
USING TODA-YAMAMOTO CAUSALITY TO MEASURE THE RELATIONSHIP BETWEEN SOME MONETARY POLICY VARIABLES IN IRAQ FOR THE PERIOD (2004 - 2023)

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Abstract

Monetary policy plays an important role in the economy of any country. It dominates and governs the banking performance and the granting of credit to banks. It allows the right climate for investments and the movement of funds through its instruments and is in control of the country's money supply. As Iraq suffers from structural problems in the economy, we have tried in this research to demonstrate and demonstrate the relationship between the variables of monetary policy instruments and the total monetary credit between using causation. (Toda - Yamoto) In order to know the causal relationship variables total cash credit, exchange rate, cash offer and interest rate in Iraq for the duration (2004-2023) The results showed a causal and one-way relationship in the majority of the results of causation tests, while some variables do not have a long-term causal relationship. This is consistent with economic theory, since the relationship between variables is intentional and travels over a short period of time.

Introduction

Monetary policy faces many challenges, especially in a rent economy that is insecurely, economically, socially and politically unstable as well as recurring internal and external crises, hence monetary policy seeks to control the volume of monetary credit and direct financial activity in order to maintain the effectiveness of the credit multiplier and the monetary multiplier So it is very carefully monitoring the cash balances generated by the majority of both government and private banks, It explored the possibility of harnessing them in the service of domestic productive activities, increased employment and economic growth, but without accompanying an increase in prices or inflation. In this research the relationship between some variables of monetary policy and total monetary credit will be highlighted as there was a short-term relationship and there was no long-term relationship and this is consistent with economic theoretical logic.

Problem of research:

the problem of research lies in weak Iraqi investment and economic activity and here was the leading role of commercial banks to stimulate it by expanding the granting of credit

The importance of research:

clarifying the role of monetary policy and its relationship with the volume of monetary credit in the Iraqi economy

Research objective:

The research aims to analyse and clarify the relationship between monetary policy variables and bank credit in Iraq's economy

Search hypothesis:

Search hypothesis starts from Goodell relationship between search variables (total bank credit, exchange rate, narrow cash offer, interest rate) and this relationship Spipe either one or two directions.

Research methodology:

Research relied on statistical methods and standard analysis to clarify the relationship between the variables in question

Research structure:

The research deals with three axes

First Axis: - Conceptual Framework and Objectives of Monetary Policy

Theme II. Iraq's monetary policy reality for the period (2004 - 2023)

Theme III: Measuring the relationship between certain variables of Iraq's monetary policy for the period (2004 -2023)

The first is the conceptual framework and objectives of monetary policy:

First: the concept of monetary policy

There are several concepts that address the definition of monetary policy, but all of them are equally content, as they are defined as the central bank's actions to manage the supply of cash and interest rates in order to achieve macroeconomic objectives (R. Glenn & Patrick,2006: 440),, Kent defines monetary policy as "managing the expansion and contraction of the volume of cash in order to obtain certain goals" (Kent, 1949, 417), and is defined as the policy pursued by the Central Bank in order to affect the domestic monetary liquidity traded within the national economy (Mohammed Taqa, 2009: 356), can also be known as those planned by the Monetary Authority (Central Bank) to manage the offer of cash and interest rate in order From to achieve full operation of resources without inflationary pressure (Amer, 2010:178) . the above definitions, monetary policy can be known as a set of actions, rules and measures taken by the central bank by controlling and controlling the supply of cash and credit policy in order to achieve macroeconomic objectives. It is clear from the foregoing that monetary

policy is closely related to cash, the banking system and credit policy. It can be argued as a general rule that monetary policy in countries with developed financial organs relates to bank credit policy for the fundamental reason that banks are the originators of money (deposit money). Therefore, monetary policy has become synonymous with credit policy and credit control .

Monetary Policy Objectives

There are a range of objectives for monetary policy as follows: -

1-Work to stabilize the price level because inflation creates instability and fear of the future and affects savings and investment and also leads to a reverse distribution of wealth in society (Ahmed, 2003:258)

2- A high rate of economic growth and the pursuit of full utilization of resources is achieved by influencing credit that affects the volume of investment. The greater the investment leads to growth in national output (Al-Hamid, 2009:276) Changes in monetary policy in commercial banks' monetary reserves, which in turn translate into money supply, are reflected in corresponding changes in interest rates that in turn determine the volume of private investment that is one of the most important determinants of economic growth (Al-Dolimi, 1990, 587).

3-Stabilizing exchange rates and improving the balance of payments because exchange rate fluctuations affect exports and the country's competitiveness as well as imports, which in turn will be reflected in the balance of payments by the final outcome (Shawish, 2011:193).

