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Application of a structural autoregressive vector model to determine the most important factors affecting the demand for bank deposits in Egypt

Emadeldin I.A. Ali[1], Ehab Ebrahim Mohamed Ebrahim[2*], Awadelkarim Elamin Altahir Ahmed[3]

[1]*Department of Mathematics, Statistics, and Insurance, Faculty of Business, Ain Shams University, Egypt.*
[2,3]*Department of Economics, College of Business, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia.*

Corresponding author: Ehab Ebrahim Mohamed Ebrahim (*Email: eebrahim@imamu.edu.sa*)

Abstract

The study applied the Structural Vector Autoregressive (SVAR) model to identify the most important factors influencing the demand for bank deposits in Egypt and to measure the relative importance of each of these factors. It also aimed to analyze the dynamic effects of shocks affecting the independent variables—namely the exchange rate, interest rate, inflation rate, average per capita income, and government spending—on the dependent variable, which is the volume of bank deposits. This was achieved by calculating the extent to which each shock contributes to the variance in the forecast error and by measuring the expected response of a variable when a sudden random shock occurs in one of the other variables within the model during the period from 1993 to 2023, The results of the impulse response functions indicated that the volume of bank deposits in Egypt is indeed affected by shocks to the study variables. The exchange rate was found to have a weak and declining negative effect in both the short and long term, while the interest rate exerts a negative influence in the short run that turns positive in the long run. Average per capita income shows a positive effect in the short term, which shifts to a weak negative effect in the long term. Government spending displays a fluctuating impact, ranging from a weak negative to a mild positive effect. The inflation rate was found to have a weak and decreasing negative effect in both the short and long term. Finally, the own shocks of bank deposits exhibited a strong and increasing positive effect over both time horizons.

Keywords: Bank deposits, Instant response functions, Structural autoregressive vector model.

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1. Introduction

The current study depends on applying the Structural Autoregressive Vector (SVAR) model to determine the most important factors affecting the demand for bank deposits in Egypt. There are two types of limitations related to the structural autoregressive vector model, which are:

- Constraints in the long run: depend on the basic results of the general equilibrium.
- Short-run constraints: they depend on the phenomena of the total adjustment at the level of some variables. They are related to the effects resulting from the change in the variables due to the change in one of them [1].

Many studies used statistical models to explain the most important determinants of demand for bank deposits. Therefore, there were many statistical models and methods used in those studies, as we find that there are:

- Studies based on multiple regression models, including a Study Mohammad Ali [2] aimed at analyzing the behavior of bank deposits of national commercial banks in Bangladesh from 1991 to 2006. The study found a significant positive effect of the interest rate on the volume of bank deposits and the presence of adverse development significant of the rate of inflation over the space of personal saving; the study Mostafa [3] measured the effect of time on the behavior of bank deposits by applying it to the Sudanese Al Baraka Bank during the period 1984-2006. The study found that 88% of the changes in total deposits resulted from the change in time, and 12% resulted from other factors. Another is the bank's policy towards increasing savings deposits and limiting the volume of investment deposits.
- Studies based on autoregressive (AR) models, among which we mention: Fung and McCauley [4] study, which dealt with the analysis of the relationship between deposit growth and each of the exchange rate and interest rat through the research of time series of the Thai banking sector for the period from January 1991 to March 2001 The study concluded that there is a statistically significant relationship between the decrease in the exchange rate of the local currency and the increase in deposits in foreign currency, There is also a statistically significant relationship between the high-interest rate on foreign deposits and the increase in the volume of deposits in the local currency. The study Ngula [5] examined the determinants of deposit mobilization in Ghana from 1980 to 2010. The results showed that the exchange rate, inflation rate, and Money suppliers are essential in explaining the behavior of bank deposits. The interest rate's effect is weak on bank deposits' volume.
- Studies based on autoregressive models conditional Heteroscedastic (ARCH), among which we mention: The study [6] which dealt with the analysis of time series data for banks in Pakistan for the period (January 2000 - December 2011), and the study found that inflation is one of the most critical factors affecting the increase in the percentage of deposits in currencies, The study [7] analyzed the dynamic effects of changes in interest rates and inflation towards the fluctuation of total deposits in Malaysian banks during the period (January 2000 - December 2010), and the study concluded that there was no significant relationship between the change in the interest rate and the change in total deposits of Islamic banks, While there is a substantial relationship between the change in the inflation rate and the difference in the total deposits of Islamic banks in the short and long run.
- Studies based on: Cointegration, Unit Roots Tests (URT), Extended Dickey-Fuller Test (ADF), Phillips- Perron Test (PP), and Error Correction Vector Model (VECM), including Study [8]. Which dealt with identifying the determinants of demand for bank deposits in Lebanon through analyzing time series data for 50 banks during the period from 1993 to 2008. The study concluded that local inflation and the high net interest margin affect the volume of bank deposits. The study [9] analyzed the dynamic effect of interest rates and inflation on bank deposits by analyzing data for the time series of the Bank of Ghana from 2000 to 2013. The study concluded that inflation negatively affects the volume of bank deposits in the short and long run. The long-run and the interest rate positively affect the volume of bank deposits. The study Abou El-Seoud [10] also examined the effect of interest rates and inflation on the national saving rate in Bahrain through an analysis of twenty-year time series data. The study concluded that the inflation rate positively and significantly affects the national saving rate in the short and long run. Moreover, the interest rate had a positive effect at a significant level of 1% in the short time only. The study [11] analyzed the potential determinants of domestic savings behavior in Egypt in the short and long run, analyzing data for a time series from 1975 to 2006. The study found that the real interest rate and inflation have a positive and statistically significant effect on the percentage of Domestic savings in the short and long run.

Based on the previous argument, it appears that:

- The existence of an agreement between the previous studies and the current research is identifying the most critical factors affecting the demand for bank deposits.
- The determinants of demand for bank deposits vary from country to country based on the nature of each country's economy. Most studies are unanimous in the effect of both the interest rate and the inflation rate on the volume of bank deposits. Average per capita income, government spending, interest rate, and inflation rate.
- The statistical model used in the current study differs from the statistical models used in previous studies, as it was found that previous studies did not consider the dynamic effects of shocks to which the explanatory variables are exposed on the dependent variable and to achieve this goal, the structural autoregressive vector model (SVAR) was relied upon.

1.1. Study Problem

Bank deposits play an essential role in the financing process. In light of the fluctuations that occurred in the movement of bank deposits during the study period, it was important to study these fluctuations by measuring the contribution ratios of each of the explanatory variables in explaining the variation in the prediction error of the volume of bank deposits, and

determining the variable that has the largest contribution rate, as well as studying the reflection of the impact of shocks that occur in the study variables on each other and the volume of bank deposits over time and thus can help in developing effective plans and policies aimed at increasing the volume of bank deposits, and then mobilizing resources for investment to achieve the targeted development rates.

1.2. Study Importance

The application of the structural autoregressive vector model (SVAR) leads to more accurate results than other standard models because it overcomes the shortcomings of the traditional (VAR) model, through which constraints can be set according to economic theory, allowing the analysis of the expected dynamic effects of the shocks of the explanatory variables on the dependent variable. Studying the most important factors affecting the demand for bank deposits due to the importance of bank deposits on the paths of financing and investment operations, the extent of its impact on the performance of the economic activity, and its contribution to the process of economic development.

