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Measuring and Analyzing the Impact of Some Economic Variables on Public Liquidity in Iraq for the Period (2004-2020)

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Abstract:
Purpose: The research aims to diagnose the extent of the central bank's control over public liquidity by integrating the arrangement of monetary and macro indicators in the economy, with the aim of improving the management of public liquidity within the Iraqi economy.
Theoretical framework: The research dealt with the study of analyzing the impact of some economic variables, such as public debt, gross domestic product, currency window, local credit, and general liquidity in Iraq, by using the linear regression model to describe the relationship between economic phenomena, specifically between the independent variables and the dependent variable. From here, the research problem can be formulated through interventions in the work of monetary policy tools. Therefore, it is necessary to determine the effects of financial authority on the economy by measuring the variance in the impact left by monetary tools, which is reflected in the macroeconomic variables, which are considered indicators of the efficiency of economic policy.
Design/methodology/approach: The study measures and analyses monetary data from (2004-2020) using the real-time equation model SURE to measure the impact of inward ratios (legal reserve, rediscount rate, currency window, public debt, GDP, domestic credit), on Iraq's public liquidity.
Findings: Using quantitative methods to achieve results enables us to obtain more accurate estimates than analytical results. Therefore, given the varying degrees of stability and the multiple equations included in the model, simultaneous equations models were adopted to measure the impact of monetary policy variables on the size of financial liquidity in the economy and to guide the Iraqi economy in specific directions. This approach is in line with the country's monetary policy.
Research, Practical & Social Implications: The results emphasize the need to integrate macroeconomic indicators into a standard model for measuring and analyzing public liquidity and understanding management.
Originality/value: The originality of the current research is highlighted by the analysis method used, which is the ordinary least squares (OLS) method, which is a widely used method in

measuring and estimating linear regression, which forms the basis for many standard economic models. The linear regression model was used to describe the relationship between economic phenomena, specifically between the independent and dependent variables**.**

Authors' individual contribution: Conceptualization — Q.T.S ; Methodology — Q.T.S.; Formal Analysis — Q.T.S. & M.M.A.; Investigation — M.M.A. ; Data Curation — Q.T.S. & M.M.A ; Writing —Original Draft — Q.T.S. ; Writing — Review & Editing — M.M.A. ; Visualization — M.M.A. ; Supervision — M.M.A. ; Project Administration — M.M.A.

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1. Introduction:

Liquidity is the ability to meet short-term obligations (Sunarto et al., 2021). Public Liquidity broadly influences non-financial corporate debt financing decisions (Julin et al., 2022). Public liquidity is important, especially when the private sector cannot generate sufficient assets to mitigate overall liquidity risks (Arseneau et al., 2020). The experience of the Global Financial Crisis in 2008 has shown that liquidity is central to the well-functioning of the financial system (Kahn & Wagner, 2021); (Neuhann & Sockin, 2023) pointed out that general liquidity in concentrated financial markets particularly affects risk-free debt. Public liquidity in the form of Treasury securities and central bank reserves plays a crucial role in normal and crisis times (Robatto, 2020a). Liquidity risk arises when institutions cannot meet their current and future cash flows efficiently, affecting their financial position (Saputra et al., 2020). The central bank was established as a major instrument in determining the supply of public liquidity through the purchase of securities - such as treasury bonds - and the issuance of reserves at interest (Robatto, 2020b). The ability of countries to mitigate the level of liquidity shortages faced by companies depends on how central banks respond. Thus, general liquidity plays a role in destabilizing any country's economy by amplifying the bank borrowing cycle and thus increasing investment inefficiency rates (Y. Li, 2022). The equilibrium value of public liquidity is reflected by the liquidity premium, which is the additional value or premium that investors or the market require for holding liquid assets compared to illiquid ones. The government can reduce the liquidity premium by supplying public liquidity and expanding banks' liquidity holdings (Li, 2023). After the financial crisis that the world witnessed in 2008 and the economic recession that followed, and consequently an unprecedented recession in the level of liquidity, the annual rate of M1 quadrupled in the post-crisis period (Bilbiie & Ragot, 2021). Statutory reserve requirements can have different effects on general liquidity, and an increase in reserve requirements can lead to a decrease in domestic credit and an increase in interest rate spreads at banks (Cantú et al., 2024). The legal reserve ratio is the ratio that commercial banks must maintain for all deposits placed with the central bank without collecting interest on them (Al-Lami, 2017). In addition, a positive reserve requirement shock can lead to a decline in exchange rates, an improvement in the current account, and an increase in prices (Addo & Seyram, 2013). The currency window can play a role in managing liquidity, containing public expenditures, and ensuring demand for foreign currency. However, criticism has been raised, especially about its cost and the potential waste of central bank reserves (Oleiwi, 2023). The currency-selling window is one of the tools central banks uses to influence exchange rates and general liquidity (Smith, 2018). It is a type of auction considered one-way, and it reflects the mechanisms that central banks will follow to intervene in the currency exchange markets (Mahood & Muneer, 2023).