4-Accelerate the process of economic development by creating the right climate for the implementation of economic development projects in developing countries (Hetti, 2005:208)

5- Stabilizing financial markets because this stability affects the ability of the financial market to align savers and borrowers with the necessary financing for productive investments. Thus, the stability of financial market institutions avoids crises makes the money transfer process easy and easy (480 R. Glenn, 2008:).

6-Stabilizing interest rates to create a stable investment environment (Ferderic, 2013:437)

Theme II: Iraq's monetary policy reality for the period (2004 -2023)

After 2003, Iraq has witnessed a new phase in Iraq's economy, which has become a phase of opening up to the world and moving towards a market economy and benefiting from its natural and human wealth after years of economic, political and social isolation, especially in the 1990s

Table (1) Some of Iraq's monetary economic variables evolve for the 2004 - 2023 period (1 million dinars)

years	Total Cash Credit (1)	Total Cash Credit Growth% (2)	Official exchange rate Dinar for \$ (3)	Exchange Rate Growth% (4)	Offer cash in a narrow sense (5)	Cash supply growth in a narrow sense% (6)	Interest Rate Policy Rate (7)
2004	775321.75		1453.3		7873820		6
2005	1033480.083	33.3	1468.7	1.06	10779900	36.91	6.33
2006	2129275.833	106.03	1467.4	-0.09	12914373	19.8	10.41
2007	3153175	48.09	1254.7	-14.5	17639351	36.59	20
2008	4014440.083	27.31	1193.1	-4.91	23880698	35.38	16.75
2009	5337799.5	32.96	1170	-1.93	32032390	34.14	8.83
2010	9887036.583	85.23	1170	0	45623639	42.43	6.25
2011	16365764.33	65.53	1170	0	54371653	19.17	6
2012	24676014.17	50.78	1166.2	-0.33	65052883	19.64	6
2013	28573929.17	15.8	1166	-0.01	73572906	13.1	6
2014	32472888.17	13.65	1166	0	77009655	4.67	6
2015	36271393.25	11.7	1167.3	0.11	73627551	-4.39	6
2016	36817811.17	1.51	1182	1.26	74703976	1.46	4.33
2017	37271314.25	1.23	1184	0.17	75175419	0.63	4
2018	38482462.25	3.25	1182.8	-0.11	75085473	-0.12	4
2019	40127910.17	4.28	1182	-0.06	81668404	8.77	4
2020	45127434.42	12.46	1192.2	0.86	94916091	16.22	4
2021	51124430.83	13.29	1450	21.63	1.15E+08	20.85	4
2022	55908827.92	9.36	1450	0	1.3E+08	13.49	4
2023	63725218.92	13.98	1315.8	-9.26	1.54E+08	18.08	6.04
length of time	compounded growth rate						
2004-2008		38.9		3.8-		24.8	22.7
2009-2013		39.8		-0.06		18	-7.4
2014-2018		3.4		0.2		-0.5	-7.7
2019-2023		9.6		2.1		13.4	8.5

Source

- Statistical Bulletins of the Central Bank of Iraq, Various Years .

- Columns (2), (4) and (6) were calculated by researchers.

- Simple growth rate calculated according to the following formula:- $R = \frac{P_t - P_{t-1}}{P_{t-1}} * 100$

- The composite growth rate is calculated according to the following formula :-

$$R = \left[\left(\frac{P_T}{P_0} \right)^{\frac{1}{N}} - 1 \right] * 100$$

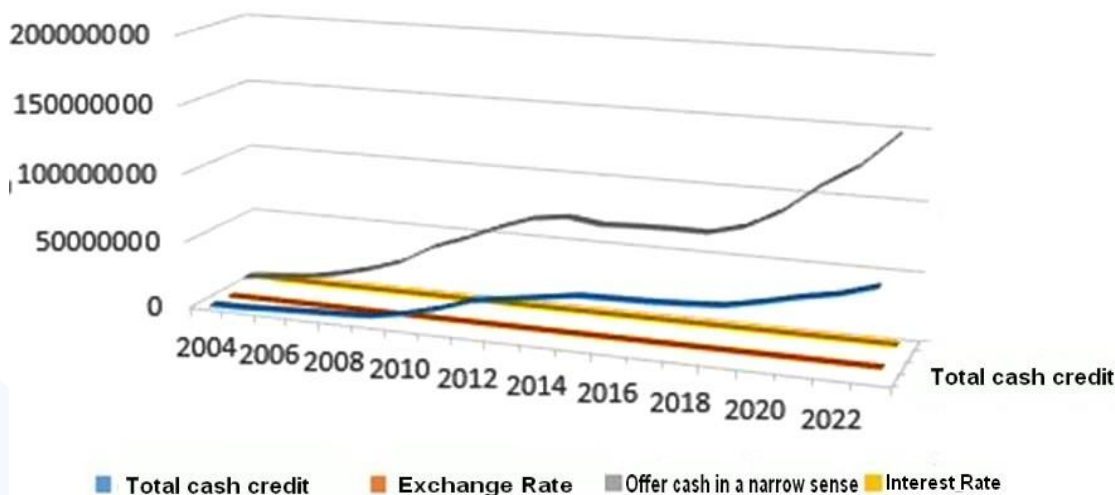
From table (1) we note that 2004 was total cash credit (775321.75) million dinars, while the exchange rate (1453.3) IQD per United States dollar, the offer of cash (7873820.167) million dinars and interest rate (6%). Total bank credit in 2005 amounted to 1033480.083 million dinars at a modest growth rate of (33.30%), the exchange rate (IQD 1468.7) was IQD per US Dollar, while the offer of cash (10779899.67) was 1 million dinars with a growth of