1.3. Study Hypothesis

1- There is a statistically significant relationship between bank deposits and the interest rate.
2- There is a statistically significant relationship between bank deposits and the average per capita income.
3- There is a statistically significant relationship between bank deposits and government spending.
4- A statistically significant relationship exists between bank deposits and the exchange rate.
5- There is a statistically significant relationship between bank deposits and the inflation rate.
Limits: The study applies to bank deposits in Egypt during the period from 1993 to 2023, an annual time series.

1.4. Study Variables

The dependent variable: DEB: Annual total of bank deposits in local and foreign currency.
Independent Variables:
EX: Nominal effective exchange rate
I: rate of interest
F: inflation rate, since inflation rate = rate of change in CPI/change in consumer prices for the previous year)
GDPc: average per capita income
GS: government spending

1.4.1. Exchange Rate

The exchange rate is defined as the number of monetary units of foreign currency that are obtained in exchange for one unit of local currency. The depositors invest in foreign currencies to avoid expected exchange rate risk.

1.4.2. Interest Rate

The interest rate is defined as the price the bank pays to its customer (deposit) customer (depositor) as a result of the latter depositing his money with the bank, t in his banking operations. The interest rate is affected by three factors: monetary policy, which is affected by the money supply and circulation; financial policy, which is affected by the volume of the public debt; and the level of economic activity, which is affected by the increase in demand for loans in the case of economic boom, and vice versa in the case of depression.

1.4.3. Inflation Rate

Inflation is defined as the continuous rise in the general level of prices for a long period. There are two basic conditions for price increases to be considered inflation: the price increase is large and continuous for some time, and the price increase includes most goods and services. This includes the relationship between inflation and the volume of demand for bank deposits. The higher the inflation rate, the lower the demand for bank deposits, and vice versa. Inflation weakens the confidence of individuals in the national currency, which leads to a weakening incentive to save. It leads to commodity preference over monetary preference, i.e., keeping money in the form of different commodities and assets.

1.4.4. Average Per Capita Income

Average per capita income can be calculated as the average per capita GDP by dividing the GDP at current prices by the population, and therefore the higher the per capita income, the greater his share of bank deposits and vice versa, that is, the average per capita income affects the volume of demand for Bank deposits have a direct positive effect.

1.4.5. Government Spending

The state can increase government spending in society by increasing its expenditures on goods and services that are added to consumer and investment spending. This policy is called the expansionist policy, which is used to treat a state of stagnation that the national economy may be exposed to. The contractionary policy reduces the total spending in society by reducing spending on goods and services, which affects consumer and investment spending. Government spending affects the income of individuals and thus affects the volume of bank deposits in banks. Government spending increases the volume of bank deposits and vice versa.

1.5. Theoretical Background

The study relied on the autoregressive vector model (SVAR) to analyze the dynamic effects of shocks in each exchange rate, interest rate, inflation rate, average per capita income, and government spending on the bank deposits in Egypt, using [12] methods, through Variance Decomposition Analysis and Impulse Response Function.

The SVAR model is an update of the VAR model by comparing the two models; the VAR model considers all the internal variables and a function of all other variables in the slow periods, with no restrictions placed on the model parameters, as a result of which every equation in the system includes the same variables In addition to the reduced VAR model estimates, this is unreliable without adding economic theory constraints [13, 14]. Therefore, Watson, Blanchard and Watson [15] and Bernanke [16] developed a VAR model with a structural autoregressive vector model (SVAR) where it became possible to integrate the economic structure into the estimation and interpretation of the traditional VAR model.

Among the advantages of the SVAR model is the consideration of the interaction between internal variables and the estimation of responses to structural shocks from empirical data. 2017).

The general form of the SVAR model can be expressed as follows:

$$AY_t = A_0 + A_1Y_{t-1} + \ldots + A_pY_{t-p} + \varepsilon_t (1)$$

Given that:

A :Structural Coefficients $n \times n$ matrix

Y_t: Endogenous Variables vertical array $n \times 1$

A_0: Intercept vertical array $n \times 1$

$A_1 \ldots\ldots A_p$: The structural coefficients matrix of the model $i = 1, 2, \ldots, p$

p: number of lag periods in the model

ε_t: error term vertical array $n \times 1$

The SAVR model in matrices form can be expressed as follows:

$$\begin{pmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{pmatrix} \begin{pmatrix} EX_t \\ I_t \\ GDPc_t \\ GS_t \\ F_t \\ DEP_t \end{pmatrix} = \begin{pmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \end{pmatrix} + \begin{pmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} & b_{26} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & b_{36} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} & b_{46} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & b_{56} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} \end{pmatrix} \begin{pmatrix} EX_{t-1} \\ I_{t-1} \\ GDPc_{t-1} \\ GS_{t-1} \\ F_{t-1} \\ DEP_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix}$$

To estimate the SVAR model, multiply Equation 1 by $A^{-1}$to produce the reduced form of a VAR:

$$A^{-1}AY_t = A^{-1}A_0 + A^{-1}A_1Y_{t-1} + \ldots + A^{-1}A_pY_{t-p} + A^{-1}\varepsilon_t$$

$$Y_t = C + A_1^*Y_{t-1} + \ldots + A_p^*Y_{t-p} + e_t (2)$$

Equation 2 can be expressed as follows:

$$Y_t = C + \sum_{i=1}^{p} A_1^*Y_{t-i} + e_t \qquad (3)$$

$$A \cdot e_t = B \cdot \varepsilon_t \qquad (4)$$

Given that: $e_t$denotes SVAR residuals and $\varepsilon_t$denotes VAR residuals.

Structural coefficients matrix =$A = \begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix}$

The Diagonal Shock Matrix= $B = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix}$

Where the matrices A and B refer to the linear relationship between the residuals of the reduced and structural model, and this relationship is called the AB model, which is determined by adding constraints on some elements of the two matrices given that the minimum number of constraints is,$n = k(k-1)/2$, where k is the number of variables included in the model.

After estimating the model parameters (SVAR), the transition matrix S can be calculated where $S = A^{-1} \cdot B$; then, the structural model factors and variance can be estimated.

Steps to construct the suggested model:

1- Stationary Test

2- Determining the optimum lag

3- Granger causality

4- Johansen Cointegration Test

5- Sort the study variables
6- Estimate the parameters of the Structural Autoregressive Vector (SVAR)
7- Analyze the results of the structural autoregressive vector model using Variance Decomposition and Impulse Response Function.

1.6. Statistical Analysis

The dependent variable is the volume of bank deposits, and the exchange rate, interest rate, inflation rate, average per capita income, and government spending are independent variables from 1991 to 2020. Table 1 shows some decisive statistics for all study variables.

Table 1.
Descriptive statistics of study variables.

