independent variables	**Reg (1)**	**Reg (2)**	**Reg (3)**	**Reg (4)**	**Reg (5)**
Changed sources in TFP	ln Physical Capital	0.2452	0.3039	0.4159	0.3399	0.3906
		[3.023]**	[6.590]***	[14.86]***	[11.05]***	[22.77]***
	ln (Labor*Human Capital)	0.8231	0.5946	0.4220	0.5332	0.4649
		[8.245]***	[9.098]***	[10.56]***	[11.97]***	[18.73]***
	ln TFP	0.4367				
		[3.463]**				
	Exchange Rate Volatility		0.2979	0.3937	0.3786	0.4362
	(PDL01)		[1.928]*	[4.639]***	[6.169]***	[12.19]***
	(PDL02)		-0.22020	-0.2739	-0.2734	-0.3097
			[-2.146]**	[-5.270]***	[-7.377]***	[-14.25]***
	(PDL03)		0.0303	0.0413	0.0421	0.0471
			[2.359]**	[5.814]***	[8.158]***	[15.64]***
	lnFDI			0.0032	0.0040	0.0026
				[2.028]*	[2.845]**	[2.571]**
	ln Current account			-0.0098	-0.0079	-0.0077
				[-3.082]***	[-2.919]**	[-4.704]***
	ln Inflation				-0.0084	-0.0076
					[-3.044]**	[-5.008]***
	ln Budget deficit					-0.0081
						[-2.049]*
	Constant	6.0279	8.4708	8.4229	8.5797	8.4006
		[9.229]***	[47.98]***	[71.04]***	[84.46]***	[127.9]***
	Method	ARDL	MIDAS	MIDAS	MIDAS	MIDAS
	Adjusted R-squared	%99.99	99.92%	99.98%	%99.99	%99.99
	F-Bounds test	(6.7962)***	-	-	-	-
	Observation	26	29	27	27	27
	Las selection	(3, 4, 4, 4)	6	6	7	6
	Lag	**Exchange rate volatility / Coefficient (Distribution)**				
	0	0.126272		0.161094	0.147298	0.173539
	1	0.015233		0.011102	0.006149	0.026218
	2	-0.035146		-0.056313	-0.062858	-0.080851
	3	-0.024866		-0.041153	-0.041661	-0.048819
	4	0.046072		0.056585	0.053578	0.065314
	5	0.177669		0.236998	0.253179	0.273748
	6				0.528844	

***Note*:** ***, **, * indicate at 1%, 5% and 10% respectively.

To investigate the source of this positive effect on economic growth , we have split the exchange rate fluctuations data into positive and negative fluctuations. Results re shown in table 5.

Table 5: Estimating the effect of positive & negative exchange rate volatility on economic growth:

Dependent Variable: In RGDP

Method: MIDAS [PDL/Almon (polynomial degree: 3)]

Independent variables	***Reg (6)***	***Reg (7)***
	Negative volatility	***Positive volatility***
ln Physical Capital	0.1038	0.1546
	[5.227]***	[3.222]**
*ln (Labor*Human Capital)*	0.9328	0.8079
	[33.99]***	[11.62]***
Exchange Rate Volatility (PDL01)	1.9298	-0.0359
	[11.93]***	[-0.814]
Constant	8.0795	8.8413
	[94.09]***	[60.79]***
Method	AS	MIDAS
Adjusted R-squared	99	99.97%
Observation		13
Las selection		1
Lag	***Exchange rate volatility / Coefficient (Distribution)***	
0	1.929772	-0.035975

***Note*:** ***, **, * indicate at 1%, 5% and 10% respectively.

Regression (6) illustrates the impact of the negative fluctuations of foreign exchange rates on economic growth. Results show that there is positive impact of negative exchange rate fluctuations on economic growth.The decline in foreign exchange rates is beneficial for economic growth in Egypt. This positive impact of negative fluctuations is logical, as Egypt is a developing country that suffers from a large deficit in its balance of payments, driven by the inflexibility of the Egyptian production system and its dependence on importing raw and intermediate materials from abroad, in addition to capital equipment.

However, positive fluctuations of foreign exchange rates have no effect on the economic growth (see table 5).So that we can conclude from regression (6) and (7) that the positive impact of exchange rate fluctuations on economic growth in Egypt is affected bythe negative fluctuations, given the dominance of negative fluctuations in exchange rates on the overall fluctuation series (negative volatility accounts for 63.1% of the total fluctuations).

Table (6) provides more details about the source of the positive impact of exchange rate fluctuations on economic growth in Egypt. Results show that foreign investment flows, current account, and the level of inflation, represent transmission channels through which exchange rate fluctuations affect economic growth, while the budget deficit couldn't be considered as a transmission channel for influence.