up to 36.91% at an interest rate of up to (6.33%), in 2006 total cash credit (2129275.833) million dinars with a growth of 106.03% reflects the government's trend in encouraging credit for new projects, new investments, reconstruction and post-war economy in Iraq, exchange rate reached (1467.4) dinars per dollar with a growth rate of (0.09%) While the cash offer (12914373.33) was KWD 1 million with growth of (19.80%) at an interest rate of 10.41% in 2007 and 2008 amounted to total cash credit (3153175) and (4014440.083) million dinars with growth (48.09%) and (27.31%), respectively, at an exchange rate of 1254.7 and 1193.1 JD per dollar and it is clear to us that the central bank controlled the exchange rate and tried to stabilize it, and the offer of cash was (17639351.42) and (23880697.83) million dinars with positive growth of 36.59% and (35.38%) respectively at an interest rate of (20%) and (16.75%) respectively. The combined growth for the first period of the total bank credit was 38.9%, while the exchange rate was -3.8 %. The growth of the cash offer for the same period was (24.8%), as well as the combined growth of the interest rate for the same period was (22.7%).

In 2009, total cash credit (53,37,799.5 million dinars) reached a modest growth of (32.96%) and the exchange rate was (1170.0) dinars per USD with a simple negative growth (1.93%) This is less than the previous year and reflects an attempt to stabilize exchange rates and work to stabilize at this low level by the country's monetary authorities, and the offer of cash is as high as (32032390) million dinars with positive growth (34.14%) while the interest rate was at (8.83%) which is lower than the previous year. For 2010 and 2013, total increased credit, fixed exchange rate, increased cash supply, stable interest rate and second-term composite growth of total bank credit reached (39.8%). The exchange rate was -0.06 %. For the same period, the composite growth of the cash supply reached (18.0%) and interest rate (-7.4% %) for the same second term, in 2014 as total cash credit (32472888.17) million dinars with a small growth rate of 13.65% An exchange rate of 1166.0 dinars per US dollar with growth (0.00%) cash offer amounting to (77009654.58) million dinars with positive growth of (4.67%) at a fixed interest rate (6%).

In 2015, total cash credit (36271393.25) amounted to KWD 1 million with a modest positive growth of KWD 1 million. (11.70%) and exchange rate (1167.3) dinars per US dollar at a growth rate (0.11%) while the cash offer (73627550.75) was KD million at a negative growth rate of (4.39%) due to the repercussions of ISIS entering Iraq and occupying parts of Mina and also the decline in oil prices globally, while the interest rate reached (6%), in 2016 the total cash credit (36817811.17) was 1 million dinars with growth reaching (1.51%) and exchange rate of (1182.0) dinars per US dollar with growth (1.26%) The cash offer amounted to (74703976.42) million dinars with growth (1.46%) at an interest rate of (4.33%), while in 2017 and 2018 the total credit was with an increasing positive growth of (1.23%) and (3.25%) and an exchange rate of (1184.0) and (1182.8) dinars per United States dollar, respectively, and the growth of the converging money supply reached (0.63%) and (0.12% -%) at a fixed interest rate of (4%) and the combined growth of the third part-time period of total bank credit reached (3.4%) while the exchange rate was (0.2%) The growth of the cashier for the same period was (0.5-%) and the cashier for the interest rate was (-7.7 %) for the same third period