	DEP	EX	I	F	GDPc	GS
Mean	887339.2	6.419333	8.915333	9.726667	28783.83	2.37E+11
Median	458486	5.525	8.725	9.2	28111.04	2.26E+11
Maximum	3936076	17.69	12.32	23.5	39040.63	3.91E+11
Minimum	110171	3.25	6.02	2.3	19654.85	1.25E+11
Std. Dev.	1033994	4.284693	2.111391	5.496641	6104.434	7.63E+10
Skewness	1.702596	1.768629	0.274682	0.832293	0.015632	0.414756
Kurtosis	4.869564	4.866161	1.692567	3.285249	1.660254	2.119489
Jarque-Bera	18.86325	19.99345	2.513977	3.56527	2.24487	1.829235
Probability	0.00008	0.000046	0.28451	0.168194	0.325486	0.40067
Observations	30	30	30	30	30	30

Table 1 of the variable volume of bank deposits (DEP) indicates that the highest value of the volume of bank deposits amounted to 3.9 trillion Egyptian pounds in 2023, and the lowest value was about 458 billion Egyptian pounds in 1994, while the average was 887 billion Egyptian pounds. The ss coefficient was 1.7, and the coefficient of kurtosis was about 4.9, which is greater than 3; the distribution was leptokurtic. The results of the Jarque-Bera test show that all study variables follow a normal distribution, as the value of P is greater than 5%, except for the two variables of bank deposit volume and the exchange rate, which do not follow a normal distribution.

1.6.1. Stationary Test

Augmented Dickey–Fuller test (ADF) tests can be used to check the stationary of the time series; the null hypothesis of this test is that the unit root exists in a time series against the alternative hypothesis, which is that the unit root is not existing in a time series. The null hypothesis can be rejected if the P-value of the ADF test is smaller than the significance level of 5% and vice versa.

The expanded Dickey-Fuller test (ADF Test) was relied upon, and it was found that the time series of government spending (LGS) is static at the level. While the rest of the time series variables were shown to be static at the first difference, the first difference of the natural logarithm of these variables was carried out. Also, the degree of integration of the study variables is a mixture between level I(0) and the first difference I(1), indicating no joint integration between the model variables. The suitable model to test the study's hypotheses is the structural autoregressive vector SVAR.

Table 2.
Results of the ADF test Stationary of the study variables.

Variable	ADF	
	Level	1st difference
LDEP	-1.539532	-3.9509
	-0.7909	(0.0229) *
LEX	2.488636	-3.104406
	-0.9958	(0.0031) *
LI	-0.797434	-3.944033
	-0.3608	(0.0003) *
LF	-0.983333	-4.773242
	-0.304	(0.0000) *
LGDP	-2.87452	-3.721918
	-0.1851	(0.0387) *
LGS	-3.997409	-
	(0.0238) *	

Note: *The first values in the table represent the test statistic, and the values in parentheses represent the P-value

1.6.2. Determine the Optimal Lag

Increasing the number of lag periods leads to data loss, and the decrease in the lag periods leads to the appearance of the autocorrelation problem due to the presence of information from previous years that was not taken into consideration. The optimum number of lags can be determined by applying many measures, such as Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Sequential modified LR test statistics (LR), Final prediction error (FPE), and Hannan – Quinn Information Criterion (HQ). The smallest P-value of these tests can be used to determine the optimum number of lag periods.

Estimating the (SVAR) model requires determining the optimal lag period based on a set of criteria (LR, FPE, AIC, SC, HQ) and the lowest value corresponding to the criteria used. It is clear from the results of Table 3 that the number of optimal lag periods is one. Thus, the SVAR model will be estimated when P; thus.

Table 3.
Results of tests to determine the optimal lag period.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	161.5707	NA	3.99e-13	-11.52376	-11.23579	-11.43813
1	270.0217	160.6681*	2.00e-15*	-16.89050*	-14.87475*	-16.29111*
2	301.4691	32.61216	4.39e-15	-16.55327	-12.80974	-15.44012

Note: *It means that the criteria select the optimal lag period

1.6.3. Testing the Causality Between Variables (Granger Causality)

The Granger causality test is a statistical hypothesis test for determining whether the time series of variable x is useful in forecasting the time series of variable y. The following two equations can describe the behavior of the two variables:

$$y_t = \alpha_0 + \sum_{i=1}^{p} B_i y_{t-i} + \sum_{i=1}^{p} \phi_i x_{t-i} + \mu_{1t} (5)$$

$$x_t = \delta_0 + \sum_{i=1}^{p} \omega_i x_{t-i} + \sum_{i=1}^{p} \theta_i y_{t-i} + \mu_{2t} (6)$$

To determine the causal relationship between the variables, the appropriate number of lag periods (denoted by P) must be determined. Because if the number of lag periods is less than P, an error in characterization can occur, and if it is greater than P, It leads to a complete underutilization of the time series information and reduces the degrees of freedom. The Granger test requires the use of variables in their stationary form. The steps in the Granger test are as follows:

(a) Estimate the restricted formula as follows:

$$y_t = \alpha_0 + \sum_{i=1}^{p} B_i y_{t-i} + \varepsilon_{1t} (7)$$

Given that $\sum_{i=1}^{p} \phi_i = 0$ in Equation 5 which means that the variable *x* does not affect the variable Y, the sum of the squares of the estimated residuals can be calculated $\sum \hat{\varepsilon}_{1t}^2$from the restricted formula Equation 7.

(b) Estimate the unrestricted formula (Equation 5), and the estimated sum of squares of the residuals can be calculated from the unrestricted formula (Equation 5) $\sum \hat{\mu}_{1t}^2$.

(c) Test the null hypothesis $H_0: \sum_{i=1}^{p} \phi_i = 0$using Fisher statistic; as follows:

$$F_c = \frac{(\sum \hat{\varepsilon}_{1t}^2 - \sum \hat{\mu}_{1t}^2)/P}{\sum \hat{\mu}_{1t}^2 /(n-k)} (8)$$

Given that: n denotes the sample size, k and n-k are the numbers of estimated parameters and the degrees of freedom of the unrestricted formula. If then, $F_{calculated} > F_{critical}$ the null hypothesis can be rejected, meaning that variable X has a significant effect on variable Y and vice versa.

(d) Same steps (a to c) can be repeated using formula (6) to test the null hypothesis.

Thus, there are four possible outcomes of the Granger causality test:

- Variable X causes variable Y, and variable Y does not cause variable X
- Variable X does not cause variable Y, and variable Y causes variable X
- Variable X causes variable Y, and variable Y causes variable X
- Variable X does not cause variable Y, and variable Y does not cause variable X

After ensuring the stability of the study variable and determining the optimal lag period, a Granger test is performed for the short-run causal relationship between the study variables. When the value of Prob is greater than 5%, the null hypothesis can be accepted, which states that there is no causal relationship between the two variables. If Prob is less than 5%, the null hypothesis can be rejected, and the alternative hypothesis is accepted. This means that there is a causal relationship between the two variables. Table 4 shows that all probabilities are greater than 5%, which means that the null hypothesis is accepted; that is, there is no causal relationship between the variables, except the hypothesis indicating the causal relationship between government spending and the interest rate, as well as the causal relationship between government spending and the volume of bank deposits.