Through it, central banks buy and sell foreign currencies to stabilize the exchange rate and control the foreign money supply in the market. Thus, central banks can influence the value of the local currency and, thus, public liquidity (Brown. A., 2020). Credit also impacts credit markets, general liquidity, and the decline in interest rates in local markets on consumer loans as

a response to the expansionary government spending shock (Auerbach et al., 2020). Moreover, studies have shown that liquidity shocks to financial institutions can negatively affect borrower performance, highlighting the interrelation between credit and liquidity (Bui et al., 2020). In the banking sector, the causes of credit risks and their associated difficulties may be multiple, such as increased risk perception. In addition, banks may accept losses from their usual financial income (Al-Husainy & Jadah, 2021). Credit Quality and Liquidity are usually highly correlated (Gómez-Puig et al., 2023). Interventions in the work of monetary policy tools are among the most important problems that affect the formulation and implementation of monetary policy and are related to the use of quantitative tools that would leave these interventions with negative effects on the Iraqi economy. Therefore, it is necessary to determine the effects of monetary authority on the economy by measuring the variation in the impact left by monetary instruments, which is reflected in macroeconomic variables, which are considered indicators of the efficiency of monetary policy. Therefore, the research aimed to monitor the Central Bank's public liquidity by integrating monetary and macro indicators in the economy to improve the management of public liquidity within the economy. The importance of the research comes in identifying the path of monetary policy in Iraq, the reflection of its monetary tools, and indicators of its efficiency in public liquidity by conveying the impact of monetary policy through its efficiency indicators, as the monetary authorities seek to track their policy and read the efficiency of their tools through a set of economic indicators.

2. Literature Review and Hypothesis Development:

The study (Elean. D, 2022) showed that startups are more sensitive to monetary policy shocks and that high financial leverage amplifies the effects. (Zhuochen et al., 2024) analyzed the effects of adopting financial technology on creating bank liquidity for a sample of American banks, and the results confirm the transformative impact of financial technology on the basic liquidity creation function within traditional banking services. The study (Al-Helo & Al-Jayashi, 2022) dealt with the level of importance of financial sustainability and the possibility of achieving it considering the risks of public debt, especially since Iraq suffers from financial and economic difficulties internally and externally. The problem of the study revolved around the effects of the rise in public debt and the difficulty it poses in achieving financial sustainability for the country. The study (al-Sahlani & abed Asadi, 2020) aimed to clarify the effect of surplus or uncontrolled expansion of monetary liquidity (M1, M2) on indicators of economic stability. The research problem focused on developing liquidity growth in the gross domestic product, the general budget, and the exchange rate. The study (Al-Hamdaney & Al-Karaawiyb, 2024) indicated that public debt is one of the economic indicators affecting money supply movements through the impact of internal debt on interest rates and monetary policy needs. The study conducted by (Al-Sharaa & Zaid, 2023) investigated the level of importance of domestic public debt and the impact of this debt on the level of stability indicators in the banking sector, as both the domestic public debt and banking stability were analyzed and explained in addition to measuring the impact between the two research variables. The study (Al-Mayahi & Shindi. A. Q, 2022) indicated that the Central Bank of Iraq was able to achieve stability in the exchange rate and improve the value of the Iraqi dinar during the period 2004-2019 by introducing a window tool for selling foreign currency. From this, we propose the following hypothesis:

There is a positive sincere relationship between monetary policy tools and general liquidity and indicators of monetary policy efficiency.