In 2019 and 2020, total credit growth reached 4.28%. and (12.46%) respectively with exchange rate growth of (0.06%) and (0.86%), respectively, as exchange rate increases and instability emerged as a result of the coronavirus pandemic that hit the world, with cash supply growth of (8.77%) And (16.22%) at an interest rate of (4%), but in 2021 and 2022 the total cash credit was (51124430.83) and (55908827.92) million dinars, while the official exchange rate was (1450.0) and (1450.0) IQD per USD respectively with growth (21.63%) and (0.00%). The increase in currency exchange is evidenced by currency smuggling abroad, lack of border control, as well as fake operations to withdraw and smuggle the dollar abroad, which increased demand and the monetary authorities' inability to control the previous exchange rate. (130189018.9) million dinars with positive growth (13.49%) and interest rate (4%). In 2023, total credit amounted to 63725218.92 million dinars with growth (13.98%) and exchange rate of (1315.8) dinars per US dollar with negative growth of (9.26%) Here the monetary authorities attempt to adjust the exchange rate and it was reduced from the previous two years and try to adjust the exchange rates on the black market and smuggle the dollar abroad, while the cash offer was (153724515.9) A million dinars with growth reached (18.08%) at a high interest rate for the previous year to reach (6.04%) which reflects the direction of the State to encourage the citizen to deposit his money with banks and take advantage of the high interest and also to withdraw the cash mass from trading and take advantage of it to pay salaries and other things due to the pressures and sanctions imposed on Iraqi banks by the U.S. Treasury due to the smuggling of dollars abroad as in the figure (1) .The combined growth of the fourth part-term was total cash credit. (9.6%) and the composite growth of the exchange rate was (2.1%) for the same fourth period of time and the composite growth of the cash offer (13.4%) and composite interest rate growth of (8.5%) for the same fourth partial period



Form (1) Evolution of some of Iraq's monetary economic variables for 2004-2023

Constructive form of researcher's preparation based on table (1)

Through table (2), after using metric descriptive statistics, to know the normal distribution of time series data of total cash credit (CM), exchange rate (EX), cash offer in the narrow sense (M1), interest rate (R), using EViews and based on data in table (1). As follows:-

Table (2) Some descriptive measures, not the aesthetic of monetary credit and some variables of Iraq's monetary policy, for the period 2004 - 2023

The scale	CM	EX	M1	R
Mean	26663796	1257.563	64727562	6.947917
Median	30523409	1183.375	73600228	6
Maximum	63725219	1468.667	1.54E+08	20
Minimum	775321.8	1166	7873820	4
Std. Dev.	20098974	123.8593	40249762	4.280183
Skewness	0.100946	0.946846	0.3757	2.090554
Kurtosis	1.794798	2.062221	2.605536	6.423965
Jarque-Bera	1.244394	3.721249	0.600169	24.33767
Probability	0.536764	0.155575	0.740755	0.101005
Sum	5.33E+08	25151.25	1.29E+09	138.9583
Sum Sq. Dev.	7.68E+15	291481.3	3.08E+16	348.0794
Observations	20	20	20	20

Source: Prepared by the researcher based on the results of the analysis of the programme (Eviews 9)

From Table (2) it is clear to us from the metric descriptive of the variable (CM) that the Mean value is (26663796) which is greater than the Std. Dev (20098974), while the statistical value of Jarque-Bera (1.244394) at Probability (0.536764) was greater than 0.05, indicating that its variable data are naturally distributed. Dev (123.8593) had a statistical value of Jarque-Bera (3.721249) at Probability (0.155575) which is also greater than 0.05. This indicates that the time-series data of this variant is naturally distributed, while the variant (M1) has a mean value of 64,727,562 (62). Dev (40249762) while Jarque-Bera's statistical value (0.600169) at Probability (0.740755) was greater than 0.05 also indicates that the data of this variable is naturally distributed, the last variant is (R) and Mean's value was (6.947917), which is greater than Std. The adult Dev (4.280183) while the statistical value of Jarque-Bera (0.600169) at the adult Probability (0.101005) was also greater than the 0.05 also indicated that the chain of this variable is naturally distributed.

Axis III: Using a causal model (Toda-Yamamoto) to measure the relationship between some of Iraq's monetary policy variables and monetary credit for the duration (2004 – 2023)

First: Model characterization

The Toda-Yamamoto model is one of the causation tests that measures the long-term relationship between variables and sometimes calls it the Granger Causal Test for Time Series which is different from the simple causation test because the latter measures the short-term relationship between variables in the model, the test is B (Granger Causal) This method does not require integration of variables at the same level that is, it accepts its integration of zero degree I (0) or one degree I (1) or both .

In order to take the test, we will first test the stability of Dickie Fuller's expanded unit root test showing the stability of the time series and the rank of each variable in the chain and its integration And then we identify the appropriate slowing periods using the self-regression

model and find from the optimal model backward period, And then we estimate the test of the causation of Toda-Yamamoto that shows the long-term causal relationship between the model variables whether one-way, two-way or all the model.

Using EViews we will test the data in the State of Iraq for the period (2004 - 2023). The values were taken in monthly form and for all variables and for the full duration and a causal analysis (Granger) or Toda-Yamamoto among some of the monetary economic variables (total cash credit, exchange rate, offer cash, interest rate) that took the following codes.

Total cash credit = CM

Exchange Rate: = EX

Offer cash in a narrow sense = M1

Interest Rate = R

According to the Toda-Yamamoto causation model, variables are an autonomous variable TER and a variable of another and each variable within the model.