Table (6): Estimating the effect of exchange rate volatility on economic growth through the transmission channels: we have done some estimations to identify

Dependent Variable: ln RGDP

Method: ARDL

Independent variables	**Reg (8)**	**Reg (9)**	**Reg (10)**	**Reg (11)**
Long run Coefficients:				
ln Physical Capital	0.3711 [7.558]***	-0.0364 [-1.038]	0.2462 [5.342]***	0.2598 [18.03]**
ln (Labor*Human Capital)	0.5033 [6.413]***	1.2843 [24.45]***	0.7166 [10.13]***	0.6714 [29.01]**
Exchange rate volatility	2.1399 [12.80]***	1.7889 [4.421]**	-0.3086 [-0.324]	15,592 [6.701]*
ln FDI	0.0113 [3.065]*			
Exchange volatility*ln FDI	2.0488 [4.310]**			
ln Current account		0.2146 [7.579]***		
Exchange volatility*ln Current account		-4.1555 [-5.449]**		
ln Inflation			0.0012 [0.500]	
Exchange volatility* ln Inflation			0.9421 [2.279]*	
ln Budget deficit				-0.0713 [-5.926]
Exchange volatility* ln Budget deficit				-5.0477 [-5.778]
Constant	8.1629 [84.66]***	5.5793 [17.05]**	7.8722 [107.1]***	8.4724 [199.6]***
Error Correction Model:				
ECM(-1)	-1.0394 [-35.68]***	-0.1879 [-86.99]***	-1.4294 [-20.78]***	-0.6904 [-392.2]***
Observation	27	28	27	27
Las selection	(2, 3, 3, 3, 3, 3)	(2, 2, 2, 2, 1, 2)	(2, 3, 3, 3, 1, 3)	(3, 3, 3, 3, 3, 3)
F-Bounds test	(60.612)***	(360.31)***	(30,847)***	(3139.4)***
Adjusted R-squared	%99.99	%99.99	%99.99	%99.99
Durbin-Watson stat.	2.5633	2.8621	3.1699	2.5389
Fisher test (F-stat.)	(38225)***	(450986)***	(16459)***	(2372443)***

***Note*:** ***, **, * indicate at 1%, 5% and 10% respectively.

5. Conclusion

The role of exchange rate volatility on economic growth is still largely debated. The academic literature generally predicts a negative effect of exchange rate volatility on economic growth and international trade, although some evidence indicates a positive relationship. The main purpose of our research is to investigate the impact of exchange rate volatility on economic growth in Egypt. The empirical analysis is based on data spanning the period of- 1992–2018. Exchange rate volatility is calculated using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model proposed by Bollersleg (1986. We have employed the corresponding Mixed Data Sampling (MIDAS) regression models that first proposed by Ghysels et al (2005, 2006)for the analysis purposes. Results show that measures of exchange rate volatility has a significant positive impact on economic growth in Egypt. However, the negative fluctuations accounts for 63% of the total fluctuations and it has positive impacts on economic growth. So that we could conclude that the decrease in the exchange rate has positive effects on economic growth, where the positive fluctuations don't have any significant impact on economic growth.

The paper also provides some important evidence about The transmission channels by which the exchange rate volatility affects economic growth. the research confirms that foreign investment flows, current account, and the level of inflation are important transmission channels of the exchange rate effect on economic growth, while the budget deficit couldn't be considered as a transmission channel for influence.

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أثر تقلبات سعر الصرف على النمو الاقتصادي في مصر

دكتور /دينا نبيل الشهواني

مدرس بقسم الاقتصاد كلية التجارة جامعة الزقازيق

بسمة السيد سليم ورد

المعيدة بأكاديمية الشروق القاهرة

ملخص الدراسة:

يلعب سعر الصرف ً كأحد أهم أدوات السياسة الاقتصادية الكلية دوراً هاماً في الاقتصاد القومي وخاصة النشاط الاقتصادي الدولي. وقد أثرت التطورات الحالية في مجال التجارة الدولية تأثيراً كبيراً على تقلبات أسعار الصرف، حيث أدت تدفقات رأس المال والزيادة الهائلة في حجم المعاملات الدولية إلى زيادة تقلبات سعر الصرف والتي كان لها عظيم الآثر على العديد من الاقتصاديات وخاصة الأسواق الناشئة.

تبحث الدراسة آثر تقلبات سعر الصرف على النمو الاقتصادي في مصر بالاعتماد على بيانات الفترة (1990 – 2020). حيث قامت الدراسة بحساب تقلبات سعر الصرف بإستخدام نموذج الانحدار الذاتي الشرطي المعمم GARCH. وبإستخدام نموذج إنحدار عينات البيانات المختلطة (Mixed-Data Sampling) (MIDAS) تم تقدير العلاقة بين بين متغيرات الدراسة ، وقد جاءت النتائج تؤكد وجود تأثير إيجابي معنوي لتقلبات سعر الصرف على النمو الاقتصادي في مصر. إلا أنه بمزيد من البحث والتحليل وجد أن الآثر الموجب لتقلبات سعر الصرف على النمو الاقتصادي يرجع إلى التقلبات السالبة لأسعار الصرف التي تمثل 63٪ من إجمالي التقلبات خلال فترة البحث دون التقلبات الموجبة. حيث ظهرت العلاقة بين التقلبات السالبة والنمو الاقتصادي موجبة ومعنوية متفقة بذلك مع نتائج الدراسة، بينما لم تسجل التقلبات الموجبة أثراً يذكر على النمو الاقتصادي في مصر.