3. Methodology:

The study measures and analyses monetary data from (2004-2020) using the real-time equation model SURE to measure the impact of inward ratios (legal reserve, rediscount rate, currency window, public debt, GDP, domestic credit) on Iraq's public liquidity.

The Ordinary Least Squares (OLS) method is widely used in measuring and estimating linear regression, which forms the basis for many econometric models. It aims to provide more accurate estimates and results for parameters. The slope and intercept estimates of the straight-line equation are considered the best estimates for the data used in this method. Additionally, it is employed in analyzing macroeconomic relationships between variables within the econometric model. The linear regression model is used to describe the relationship between economic phenomena, specifically between the independent variables and the dependent variable, which the following equation can express:

$$Yi = Bo + B1X1 + B2X2 + \cdots + BnXin + ui$$

In the equation, B0, B1, B2B_0, B_1, B_2B0, B1, B2 represent the regression equation parameters, while (ui) refers to the standard error or random error value. The challenge in determining the straight line for) n) parameters is based on the value of the random error (ui), also known as the random component, which causes deviations from the linear relationship between the independent variables and the dependent variable, leading to the relationship splitting into two parts: $B1X1 + B2X2B\_1X\_1 + B\_2X\_2B1X1 + B2X2$ representing the independent variables. ui : representing the random variable resulting from the deviations of values from their mean. The Seemingly Unrelated Regression Equations (SURE) system was used for estimating simultaneous equations instead of the ordinary least squares (OLS) method because the SURE system is more efficient in estimating simultaneous equations, especially when there is more than one independent variable in a single equation. In such cases, an independent variable in one equation becomes a dependent variable in another, which applies to the other explanatory variables in the model. This indicates the presence of interactions between the equations when the error terms of the equations are correlated. This leads us to understand that the equations may be statistically related but not structurally related, as seen through the error term distribution via a non-diagonal covariance matrix across multiple equations. The Augmented Dickey-Fuller (ADF) test, one of the most important tests used to detect the presence of a unit root in time series data, was employed. This test is an extension of the simple Dickey-Fuller test, with the addition of lagged differences to address the issue of autocorrelation in the residuals. By comparing the calculated t value with its critical value, if the calculated value is greater than the critical value, the series is considered non-stationary, indicating the presence of a unit root. In such cases, differencing the series is necessary until it becomes stationary. The following equation is required to conduct the ADF test:

$$t = ßYt - 1 + ß1\sum \Delta Yt - j + et . Y\Delta$$

This developed form later became known as the Augmented Dickey-Fuller (ADF) test. This test is based on the same equations as the simple Dickey-Fuller test to determine the presence of a unit root and, consequently, the stationarity of the time series. It also relies on the same hypotheses (null and alternative) to determine whether the series is stationary or not. Therefore, the ADF test is based on the following:

$$Xt = pxt - 1 - \sum øj \Delta xt - j + 1 + Ɛt$$
$$\Delta xt = pxt - 1 - \sum øj \Delta xt - j + 1 + C + Ɛt$$
$$\Delta xt = pxt - 1 - \sum øj \Delta xt - j + 1 + C + bt + Ɛt$$

The Phillips-Perron (P.P) test was also used to eliminate the effects of autocorrelation in the residuals of the unit root test equation by making a non-parametric adjustment to the model's variance.

This adjustment takes into account the presence of autocorrelation and reflects the dynamic nature of the series. Unlike the ADF test, which uses a parametric method, the P.P test proposes a non-parametric method for correcting autocorrelation. The P.P test differs from both the simple and augmented Dickey-Fuller tests in that it does not include lagged differences. It has a better and more accurate statistical testing capability than the augmented Dickey-Fuller test, especially when the sample size is large. The P.P test is also robust to the non-fulfillment of the traditional assumptions regarding the distribution of the random error term. The Phillips-Perron test requires the estimation of the following equation:

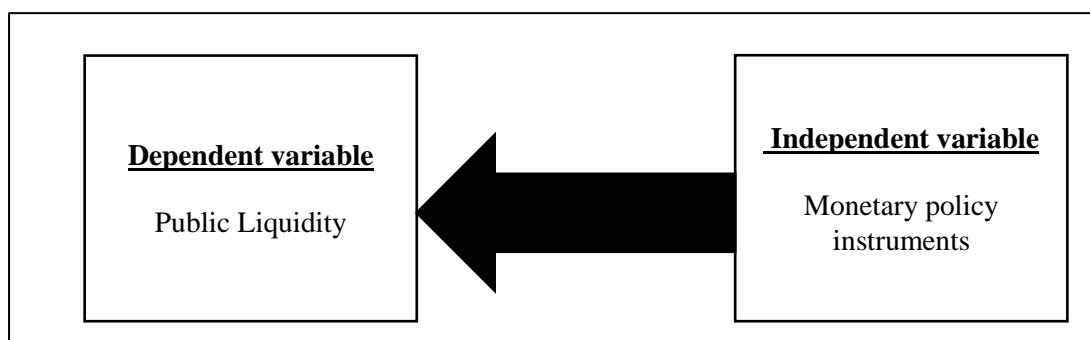$$\Delta Yt = a0 + a1Yt - 1 + a2t + et$$

Figure 1: Shows the research model

4. Results:

The econometric model is based on the equation of the Gross Domestic Product (GDP), which was formulated by relying on some studies that used the same variables. These studies demonstrate the impact of various monetary policy variables, such as the legal reserve ratio for commercial banks (X1), the discount rate (X2), the net foreign currency auction (X4), the logarithm of public debt (X12), the logarithm of GDP (Y1 LOG), and the logarithm of domestic credit granted by banks (X10 LOG).

$$LOG(X7) = C(26) + C(27) * X1 + C(28) * X2 + C(30) * X4 + C(33) * LOG(X12) + C(34) * LOG(Y1) + C(35) * LOG(X10)$$

Table (1) indicates the nature of the relationships between the variables used in the model based on the nature of economic relationships and previous economic literature. This allows us to understand the relationships between the independent and dependent variables, as shown in the following table :

Table1: The nature of the relationships between economic variables in the simultaneous equations

Public Liquidity Equation				
Reversible	LOG(X7)	Legal reserve	X1
Reversible	LOG(X7)	Re-discount price	X2
Expulsion	LOG(X7)	Net currency selling window	X4
Reversible	LOG(X7)	Public debt	LOG(X12)
Expulsion	LOG(X7)	gross domestic product	LOG(Y1)
Expulsion	LOG(X7)	Local credit	LOG(X10)

Source : Researchers

The equation of Public Liquidity estimated the impact of the legal reserve, the discount rate, the net foreign currency auction, public debt, GDP, and domestic credit on Public Liquidity. Table (2) shows the statistical results that were reached through the basic equations of the proposed model: statistical tests of the equations used in the proposed model :

Table 2 : Statistical results for the simultaneous equations

Durbin-Watson stat	S.E. of regression	Adjusted R-squared	R-squared	equations
1.759995	0.431361	0.755485	0.841784	Public Liquidity

Source : E-views 10.

The results from table (2) of the statistical tests show that the coefficient of determination for the Public Liquidity equation is (84%). This indicates that the independent variables included in the model account for 84% of the variance in the dependent variable.
The remaining percentage is due to other factors not included in the model. Therefore, the model's explanatory power is considered good. Table (3) shows the results of the Jarque-Bera test for the model used :

Table3: Results of the normal distribution test (Jarque-Bera)

Component	Jarque-Bera	df	Prob.
4	0.462913	2	0.7934

Source : Researchers

Table (3) shows the normal distribution of the data included in the time series. The results indicate that the time series are normally distributed, and this is evident from the probability value (Prob.), which was greater than (0.05) for the standard model equation. Therefore, we can rely on our results to measure the impact of monetary policy on Public Liquidity and direct the Iraqi economy as long as the conditions of normal distribution are met. After estimating the Public Liquidity equation according to the simultaneous equations, we can interpret the results of that equation, as shown below :

Table 4 : Estimation results of the Public Liquidity Equation

	Coefficient	Std. Error	t-Statistic	Prob.
C (26)	-31.812	0.367	-86.649	0.000
C (27)	9.98e-08	0.000	-4.647	0.000
C (28)	0.128	0.020	6.386	0.000
C (30)	0.000	0.000	-5.057	0.000
C (33)	8.509e-5	0.000	-1.765	0.083
C (34)	2.703	0.000	33005.490	0.000
C (35)	-0.050	0.020	-2.525	0.014