Second: Test results

1-Unit root test (stable time series)

Table (3) Dickie Fuller's expanded test of unit root in Iraq for 2004-2023

UNIT ROOT TEST RESULTS TABLE (ADF)					
Null Hypothesis: the variable has a unit root					
At Level					
EX	M1	R	CM		
-1.9544	2.437	-2.0877	2.8309	t-Statistic	With Constant
0.3071	1	0.2499	1	Prob.	
n0	n0	n0	n0		
-1.6994	0.4118	-2.6213	-0.761	t-Statistic	With Constant & Trend
0.7488	0.999	0.2713	0.9666	Prob.	
n0	n0	n0	n0		
-0.6075	5.6195	-0.7363	7.4148	t-Statistic	Without Constant & Trend
0.4534	1	0.3967	1	Prob.	
n0	n0	n0	n0		
At First Difference					
d(EX)	d(M1)	d(R)	d(CM)		
-9.8864	-11.9019	-7.9691	-13.9352	t-Statistic	With Constant
0	0	0	0	Prob.	
***	***	***	***		
-9.9699	-12.2647	-7.9523	-14.3996	t-Statistic	With Constant & Trend
0	0	0	0	Prob.	
***	***	***	***		
-9.894	-2.909	-7.9851	-0.3513	t-Statistic	Without Constant & Trend
0	0.0037	0	0.5575	Prob.	
***	***	***	n0		

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

After conducting the unit root test of the search variables and by comparing the results of the program (9 EViews) and through table (3), we find that the time chains of the CM variable did not stabilize at the level and contained the unit root and settled on the first difference i.e.

the variable is integrated from the grade (I (1)). As well as the EX variable stabilized at the first difference with the integration of I (1), the M1 variable stabilized at the first difference as well, the R variable settled on the first difference of I (1), and all variables were not stabilized at the level but were stable at the first difference with the definite presence of the I (1) integrated.

2- Limiting the slowing period and in this test we use several criteria to determine the optimal slowing period and the most important of these criteria (Hannan-Quinn, Schwarz, Akaike (FPE) and as follows:-

Table (4) Slowing Down Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10452.44	NA	5.23E+33	88.99095	89.04984	89.01469
1	-8287.209	4238.317	5.95E+25	70.69965	70.99409*	70.81835
2	-8248.124	75.17682	4.89E+25	70.50318	71.03316	70.71685*
3	-8224.171	45.25542	4.57e+25*	70.43550*	71.20102	70.74412
4	-8213.376	20.029	4.78E+25	70.47979	71.48086	70.88338
5	-8198.443	27.19714*	4.83E+25	70.48887	71.72549	70.98742

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

Through Table (4) we show that the optimal slowing period of the model is Lag 3 because it met most of the standard criteria to determine .

3-Toda-Yamamoto Test

After conducting the unit root test for variables and determining the biggest difference and after determining the optimal slowing period of the model we will test the long-term causal relationship between the variables as follows:

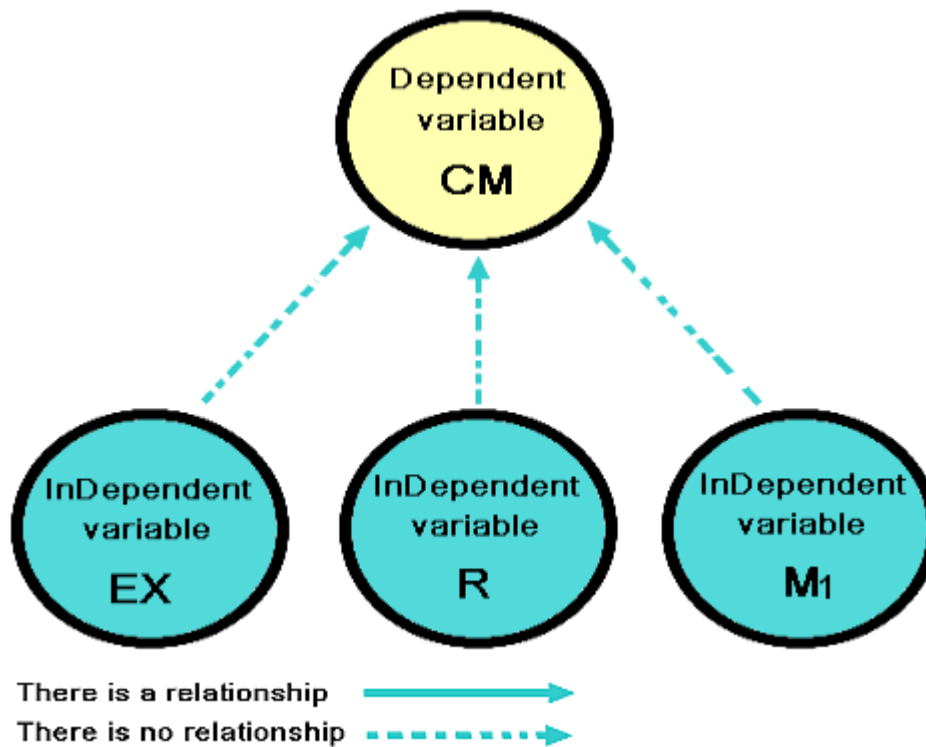
Table (5) Toda-Yamamoto Causal Test in Iraq for 2004-2023

