

Causal Analysis of the Relationship Between Bank Credit and Economic Growth in Iraq Through the Investment Sector Using the SVAR Model

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Abstract

In this study, the relationship among credit, investments, and economic growth in Iraq is examined, with particular attention paid to the role played by the credit transmission mechanism within an economy recovering from war and endowed with natural resources. The study employs annual time series data for the period 1960–2023, with the SVAR approach coupled with Phillips-Perron tests of unit roots, Granger causality test, impulse response function, and variance decomposition techniques. The results reveal that credit can be used as a predictor of investments and economic growth, whereas the structural results indicate that credit's influence on economic growth operates partly through investments. Moreover, it turns out that the credit transmission process is heterogeneous since certain credit shocks have negative effects on investment, implying the presence of credit allocation inefficiency. At the same time, economic growth can be mostly attributed to internal forces that probably result from fiscal factors, high oil dependency, and other exogenous shocks in the Iraqi economy. The paper demonstrates context-specific findings, according to which the credit's developmental potential in Iraq will be influenced not only by its availability but also by credit allocation effectiveness and other aspects of institutional development.

1. Introduction

The role of bank credit in the growth of the economy is still a important issue studied by macroeconomists, especially in countries where banks contribute greatly to securing capital for expansion. The study examines this relationship again for Iraq by including investment as one of the main channels. Understanding how credit allocation shapes the real economy in developing and emerging markets needs to be studied, as pilot tests in the Iraqi economy have given mixed results. While a few studies have observed that more finance for the private sector encourages growth by supporting better use of resources and capital [1][2][3], other scholars have argued this may differ according to where the funds are invested, the strength of institutions and financial stability [4, 5]. According to Hussein et al. (2022), previous results demonstrate that how banks extend credit to the public might be linked to investment and spending in Iraq, yet this relationship needs to be explored further using dynamic models [6].

Canova's (2007) and Kilian's and Lütkepohl's (2017) methodological improvements in empirical macroeconomics are used to analyze the ways in which BCR, INV and GDP are linked in a structural time series system [7]. Unlike with a single-equation model, structural vector autoregressive (SVAR) considers the link between variables and divides economic shocks into parts that can be understood as separate structural elements. It is especially useful for exploring transmission paths in the economy as this method gives us dynamic impulse response functions and a detailed analysis of historical

trends [8, 9]. by adopting a recursive Cholesky identification ($BCR \rightarrow INV \rightarrow GDP$), the model reflects the theoretical assumption that bank credit affects investment before its effects are realized in output. This ordering is consistent with the financial accelerator approach and credit-led growth approach in emerging countries [10, 11]. In this approach, the investment component acts as the key mechanism for bank credit policy to be channeled towards productivity.

2. Problem Statement

The problem statement is related to the lack of clarity about the role of bank credit in promoting economic growth through investment in Iraq, especially under macroeconomic instability and inefficiency.

3. Significance of the Study

The justification for the study lies in its focus on the core issue of bank credit in the Iraqi economy, namely, its contribution to productive investment and economic growth, and in the use of a dynamic structure model that provides more profound empirical evidence compared to traditional methods.

4. Objectives of the Study

In this research, we examine the dynamics among bank credit, investment, and economic growth in Iraq to find out whether investment acts as an intermediary channel. Moreover, we try to identify the impact of any shock to bank credit on investment and gross domestic product (GDP). This paper comprises of five main sections. Following the introductory part, section two reviews the available literature on the relation between bank credit, investment, and economic growth. The fourth section presents the empirical results and discusses the findings in the context of the Iraqi economy. Finally, the fifth section summarizes the conclusions and provides policy recommendations based on the analysis.

5. Literature Review

Many development and financial economists have investigated the way bank credit affects economic growth. Economists recognised early on that financial intermediation helps to gather savings and use them in the most effective way [12, 13]. In recent years, studies in developing economies focus on understanding both the direction of the relationship and the ways in which increasing credit can stimulate the economy. Adebisi (2023) notes that for credit to support the economy of low-income countries, it must be directed towards useful areas [14]. Ahmed and Driss (2024) concur through Granger causality tests that loans to the private sector in Morocco help produce GDP growth [15]. Belinga et al. (2016) proved that the relationship between credit and growth in Cameroon is two-way and that they are in a stable equilibrium [16].