Source : researcher

$$LOG(X7) = -31.811 + 9.98 * X1 - 0.128 * X2 - 0.00022 * X4 - 8.509 * LOG(X12) + 2.703 * LOG(Y1) + 0.049 * LOG(X10)$$

R^2=(0.841784)
$R^{2'}$=(0.755485)

The results of the general liquidity equation estimation indicate a positive relationship between general liquidity $LOG(X7)\text{LOG}(X7)LOG(X7)$ and the legal reserve $X1X1X1$. An increase of 1% in the foreign reserve leads to an increase in general liquidity by 9.98 monetary units. This suggests the positive effects of an increase in foreign reserves, as higher reserves allow monetary and fiscal policy to expand public spending and increase overall liquidity in the economy.For the relationship between general liquidity $LOG(X7)\text{LOG}(X7)LOG(X7)$ and the discount rate $X2X2X2$, it was found to be inverse. An increase in the discount rate leads to a decrease in general liquidity in the economy by -0.128 monetary units. The relationship between general liquidity $LOG(X7)\text{LOG}(X7)LOG(X7)$ and the net foreign currency auction $X4X4X4$ was also inverse. An increase of 1% in the net foreign currency auction leads to a decrease in general liquidity by -0.00022 monetary units. This suggests that the monetary policy aims to control the overall price level and manage liquidity, guiding the Iraqi economy towards specific directions.

The relationship between general liquidity LOG(X7)\text{LOG}(X7)LOG(X7) and public debt LOG(X12)\text{LOG}(X12)LOG(X12) was inverse. An increase of 1% in public debt leads to a decrease in general liquidity by -8.509 monetary units. This reflects the economic conditions in Iraq, as the state typically resorts to borrowing only during challenging economic circumstances, such as economic contraction, which in turn reduces the overall liquidity in the economy.

The relationship between general liquidity LOG(X7)\text{LOG}(X7)LOG(X7) and GDP LOG(Y1)\text{LOG}(Y1)LOG(Y1) was positive. An increase of 1% in GDP leads to an increase in general liquidity by 2.703 monetary units.

This indicates the positive effects of increases in total production volume and the financial returns to employed individuals, which boost overall demand and the rate of money circulation in the economy, thereby increasing overall liquidity.

The relationship between general liquidity LOG(X7)\text{LOG}(X7)LOG(X7) and domestic credit LOG(X10)\text{LOG}(X10)LOG(X10) was positive. An increase in domestic credit granted to individuals and various sectors leads to an increase in general liquidity in the economy by 0.049 monetary units. This reflects that most borrowed funds are directed towards financing local consumption, subsequently impacting the total financial liquidity in the economy.

5. Conclusion:

Using quantitative methods to achieve results enables us to obtain more accurate estimates than analytical results. Therefore, given the varying degrees of stability and the multiple equations included in the model, simultaneous equations models were adopted to measure the impact of monetary policy variables on the size of financial liquidity in the economy and to guide the Iraqi economy in specific directions. This approach is in line with the country's monetary policy.

The general liquidity equation had positive relationships with the legal reserve, GDP, and domestic credit. At the same time, it had negative relationships with the discount rate, net foreign currency auction, and public debt. In the equation concerning foreign reserves, the relationships were positive with the legal reserve, the discount rate, the net foreign currency auction, and public debt.

This indicates the role of monetary policy in managing and monitoring general liquidity, maintaining the stability of the currency's value, and its exchange rate with other foreign currencies. Furthermore, it highlights the role of monetary policy in directing the Iraqi economy towards specific objectives. The research aims to determine the extent of the impact of certain economic variables on general liquidity, steer liquidity towards desired objectives, and assess whether these variables significantly impact general liquidity and the depth of that impact. The monetary policy has proven successful in this area, utilizing the central bank's independence in making appropriate decisions to achieve financial and monetary stability and to set the direction of the Iraqi economy in alignment with the goals of that policy.

Authors Declaration:

Conflicts of Interest: None

-We Hereby Confirm That All The Figures and Tables In The Manuscript Are Mine and Ours. Besides, The Figures and Images, which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- Ethical Clearance: The Research Was Approved by The Local Ethical Committee in The University.

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