Dependent variable: CM			
Excluded	Chi-sq	df	Prob.
EX	2.264403	3	0.5194
R	2.290729	3	0.5143
M1	10.33845	3	0.0159
All	15.70221	9	0.0734

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

The first model is that the affiliate variable is CM and the other variables are independent and it becomes clear to us that EX does not scatter the CM variable and there is no long-term relationship between them While the R variant does not affect the CM variant either or the MM variant, there is also no long-term causal link between the CM and the model as a whole. There is no long-term relationship between the variables and the CM variable as shown in figure (2).

Form (2) Long-term relationship between variables



Form of Research Preparation by Accreditation Results Table (5)

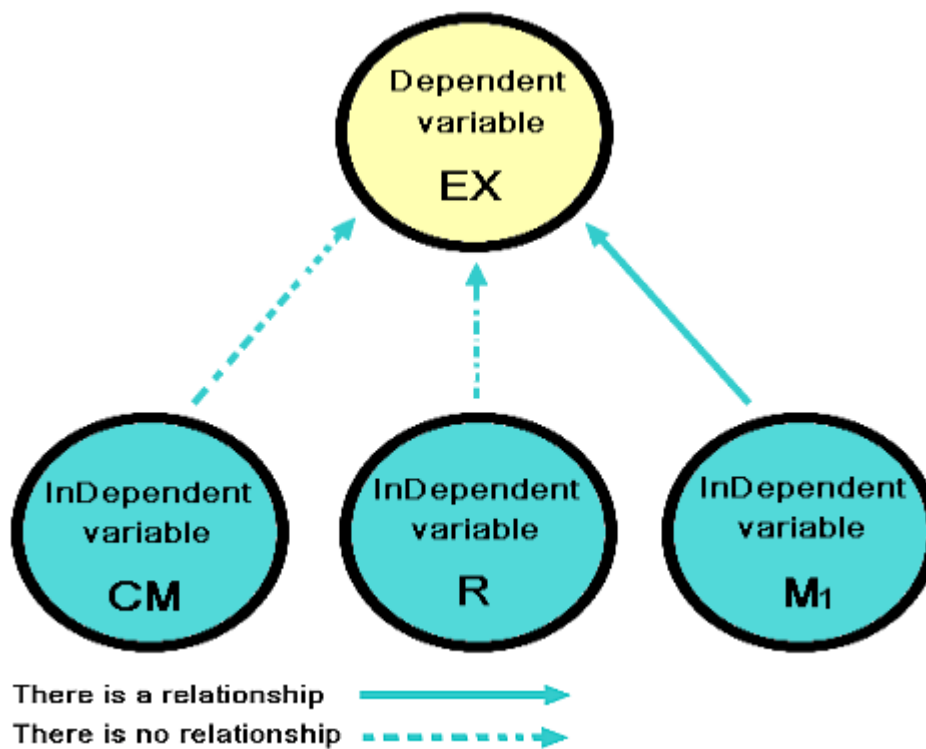
Table (6) Toda-Yamamoto Causal Test in Iraq for 2004-2023

Dependent variable: EX			
Excluded	Chi-sq	df	Prob.
CM	4.653613	3	0.199
R	4.474637	3	0.2146
M1	10.87831	3	0.0124
All	22.66371	9	0.007

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

Model II: - Faithful the affiliate variable is EX and other variables are independent and it becomes clear to us that CM is not scattered by the EX variant and there is no long-term relationship between them, While the R variant does not affect the EX variant either or the M1 variant shows a long-term causal link between the EX and the model as a whole shows a long-term relationship between all variables in total and the CM variable as shown in figure (3)

Form (3) Long-term relationship between variables



Form of Research Preparation by Accreditation Results Table (6)