Certain studies point out that how credit influences growth depends on both the quality of the credit and which sectors it is given. They found that excessive credit provision, not linked to investments, can bring instability to the economy in Nigeria. In Vietnam, Pham and Nguyen (2020) discovered that credits grew independently from the economy due to problems with financial policies and issues in capital markets [17]. Analysing sectors brings forward more points for discussion. According to Majeed and Iftikhar (2020), when breaking down credit in Pakistan, growth was only well stimulated by credits targeted at manufacturing and investment [18]. Hussein et al. (2022) also studied Iraq and found that more credit did influence both types of expenditure, though this often did not lead to more economic activity [19]. A number of scholars have utilised time series models to discover the ways in which different elements of economics are connected. Kilian and Lütkepohl (2017) argue that the SVAR framework allows researchers to recognise structural shocks and determine their varying impacts. Impulse response analysis and historical decomposition are highlighted by Canova (2007) and Breitung and Eickmeier (2011) in terms of discovering transmission mechanisms in a macroeconomy [20-22]. They are commonly employed to measure the effects of financial and investment shocks on the economy's performance at different points and

distances in the future.

Non-linear Granger causality and switching models have begun to be applied in various studies. The researchers used a Markov-switching Granger model to find if there was a difference in the relationship between credit and growth in Iran based on different economic stages. The researchers found that the way the relationship works comes down to the economy's phase and the rules of the country. One frequent point in the review: the way credit growth impacts the economy is different in different regions and times. It is influenced by how credit is distributed; the quality of financial institutions and ways investment affects it. Because of this, this study improves our understanding of the Iraqi economy by including investment in a structural time series model and exploring the role of bank credit in growth through various sectors.

While previous research has examined the connection between bank credit and economic growth in developing countries, there are still three gaps that are noticeable. First, there is a lack of empirical research on Iraq compared to the extensive international literature. Second, current Iraqi research does not adequately capture the dynamics of investment as an intermediate channel through which bank credit affects economic growth. Finally, most of the past findings have used either direct correlation or causality analysis without adequate consideration for structural dynamic models capable of separating instantaneous, cumulative, and historical decomposition impacts of credit shocks. Therefore, this paper seeks to fill the gaps mentioned above by presenting Iraq-based evidence and using the Structural Vector Autoregressive (SVAR) approach, which will examine the structural and dynamic relationships between bank credit, investment, and economic growth from 1960 to 2023. This research is significant since Iraq is unique due to its financial system's operations in a post-conflict economy reliant on oil revenues and institutional constraints.

6. Methodology

6.1. Data Preparation

The dataset used for this research contains annual data for Iraq from the years 1960 to 2023. In the empirical analysis, the following five macroeconomic variables have been included in the research: economic growth (GDP), growth of bank credits (BCR), bank credits total (BCRT), GDP at market prices (GDPT), and the proportion of investment in GDP (INV). The reason behind using these variables is that they are all indicative of the core transmission channel in consideration – the effect of bank credit on economic growth through investment. GDP growth represents the performance of the economy, BCR shows the fluctuations in the amount of banking lending activity, while INV shows the level of importance of investment in the economy. As far as BCRT and GDPT are concerned, these indicate the actual numerical levels of the variables being measured.

Before modeling, the variables were classified based on their economic measure characteristics. The growth and ratio variables like GDP, BCR, and INV were kept in terms of percentages since these variables already measure relative changes and the proportions of different sectors. The two other variables like BCRT and GDPT were kept at level since they measure the size and the nominal changes of the financial and productive sectors in the economy. A universal logarithmization was not done since there are variables that have negative values and rates which cannot be converted using logarithm functions, as well as the need to maintain the economic meaning of growth rates. Stationarity tests were used to determine if the variables can be analyzed in levels. This method of analyzing data is appropriate for time series models whose goal is structural meaning of relationships within the economy.

Table (1): Descriptive Statistics of Key Variables

V	BCR	BCRT	GDP	GDPT	INV
I	Bank credit growth %	Total bank credit (Iraqi dinars)	Economic growth %	GDP at local currency prices	The investment sector's contribution to the GDP %
Mean	98.90362	6.52E+12	6.874300	7.80E+13	22.85148
Median	42.10787	2.06E+10	4.625468	4.47E+13	19.24688
Maximum	2202.931	6.56E+13	57.81783	2.22E+14	61.88210
Minimum	-95.17095	8870000.	-64.04711	7.72E+12	-12.88008

Std. Dev.	360.4173	1.45E+13	16.59738	6.81E+13	14.47380
Skewness	5.054951	2.516744	-0.566164	0.829236	1.051321
Kurtosis	28.01970	8.697208	9.005909	2.311629	4.523658
Jarque-Bera	1941.855	154.1178	99.60828	8.598365	17.98037
Probability	0.000000	0.000000	0.000000	0.013580	0.000125
Observations	64	64	64	64	64