Table 4.
Results of the Granger test for the causal relationship between the study variables.

Pairwise Granger Causality Tests			
Sample: 1991 2020			
Lags: 3			
Null Hypothesis:	**Observations**	**F-Statistic**	**Prob.**
DLEX does not Granger Cause LGS	26	0.40510	0.7510
LGS does not Granger Cause DLEX		2.79967	0.0679
DLI does not Granger Cause LGS	26	1.54092	0.2365
LGS does not Granger Cause DLI		8.66772	0.0008
DLF does not Granger Cause LGS	26	1.19578	0.3381
LGS does not Granger Cause DLF		0.26284	0.8513
DLGDP does not Granger Cause LGS	26	0.50628	0.6826
LGS does not Granger Cause DLGDP		1.15051	0.3544
DLDEP does not Granger Cause LGS	26	0.54435	0.6579
LGS does not Granger Cause DLDEP		3.47897	0.0363
DLI does not Granger Cause DLEX	26	0.45395	0.7175
DLEX does not Granger Cause DLI		0.27786	0.8407
DLF does not Granger Cause DLEX	26	0.21997	0.8813
DLEX does not Granger Cause DLF		0.77154	0.5241
DLGDP does not Granger Cause DLEX	26	0.53187	0.6659
DLEX does not Granger Cause DLGDP		0.54436	0.6579
DLDEP does not Granger Cause DLEX	26	0.52754	0.6687
DLEX does not Granger Cause DLDEP		0.71914	0.5528
DLF does not Granger Cause DLI	26	0.23495	0.8709
DLI does not Granger Cause DLF		1.32669	0.2951
DLGDP does not Granger Cause DLI	26	0.27768	0.8408
DLI does not Granger Cause DLGDP		1.11192	0.3689
DLDEP does not Granger Cause DLI	26	0.78532	0.5168
DLI does not Granger Cause DLDEP		0.13142	0.9402
DLGDP does not Granger Cause DLF	26	0.49614	0.6893
DLF does not Granger Cause DLGDP		0.90706	0.4561
DLDEP does not Granger Cause DLF	26	1.38553	0.2777
DLF does not Granger Cause DLDEP		0.50021	0.6866
DLDEP does not Granger Cause DLGDP	26	0.73989	0.5413
DLGDP does not Granger Cause DLDEP		0.58644	0.6313

1.6.4. Johansen Cointegration Test

The cointegration test aims to test the long-run equilibrium relationship between the study variables, and conducting this test requires that all-time series of the study variables be integrated of the same order, that the Johansen (J - J) test [17] is one of the most important tests cointegration if more than two variables are present in the model. It is based on the Maximum likelihood with complete information (FIMS), which treats all variables in the model as internal variables, and the Johansen test includes two tests:

- Trace Test:

Through this test determines the number of significant cointegration vectors y, and the relationship is considered a common vector if the value calculated for the test is greater than the tabular value.

- Max-Eigen test:

This test helps in deciding that there is no equilibrium relationship between the study's variables.

This test requires that all-time series of the study variables be integrated of the same order, and the cointegration test aims to test the long-run equilibrium relationship between the study variables, and depending on the results of the Stationary Test, it is not possible to perform the cointegration test in the long run according to the method of (Johansen Cointegration Test) due to the incompatibility of the degree of the stability of the time series of the study variables.

1.6.5. Arranging the Study Variables

The structural autoregressive vector (SVAR) model requires the order of the study variables by testing causality, studying the relationship between the variables, and determining the causal relationship between them. The dependent variable and the independent variable can be identified. The feasibility of testing the causal relationship is not proven; the arrangement is based on several factors, including reality and the researcher's experience, previous studies, and economic theory. The variables must be arranged according to the most independent, starting from the least affected by the variables and ending with the most affected by the rest of the model variables. It is known that there are internal and external factors that affect the variables.

The structural autoregressive vector (SVAR) model requires the order of the study variables. Since the feasibility of testing the causal relationship is not proven, the arrangement is based on several factors, including reality and the experience of the researcher, previous studies, and economic theory. The variables must be arranged according to the most independent, starting from the least affected by the variables and ending with the most affected by the rest of the model variables based on the above, the variables were arranged as follows: exchange rate, interest rate, average per capita income, government spending, inflation rate, and finally, the volume of bank deposits.

1.6.6. Structural Autoregressive Vector (SVAR) model estimation:

After ensuring the study variables' stability, determining the optimal lag period, and estimating the (VAR) model. it is possible to move from the reduced form of the (VAR) model to the structural form (SVAR) by defining the transition matrix S, Whereas the structural autoregressive model aims to use the economic theory of structural shocks from residuals by restricting study variables. The general form of the SVAR formula can be expressed as follows:

$$AY_t = A_0 + A_1Y_{t-1} + \ldots\ldots A_pY_{t-p} + \beta\varepsilon_t \qquad (9)$$

SVAR model estimation can be done by estimating the VAR model, model validity test, and the SVAR model through matrices A and B.

1.6.6.1. Estimating The VAR Model and Testing the Validity of the Model

The VAR model is estimated based on lag=1 (Appendix 1), and the model can be expressed as follows:

DLDEP=0.45*DLDEP (-1)-0.08*DLEX (-1)-0.02*DLF (-1)- 0.56*DLGDPC (-1) + 0.006*DLI (-1) + 0.09*LGS (-1) - 2.47

The results of this model indicated that 47.3% of the changes that occur in the volume of bank deposits in Egypt are due to bank deposits, exchange rate, interest rate, average per capita income, government spending, and inflation rate and that the model as a whole is significant, but it has not been proven significant. The relationship between bank deposits and the interest rate, as well as the bank deposits, the exchange rate, the inflation rate, and the average per capita income, each separately, and this contradicts the hypotheses: the third, fourth, sixth, and seventh of the study, while the results indicated a significant relationship between the bank deposits and government spending, which supports the fifth hypothesis, and the validity of the estimated model was tested using Inverse Roots of AR Characteristic Polynomial.

The results showed (Appendix 2) that all the values of the inverse roots are less than one and that all points are located inside or in the vicinity of the unit circle, which means the stability condition of the estimated VAR (1) model is fulfilled.

VAR Residual Serial Correlation LM Tests: the results showed (Appendix 3) that all probabilities corresponding to the calculated test values are greater than 0.05, which means accepting the null hypothesis that the model does not suffer from the problem of autocorrelation of errors.

VAR Residual Heteroscedasticity Tests: the results showed (Appendix 4) that the probability corresponding to the value of the calculated Chi-Square statistic is greater than 0.05, which means accepting the null hypothesis that the series of residuals has a homogeneous variance.

From the previous analysis, it is clear that the estimated VAR (1) model fulfills the stationary condition, does not suffer from the problem of autocorrelation, and does not suffer from the stationary problem of variance, which means that the model is accepted and its results can be relied upon.