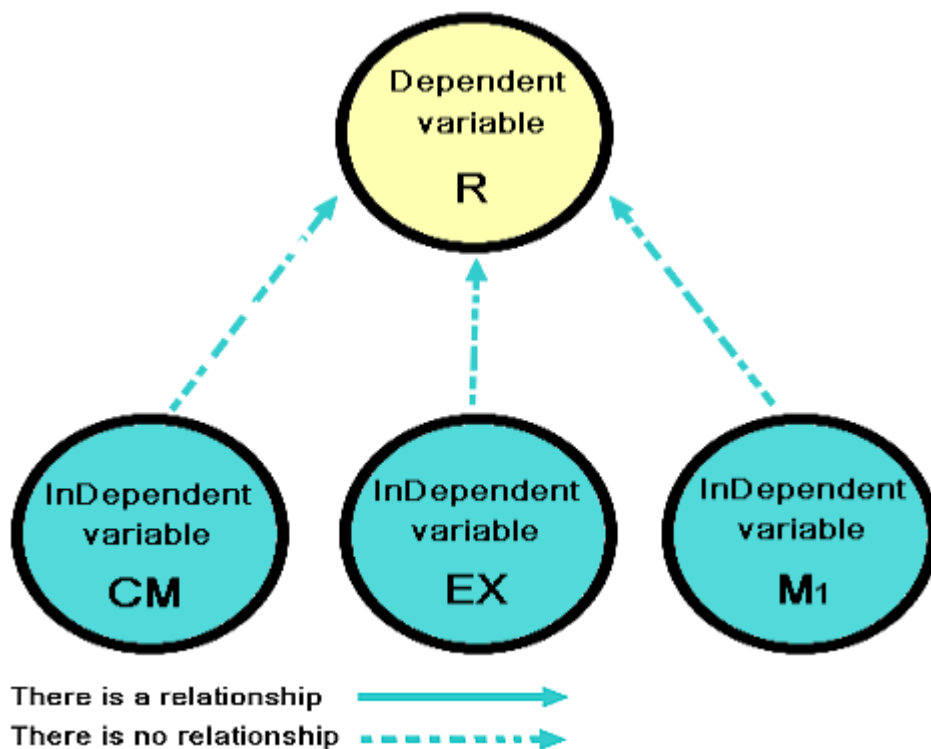
Table (7) Toda-Yamamoto Causal Test in Iraq for 2004-2023

Dependent variable: R			
Excluded	Chi-sq	df	Prob.
CM	1.754654	3	0.6249
EX	3.869145	3	0.2759
M1	2.250274	3	0.5221
All	7.21856	9	0.6144

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

Model III: - Faithful the dependent variable is R and other variables are independent and it becomes clear to us that CM does not scatter the R variable and there is no long-term relationship between them, While the EX variant does not affect the R variable either, the M1 variant shows no long-term relationship between the R and the model as a whole shows no long-term relationship between all variables in total and the R variable as shown in figure (4).

Form (4) Long-term relationship between variables



Form of Research Preparation by Accreditation Results Table (7)

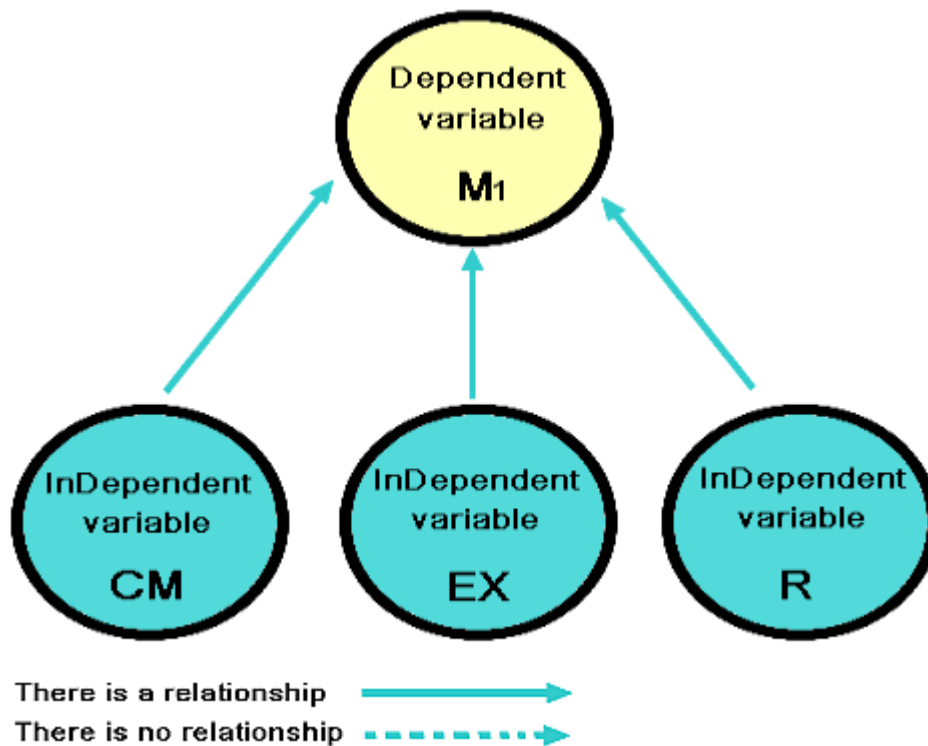
Table (8) Toda-Yamamoto Causal Test in Iraq for 2004-2023

Dependent variable: M1			
Excluded	Chi-sq	df	Prob.
CM	5.62E-07	3	1
EX	1.06E-05	3	1
R	2.88E-06	3	1
All	1.31E-05	9	1

Table of researchers' preparation by adopting the results of the analysis of the programme (Eviews 9)

Model IV: -When the dependent variable is M1 and other variables are independent and it becomes clear to us that CM is scattered by the M1 variant and there is a long-term causal relationship between them While the EX variant affects the M1 variant as well and there is a long-term relationship, The R variant shows a long-term causal link between the M1 and the model as a whole, showing a long-term causal link between all variables in total and the dependent variable of the M1 variable, as shown in figure (5).