Table (1) presents the summary statistics for the different variables. Bank credit growth (BCR) displays high volatility, with a maximum value of 2202.93%, minimum of -95.17%, and a large standard deviation of 360.42. These values imply that bank credit grew inconsistently within the decades. Economic growth (GDP) is also quite volatile, with maximum value of 57.82% and minimum value of -64.05%. Thus, GDP growth seems to experience economic recession and recovery periods, especially in cases where the country experiences economic or political shocks. Both skewness and kurtosis show that GDP and BCR are non-normal variables, with fat-tails and high asymmetry. As for the share of investment to GDP (INV), its average value is 22.85%, but there are negative and high outliers. This variable indicates inconsistent use of investment in economic development. The results of the Jarque-Bera test clearly indicate that all the variables are non-normal except for the nominal GDP growth (GDPT). The historical time-series graph (Figure 1) shows similar findings. Volatility of GDP and BCR explains macroeconomic-financial instability during Iraq’s economic development. Investment shows structural changes in capital formation, and the GDP growth and total credit growth imply the continuous growth of the Iraqi economy.

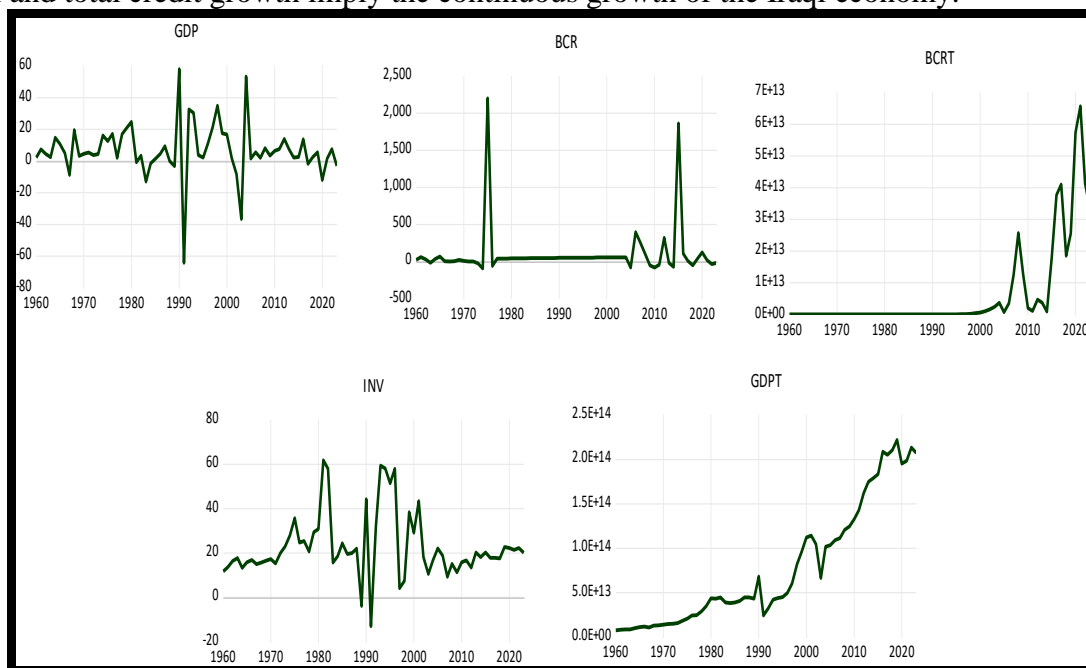


Figure (1): Historical Time Series of Key Economic Variables in Iraq (1960–2023)

7. Experimental Work

Theoretical base for this study rests on the hypothesis that financial intermediation, especially banking, serves as an important factor in the stimulation of economic growth through the flow of funds into productive use. Classical and modern macro-financial theories emphasize that credit expansion can enhance capital accumulation, facilitate business activity, and improve the efficiency of resource allocation, thereby contributing to long-run growth [12], [13], [14]. However, both empirical and theoretical studies suggest that the impact of credit strongly depends on its allocation efficiency, the institutional environment that regulates the banking sector's activities, and the extent to which the lending stimulates productive or investment purposes [17], [18], [20]. In such a context, investment plays a pivotal part as an intermediary variable through which the impacts of changes in credit become transmitted to actual economic results [6], [19]. This point is particularly relevant for developing countries whose economies heavily depend on resource extraction because of the possible

distortion of the finance-growth relationship in the face of inefficient credit allocation. Thus, in the current research, a dynamic multivariate model has been proposed that analyzes the simultaneous determination of bank credit, investment, and economic growth. From a theoretical standpoint, the use of vector autoregressions (VAR) and structural vector autoregressions (SVAR) seems well grounded since these modeling techniques allow for examining the mutual relationships between the macroeconomic variables under consideration, structural shocks affecting the economy, and the way those shocks propagate throughout the economy [7], [20], [21], [26]. Therefore, in the model under analysis, bank credit is viewed as the first financial shock, while investment and economic growth are treated as an intermediate channel and a macroeconomic result, respectively.