1.6.6.2. Estimating the (SVAR) Model through the Two Matrices A and B:

After ensuring the stability of the study variables, estimating the VAR model, and testing its validity, the minimum number of restrictions imposed was determined and reached (n=6(6-1)/2=15), and in the light of economic theory, previous studies, and the opinions of specialists and experts and according to the suitable situation of the Egyptian economy, the following constraints were imposed:

- The exchange rate variable is affected by its shock and the shocks of the two variables, inflation and government spending, and is not affected by the shocks of other variables.
- The interest rate variable: it is affected by its shock and the shocks of the following variables: inflation, average per capita income, and government spending, and it is not affected by the shocks of other variables.
- The average per capita income variable: it is affected by its shock and the shocks of the following variables: inflation, exchange rate, and government spending, and is not affected by the shocks of other variables.
- Government spending variable: affected by its shock and the shocks of the following variables: inflation, exchange rate, and average per capita income, and is not affected by the shocks of other variables.
- Inflation rate variable: It is affected by its shock and the shocks of the following variables: exchange rate, interest rate, average per capita income, and government spending, and it is not affected by the variable volume of bank deposits.
- The variable of bank deposits: it is affected by its shock and the shocks of all variables: exchange rate, interest rate, average per capita income, government spending, and inflation rate.

Thus, moving from the VAR model's reduced form to the SVAR model's structural form is possible through the two matrices, A and B. Through them, the transition matrix S can be calculated, Table 5 through which we have the factors of the structural model and its variance, in addition to the corresponding statistics for each factor.

Table 5.
Results of the model's transition matrix

Estimated S matrix:					
0.000000	0.001150	-0.012109	0.048165	-0.015832	0.014487
0.000000	0.073697	0.026969	0.097518	-0.014933	0.008692
0.000000	-0.000326	0.358282	0.295739	0.004485	0.072038
0.000000	-0.000121	-0.000637	-0.001345	0.001663	0.011849
0.000000	0.007218	0.053311	0.050681	-0.099400	0.023828
1.000000	0.002601	-0.004130	-0.004478	0.004686	-0.004456

1.6.7. Analyzing the Results of the Structural Autoregressive Vector Model Through

After estimating the SVAR model, two important analysis tools are used, which are available in the VAR model, using the effects of structural shocks and their values to reflect the amount of the effect to analyze the responses, which show the direction of the effect, which can be as follows:

First: Variance Decomposition Analysis

The analysis of variance components aims to study the reflection of the shocks and the impact of the shocked variables over time. This analysis aims to highlight the relative importance of the variables that make up the model.

Table 6.
Results of components analysis of the bank deposits variance.

Period	S.E	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6
1	0.0541140	7.1667310	8.5596030	79.2212500	5.0072860	0.0451320	0.0000000
2	0.1135240	1.6841470	2.3479660	18.4848800	2.9709790	0.2187630	74.2932700
3	0.1830310	0.7171240	0.9447250	7.1224000	1.1880630	0.1191500	89.9085400
4	0.2391900	0.4411880	0.5609340	4.1918260	0.6959470	0.0806910	94.0294200
5	0.2842130	0.3182830	0.3981120	2.9816350	0.4938170	0.0612490	95.7469000
6	0.3218100	0.2502300	0.3105570	2.3322510	0.3852550	0.0490830	96.6726300
7	0.3544860	0.2072910	0.2564460	1.9256940	0.3175670	0.0407890	97.2522100
8	0.3837730	0.1777430	0.2195750	1.6452400	0.2712230	0.0348810	97.6513400
9	0.4106000	0.1561530	0.1925780	1.4389350	0.2373140	0.0304980	97.9445200
10	0.4355350	0.1396770	0.1717870	1.2802900	0.2112810	0.0271230	98.1698400

The results of Table 6 indicate the role of each of the shocks of the variables under study in explaining the fluctuations in bank deposits during the future ten years, and they were as follows:

The results of Table 6 indicate the role of each of the shocks of the variables under study in explaining the fluctuations in bank deposits during the future ten years, and they were as follows:

- In the short run (in the second years): we find that bank deposits contribute to the largest percentage, 74.3%, in explaining the variation in prediction error of bank deposits, followed by average per capita income of 18.48%, then government spending by 2.97%, then the interest rate by 2.35%. Followed by the exchange rate at 1.68%, and finally, the inflation rate is the least influential at 0.22%.
- In the medium run (In the sixth year): bank deposits remain the most important in explaining the variation in the prediction error of bank deposits by 96.67%, followed by average per capita income by 2.33%, then government spending by 0.39%, the interest rate by 0.31%, followed by the exchange rate by 0.25%. Finally, the inflation rate is the least influential, at 0.05%.
- In the long run (In the tenth year): bank deposits remain the most influential in explaining the variation in the prediction error of the volume of bank deposits by 98.17%, followed by average per capita income by 1.28%, then government spending by 0.21%, the interest rate by 0.17%, followed by the exchange rate by 0.14. Finally, the inflation rate is the least influential by 0.03%.
- In general, it turns out that the immediate fluctuations in bank deposits in the short, medium, and long run are related to the shocks of the same variable in a very large proportion.

Second: Impulse Response Function

The immediate response function aims to analyze the structural shocks on the internal variables in the SVAR model when a shock of one unit occurs in the standard deviation of one of the model variables in the current and future values of the rest of the variables. It also shows the type of response (negative or positive) and the period required for these effects. To the estimates of the immediate response functions extended over ten years, it is possible to clarify the extent of the response of bank deposits as a result of a shock in each of the exchange rate, interest rate, average per capita income, government spending, inflation rate, as well as in bank deposits itself, according to the following Figure:

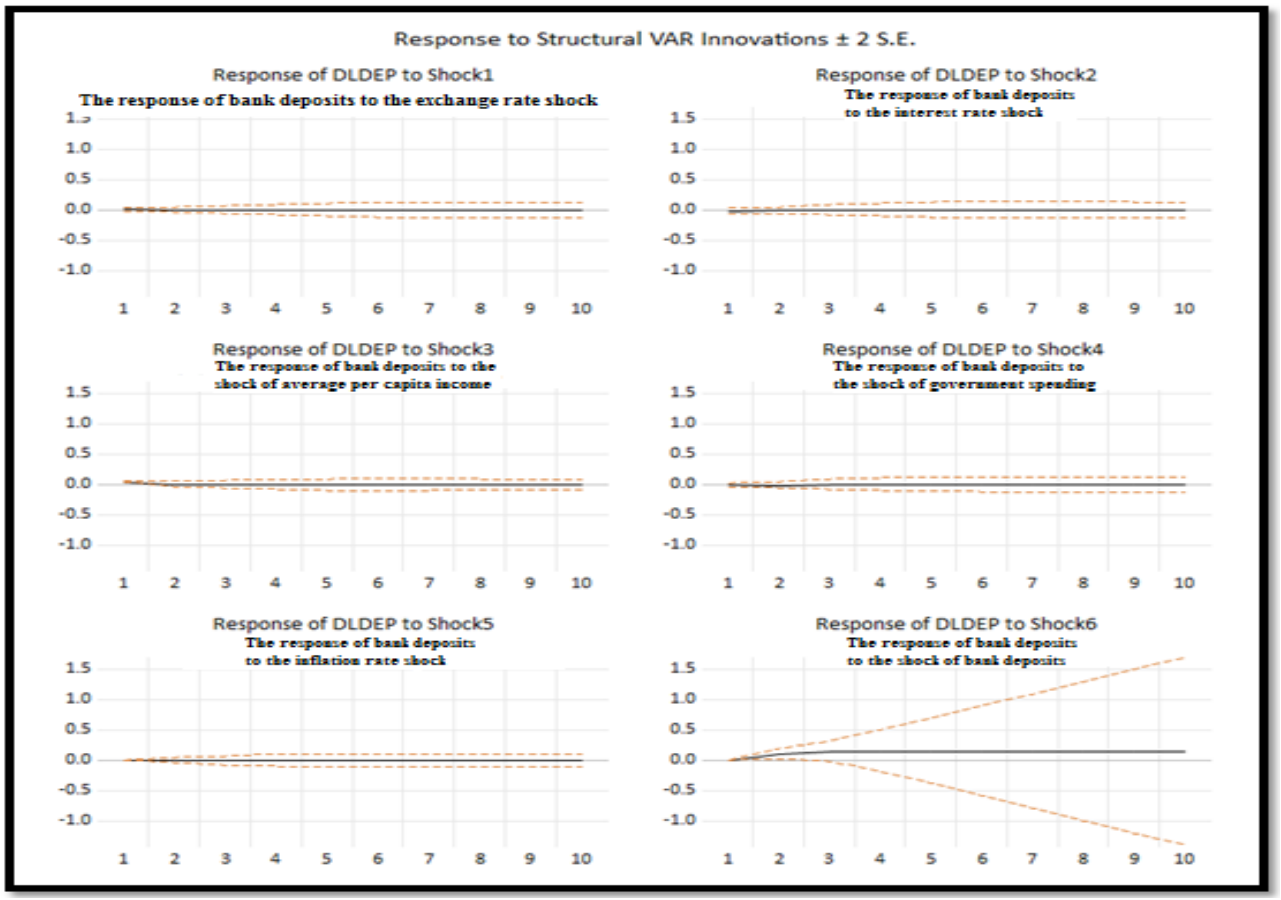

Figure 1.
Response to Structural VAR Innovations ±SE.

- It is evident from Figure 1 and the results of Appendix 5 a significant impact of shocks on each of the exchange rate, interest rate, average per capita income, government spending, inflation rate, as well as on bank deposits by one unit in the standard deviation on bank deposits, the shock response functions occurred within the critical limits at a significant level of 5%.
- The occurrence of a potential positive structural shock of one unit in the standard deviation in the exchange rate will have a weakly positive response of 0.014% on bank deposits in the first year. This response turns into a weak negative response from the second year until the end of the period in a decreasing manner, so it can be said in general that the exchange rate has a weak and decreasing negative effect on the short and long-run bank deposits. The weakness of the effect can be explained by the instability of exchange rates in Egypt during the study period, which is consistent with the lack of a significant relationship between bank deposits and the exchange rate.
- The occurrence of a potential positive structural shock of one unit in the standard deviation in the interest rate will have a weak negative response of 0.015% on bank deposits in the first year. The negative response will continue until the fifth year, and starting from the sixth year, the negative response will turn into a semi-fixed positive response until the end period, so it can be said in general that the interest rate has a negative effect in the short run and a positive effect in the long run on bank deposits. The weak effect of the interest rate on the volume of bank deposits can be explained by the fact that the investment climate and investment opportunities in Egypt are not attractive to small savings, which are the most widespread in Egypt. Therefore, individuals are looking for a haven for investment. They only find depositing their savings in banks regardless of the interest rate's value, which is consistent with the insignificant relationship between bank deposits and the interest rate.
- The occurrence of a potential positive structural shock of one unit in the standard deviation in the average per capita income will have a decreasing positive response on bank deposits in the first and second years, and starting from the third year, the positive response will turn into a weak and almost constant negative response until the end of the period, so it can be said In general, the average per capita income has a positive effect in the short run and a weak negative effect in the long run on bank deposits. This can be explained by the high marginal propensity to consume resulting from the low-income level in Egypt and, consequently, the low marginal propensity to save. This is consistent with the insignificance of the relationship between bank deposits and the average per capita income.
- The occurrence of a potential positive structural shock of one unit in the standard deviation in government spending will have a weak negative decreasing response on bank deposits starting from the first year until the third year. This negative response turns into a weakly positive response from the fourth year until the sixth year. The response returns Negative again from the seventh year until the end of the period, so it can be said that the response of bank

deposits to the shock of government spending fluctuates between a weak negative effect to a weak positive effect. The fluctuating effect of government spending on bank deposits can be explained by the fact that the government sometimes follows an expansionary policy, And periodically a deflationary policy, which, in turn, affects the incomes of individuals and thus the bank deposits.

- The occurrence of a potential positive structural shock of one unit in the standard deviation in the inflation rate will have a weakly positive response of 0.001% on bank deposits in the first year, and starting from the second year, the positive response will turn into a very weak and decreasing negative response until the end of the period so that it can be said In general, the inflation rate has a weak and decreasing negative effect in the short and long run s on bank deposits, and the negative response to the impact of inflation rates on bank deposits can be explained by the fact that the increase in inflation rates in Egypt affects the real incomes of individuals, and thus saving rates decrease, which negatively affects deposits. Banking is consistent with the insignificance of the relationship between bank deposits and the inflation rate.
- The occurrence of a potential positive structural shock of one unit in the standard deviation in bank deposits will have an increasing positive self-response on the same bank deposits over the entire period, so it can be said that the response of bank deposits to its shock will have a positive effect in the short and long run s, and it can be explained. The increasing positive response to the effect of bank deposits on themselves is that the demand of depositors to withdraw their deposits is very low because most deposits are saved for future consumption; thus, adding interest on deposits on deposit assets increases bank deposits with time.
- The conclusion of the results of the immediate response functions is that the volume of bank deposits in Egypt is affected by the shocks of the model variables, and the effect is as follows:
- The exchange rate has a weak and decreasing negative effect in the short and long run. The interest rate has a negative effect in the short run. A positive effect in the long run and average per capita income has a positive effect in the short run. A weak negative effect in the long run and the response of the volume of Bank deposits to the shock of government spending fluctuates between a weak negative effect to a weak positive effect, and the inflation rate has a weak and decreasing negative effect in the short and long run s. Finally, the response of the volume of bank deposits to its shock has a positive effect in the short and long run s.

2. Results

1- The time series stationary test results indicated that all the study variables are static at the first difference, I(1), except for the time series of government spending, which is static at the level I(0).

2- The results of the criteria used to determine the optimal deceleration period showed that the number of optimal deceleration periods is one deceleration period. Therefore, the SVAR model was estimated at P = 1.

3- The results of the Granger Causality test indicated no causal relationship between the variables, except for the hypothesis denoting a causal relationship between government spending and the interest rate, as well as the relationship between government spending and the volume of bank deposits.

4- The Johansen Cointegration Test could not be performed due to the incompatibility of the study variables' degree of stability (stillness) of the time series.

5- The study variables were arranged according to the most independent as an initial step to estimate the SVAR model. The arrangement was as follows: exchange rate, interest rate, average per capita income, government spending, inflation rate, and bank deposits.