Form (5) Long-term relationship between variables



Form of Research Preparation by Accreditation Results Table (8)

Conclusions

1. Monetary policy in any country plays a fundamental and governing role in the economy in terms of growth, investment and credit
2. Total monetary credit over time in case of a continuous increase, which indicates the expansion of lending
- 3- The impact of monetary policy instruments on monetary credit is a short-term, fast rather than long-term effect.
- 4-Stabilizing the exchange rate of Iraqi dinars has contributed to creating economic stability and lowering the overall price level.

Recommendations

1. Raising the Iraqi dinar value against the dollar, thus enhancing the Iraqi citizen's confidence in the local currency.
- 2 - Raise public confidence in the banking sector so as to encourage the individual to credit banks.
- 3-The need to attract foreign investment to strengthen Iraq's economy by providing it with an enabling environment and creating economic diversification.

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UNIT ROOT TEST RESULTS TABLE (ADF)

Null Hypothesis: the variable has a unit root

		<u>At Level</u>			
		CM	R	M1	EX
With Constant	t-Statistic	2.8309	-2.0877	2.4370	-1.9544
	Prob.	1.0000	0.2499	1.0000	0.3071
		n0	n0	n0	n0
With Constant & Trend	t-Statistic	-0.7610	-2.6213	0.4118	-1.6994
	Prob.	0.9666	0.2713	0.9990	0.7488
		n0	n0	n0	n0
Without Constant & Trend	t-Statistic	7.4148	-0.7363	5.6195	-0.6075
	Prob.	1.0000	0.3967	1.0000	0.4534
		n0	n0	n0	n0
		<u>At First Difference</u>			
		d(CM)	d(R)	d(M1)	d(EX)
With Constant	t-Statistic	-13.9352	-7.9691	-11.9019	-9.8864
	Prob.	0.0000	0.0000	0.0000	0.0000
		***	***	***	***
With Constant & Trend	t-Statistic	-14.3996	-7.9523	-12.2647	-9.9699
	Prob.	0.0000	0.0000	0.0000	0.0000
		***	***	***	***
Without Constant & Trend	t-Statistic	-0.3513	-7.9851	-2.9090	-9.8940
	Prob.	0.5575	0.0000	0.0037	0.0000
		n0	***	***	***

Notes:

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability based on MacKinnon (1996) one-sided p-values.

VAR Lag Order Selection Criteria

Endogenous variables: CM EX M1 R

Exogenous variables: C

Date: 03/14/24 Time: 09:54

Sample: 2004M01 2023M12

Included observations: 235

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10452.44	NA	5.23e+33	88.99095	89.04984	89.01469
1	-8287.209	4238.317	5.95e+25	70.69965	70.99409*	70.81835
2	-8248.124	75.17682	4.89e+25	70.50318	71.03316	70.71685*
3	-8224.171	45.25542	4.57e+25*	70.43550*	71.20102	70.74412
4	-8213.376	20.02900	4.78e+25	70.47979	71.48086	70.88338
5	-8198.443	27.19714*	4.83e+25	70.48887	71.72549	70.98742

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

VAR Granger Causality/Block Exogeneity Wald Tests

Date: 03/07/24 Time: 09:30

Sample: 2004M01 2023M12

Included observations: 236

Dependent variable: CM

Excluded	Chi-sq	df	Prob.
EX	2.264403	3	0.5194
R	2.290729	3	0.5143
M	10.33845	3	0.0159
All	15.70221	9	0.0734

Dependent variable: EX

Excluded	Chi-sq	df	Prob.
CM	4.653613	3	0.1990
R	4.474637	3	0.2146
M	10.87831	3	0.0124
All	22.66371	9	0.0070

Dependent variable: R

Excluded	Chi-sq	df	Prob.
CM	1.754654	3	0.6249
EX	3.869145	3	0.2759
M	2.250274	3	0.5221
All	7.218560	9	0.6144

Dependent variable: M

Excluded	Chi-sq	df	Prob.
CM	5.62E-07	3	1.0000
EX	1.06E-05	3	1.0000
R	2.88E-06	3	1.0000
All	1.31E-05	9	1.0000