6- The VAR model (1) was estimated. It was confirmed that the estimated model fulfills the stability condition, does not suffer from the problem of autocorrelation, and does not suffer from the pain of instability of variance, which means that the model is accepted. Its results can be relied upon, and the model takes the following formula:

$$DLDEP = 0.45DLDEP(-1) - 0.08DLEX(-1) - 0.02DLF(-1) - 0.56DLGDPC(-1) + 0.006DLI(-1) + 0.09LGS(-1) - (2.47)$$

The results of the model indicated:

That 47.3% of the changes that occur in bank deposits in Egypt are due to each of bank deposits themselves, exchange rate, interest rate, average per capita income, government spending, and inflation rate, and that the model as a whole is significant, but the relationship between bank deposits and each From the interest rate, as well as the bank deposits themselves, the exchange rate, the inflation rate, and the average per capita income, each separately, and this contradicts the hypotheses: the third, fourth, sixth, and seventh of the study, while the results indicated a significant relationship between bank deposits and government spending, which supports the hypothesis Fifth.

7- The results of the components of variance analysis indicated the following:

- In the short run: bank deposits have the most significant percentage in explaining the variance in prediction error, and bank deposits themselves rate percentage reached 74.3%, followed by average per capita income, and the least explaining variable for the variance in prediction error is inflation.
- In the medium run: bank deposits remain the most important in explaining the variation in prediction error; bank deposits themselves, at a rate of 96.67%, while the rest of the variables together explain 3.33%.
- In the long run: Bank deposits remain the most explaining variation in bank deposits' prediction error, and the percentage reached 98.17%, while the rest of the variables together explain 1.83%.

In general, the immediate fluctuations in the volume of bank deposits in the short, medium, and long run are related to the shocks of the same variable in a substantial proportion.

8- The results of the primary response functions indicated that bank deposits in Egypt are affected by the shocks of the study variables, and the effect is as follows:

- The exchange rate has a weak and decreasing negative effect in both the short and long run.
- Interest rate: It has a negative effect in the short run and a positive effect in the long run.
- Average per capita income: It has a positive effect in the short run and a weak negative effect in the long run.
- Government spending fluctuates from a weak negative to a weak positive effect.
- Inflation rate: It has a weak and decreasing negative effect in the short and long run.
- Bank deposits have a strong and increasing positive impact in the short and long run.

3. Recommendations and Future Studies

1- Conducting more studies and research related to bank deposits in Egypt because of their great importance on the paths of financing and investment operations while proposing other influencing factors such as Banks' policies towards deposits (the number of branches – the size of branches - policies for attracting deposits - ....), savings behavior of individuals, money supply, ... and others.

2- Conduct a study to compare bank deposits in local currency and deposits in foreign currency and the factors affecting each of them, and another study to compare bank deposits and short-run bank deposits and the factors affecting each.

3 - Using other statistical and standard models in studying bank deposits in Egypt and the factors affecting them, such as ARCH and GARCH models.

4- Work to increase banking awareness among individuals through appropriate means and effective methods to attract the monetary mass outside the banking system and thus increase bank deposits.

4. Conclusions

The study aimed to apply the structural autoregressive vector (SVAR) model to determine the most important factors affecting the demand for bank deposits in Egypt from 1993 to 2023. By using the (SVAR) model, is expected to increase the accuracy of the statistical prediction because it is a model that combines economic theory and time series analysis, it also enables us to analyze the dynamic effects of shocks to which the explanatory variables are exposed on the dependent variable by calculating the contribution of each shock to the variance of prediction error. Moreover, measure the expected reaction to a variable when a sudden random shock occurs in one of the other variables of the model. This study hypothesized that there is a statistically significant direct relationship between the volume of bank deposits and each of the interest rate, average per capita income, and government spending, as well as the existence of a statistically significant inverse relationship between the size of bank deposits and each of the exchange rate and inflation rate.

The study reached many results, the most important of which are: the possibility of applying the model (SVAR) where the results of the static time series test indicated that all series of model variables are stationary at the first difference except for the time series of government spending, which are stationary at the level. Ensure that the estimated model achieves stability, does not suffer from the problem of autocorrelation, and does not suffer from the pain of variance instability. This means the model is accepted, and its results can be relied upon. In general, the results of the analysis of the components of variance indicated that the volume of bank deposits in the short, medium, and long term is related to the shocks of the same variable in a substantial proportion. The results of the primary response functions indicated that the volume of bank deposits in Egypt is affected by the shocks of the variables of the study. The effect is as follows: the exchange rate has a weak and decreasing negative effect in the short and long run s, and the interest rate has a negative impact in the short run, and a positive effect in the long time, While the per capita income has a positive effect in the short run and a weak negative impact in the long run, and government spending: it has a swinging effect between a weak negative impact to a soothing, positive effect, while Inflation rate, it has a weak and decreasing negative effect in the short and long run s, and finally the volume of bank deposits, it has a strong and increasing positive effect in the short and long run. In light of the findings of the study, we recommend the following: Conducting more studies and research related to bank deposits in Egypt because of their great importance on the paths of financing and investment operations while proposing other influencing factors such as Banks' policies towards deposits (the number of branches – the size of branches - policies for attracting deposits - ....), savings behavior of individuals, money supply, ... and others. Conduct a study to compare bank deposits in local currency and deposits in foreign currency and the factors affecting each of them, and another study to compare between m bank deposits and short-run bank deposits and the factors affecting each. Work to increase banking awareness among individuals through appropriate means and effective methods to attract the monetary mass outside the banking system and thus increase bank deposits.

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Appendix 1.
Results of estimation VAR (1) model.

	DLDEP	**DLEX**	**DLF**	**DLGDPC**	**DLI**	**LGS**
DLDEP(-1)	0.453904	0.424594	3.172641	0.023935	0.055048	0.008174
	(0.27576)	(0.63887)	(2.39257)	(0.06136)	(0.64781)	(0.09134)
	[1.64601]	[0.66460]	[1.32604]	[0.39008]	[0.08498]	[0.08949]
DLEX(-1)	-0.08256	-0.049379	-0.302905	0.037122	-0.51708	-0.057457
	(0.15758)	(0.36507)	(1.36718)	(0.03506)	(0.37018)	(0.05219)
	[-0.52393]	[-0.13526]	[-0.22155]	[1.05872]	[-1.39685]	[-1.10084]
DLF(-1)	-0.022232	-0.017231	-0.109961	0.002769	0.047371	0.001068
	(0.03162)	(0.07326)	(0.27434)	(0.00704)	(0.07428)	(0.01047)
	[-0.70309]	[-0.23522]	[-0.40082]	[0.39355]	[0.63773]	[0.10193]
DLGDPC(-1)	-0.5623	-1.947707	-2.53241	0.661343	-0.316083	-0.249105
	(0.73752)	(1.70864)	(6.39891)	(0.16411)	(1.73256)	(0.24428)
	[-0.76242]	[-1.13992]	[-0.39576]	[4.02996]	[-0.18244]	[-1.01973]
DLI(-1)	0.006813	0.250688	-0.939577	-0.04087	0.701062	0.000427
	(0.12981)	(0.30074)	(1.12628)	(0.02888)	(0.30495)	(0.04300)
	[0.05249]	[0.83357]	[-0.83423]	[-1.41493]	[2.29895]	[0.00992]
LGS(-1)	0.097850	0.053966	-0.035989	-0.007866	0.039233	1.000359
	(0.04152)	(0.09620)	(0.36027)	(0.00924)	(0.09755)	(0.01375)
	[2.35649]	[0.56098]	[-0.09989]	[-0.85130]	[0.40220]	[72.7339]
C	-2.472918	-1.356095	0.581793	0.208194	-1.006661	0.037797
	(1.07362)	(2.48731)	(9.31503)	(0.23889)	(2.52212)	(0.35561)
	[-2.30334]	[-0.54521]	[0.06246]	[0.87149]	[-0.39913]	[0.10629]
R-squared	0.473065	0.243996	0.106554	0.515836	0.227612	0.997203
Adj. R-squared	0.322513	0.027995	-0.148716	0.377503	0.006929	0.996404
Sum sq. resids	0.061691	0.331116	4.643973	0.003054	0.340450	0.006768
S.E. equation	0.054200	0.125568	0.470257	0.012060	0.127326	0.017952
F-statistic	3.142192	1.129608	0.417418	3.728951	1.031399	1247.950
Log-likelihood	45.91916	22.39459	-14.5774	87.99690	22.00542	76.85800
Akaike AIC	-2.77994	-1.099614	1.541243	-5.785493	-1.071816	-4.989857
Schwarz SC	-2.446889	-0.766563	1.874294	-5.452442	-0.738764	-4.656806
Mean dependent	0.121973	0.056102	-0.046743	0.023712	-0.015477	26.17890
S.D. dependent	0.065849	0.127364	0.438762	0.015286	0.127769	0.299382

The numbers in brackets () represent the standard error, and the numbers in brackets [ ] represent the calculated t-value.

Appendix 2.
VAR model validity test.

Unit Root Test:	
Roots of Characteristic Polynomial	
Endogenous variables: DLX1 DLX2 DLX3	
DLX4 DLY LX5	
Exogenous variables: C	
Lag specification: 1 1	
Date: 09/21/22 Time: 22:10	
Root	Modulus
0.995554	0.995554
0.519678 - 0.303831i	0.601978
0.519678 + 0.303831i	0.601978
0.286054	0.286054
0.168182 - 0.147613i	0.223774
0.168182 + 0.147613i	0.223774
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Appendix 3.
VAR Residual Serial Correlation LM Tests.

Null hypothesis: No serial correlation

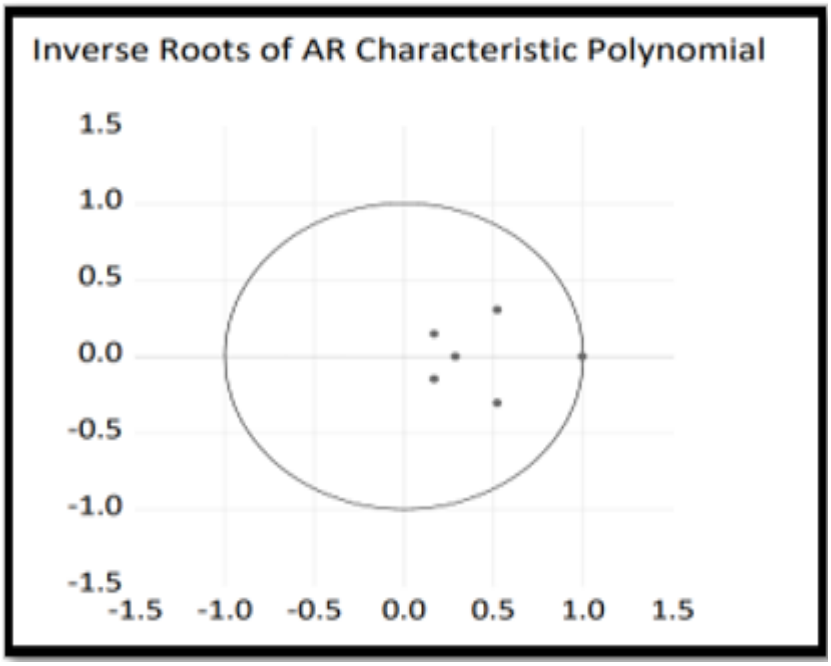
Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	38.35082	36	0.3634	1.071316	(36, 46.7)	0.4082
2	34.06269	36	0.561	0.917106	(36, 46.7)	0.6026
3	44.8638	36	0.1476	1.326331	(36, 46.7)	0.1808
4	41.85349	36	0.2317	1.205217	(36, 46.7)	0.272
5	58.37088	36	0.2906	1.946124	(36, 46.7)	0.3164

Appendix 4.
VAR Residual Heteroscedasticity Tests.

Test Statistic	Value	Df	P - Value
Chi-Square	275.6752	252	0.1462

Appendix 5.
The results of the immediate response function of the reaction.

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6
1	0.014487	-0.015832	0.048165	-0.012109	0.001150	0.000000
	(0.01759)	(0.02584)	(0.00793)	(0.01558)	(0.00188)	(0.00000)
2	-0.00268	-0.007207	0.007900	-0.015371	-0.005184	0.097850
	(0.02106)	(0.02514)	(0.02182)	(0.02355)	(0.02309)	(0.04146)
3	-0.004816	-0.003726	-0.001936	-0.003888	-0.003424	0.143335
	(0.03277)	(0.03882)	(0.03356)	(0.03877)	(0.03650)	(0.08807)
4	-0.003489	-0.002106	-0.003493	0.000400	-0.0025	0.153871
	(0.04531)	(0.05414)	(0.04332)	(0.05190)	(0.04769)	(0.17531)
5	-0.002165	-0.000814	-0.003203	0.000853	-0.00182	0.153446
	(0.05543)	(0.06438)	(0.04731)	(0.05879)	(0.05249)	(0.27078)
6	-0.001429	0.000185	-0.002615	0.000291	-0.001164	0.150911
	(0.06157)	(0.06844)	(0.04807)	(0.06133)	(0.05343)	(0.37063)
7	-0.001158	0.000796	-0.002124	-0.000281	-0.000652	0.148632
	(0.06441)	(0.06854)	(0.04768)	(0.06144)	(0.05278)	(0.47297)
8	-0.00114	0.001069	-0.001818	-0.000637	-0.000344	0.147021
	(0.06515)	(0.06701)	(0.04705)	(0.06054)	(0.05170)	(0.57617)
9	-0.001216	0.001130	-0.001672	-0.000795	-0.000209	0.145960
	(0.06485)	(0.06526)	(0.04653)	(0.05948)	(0.05073)	(0.67917)
10	-0.0013	0.001092	-0.001629	-0.000829	-0.00018	0.145230
	(0.06423)	(0.06396)	(0.04619)	(0.05864)	(0.05003)	(0.78147)
Factorization: Structural				Standard Errors: Analytic		


Inverse Roots of AR Characteristic Polynomial
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5