7.1. Statistics Framework

The theoretical background behind this research uses time-series econometric analysis to evaluate the interrelationships between bank credit (BCR), investment (INV), and gross domestic product (GDP). The methodology includes such techniques as unit root test, Granger causality analysis, Vector Autoregression (VAR), Structural VAR (SVAR), and its impulse response function (IRF) and historical decomposition [23-25]. The research starts with the Phillips-Perron (PP) unit root test for each time series in order to determine its stationarity. The PP unit root test is based on the regression equation:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \varepsilon_t \quad (1)$$

Where y_{t-1} is the series being tested, Δy_t is its first difference, and ε_t is the error term [26, 27]. Stationarity is crucial for valid statistical inference in dynamic models. After identifying the integration properties, the Granger causality test is used to assess predictive causal relationships. The model tests whether past values of a variable X improve the prediction of another variable Y:

$$Y_t = \alpha + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{j=1}^q \gamma_j X_{t-j} + \varepsilon_t \quad (2)$$

The null hypothesis is that all $\gamma_j = 0$ indicating no Granger causality from X to Y [28, 29]. For multivariate dynamic modeling, a Vector Autoregressive (VAR) model is estimated:

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + \dots + A_p Z_{t-p} + u_t \quad (3)$$

Where Z_t is a vector containing GDP, INV, and BCR, and u_t is a vector of reduced-form disturbances [30]. This framework allows endogenous interactions without imposing theoretical restrictions. To recover economically meaningful shocks, the Structural VAR (SVAR) model is formulated:

$$A_0 Z_t = A_1 Z_{t-1} + \dots + A_p Z_{t-p} + \varepsilon_t \quad (4)$$

which can be rewritten as:

$$Z_t = A_0^{-1} (A_1 Z_{t-1} + \dots + A_p Z_{t-p}) + A_0^{-1} \varepsilon_t \quad (5)$$

with structural innovations ε_t assumed to satisfy:

$$E[\varepsilon_t \varepsilon_t'] = I \quad (6)$$

This approach allows identification of orthogonal structural shocks using a recursive Cholesky ordering [31].

This is possible by evaluating the roots of the AR polynomial. For stability in a dynamic sense for the VAR model, all of its inverse roots need to fall within the unit circle (Hamilton, 1994; Lütkepohl, 2005). The second stage in the analysis entails estimation of impulse responses to evaluate the paths taken by the variables to adjust themselves after being exposed to an impulse. In this study, the accumulated impulse responses considered are those that are:

$$\text{Accumulated IRF}_h = \sum_{i=1}^h \psi_i \varepsilon \quad (7)$$

Where ψ_i refers to the impulse response in period i and ε stands for the structural shock (Pesaran & Shin, 1998). The Historical Decomposition (HD) method is used to calculate the contribution of each identified structural shock to the historical evolution of the variable over time (Breitung & Eickmeier, 2011; EViews, 2022). Together, this econometric approach offers a statistically sound and theoretically consistent approach to examine the causal relationships and dynamic impacts between bank credit, investment, and economic growth in Iraq.

7.2..Results and Discussion

In an attempt to find out the dynamics that exist between the variables BCR, INV, and GDP in Iraq, time series econometric test techniques were conducted. They assist in creating a base from where stationarity, causality, lag order, shocks, and stability of the model can be tested. The results obtained through these tests can be seen in the tables below.

Firstly, the PP Unit Root test was conducted. It can be seen in Table (2) that it focuses on stationarity properties of the variables. From the table, it is noted that all three variables, BCR, GDP, and INV, are level stationary in all models (with trend and intercept, only intercept, and no). This implies that it is possible to move ahead with the application of VAR without having to difference the data. The highly significant rejection of the null hypothesis shows that there are no unit roots, thus meeting the criteria for VAR analysis [9,14].

Table (2): Phillips-Perron Unit Root Test Results

Variable	Specification	Test Statistic	p-value	Critical Values (1%, 5%, 10%)
BCR	Trend & Intercept	-8.595	0.0000	-4.110, -3.483, -3.169
	Intercept Only	-8.647	0.0000	-3.538, -2.908, -2.592
	None	-8.003	0.0000	-2.602, -1.946, -1.613
GDP	Trend & Intercept	-11.136	0.0000	-4.110, -3.483, -3.169
	Intercept Only	-10.990	0.0000	-3.538, -2.908, -2.592
	None	-8.893	0.0000	-2.602, -1.946, -1.613
INV	Trend & Intercept	-5.525	0.0001	-4.110, -3.483, -3.169
	Intercept Only	-5.568	0.0000	-3.538, -2.908, -2.592
	None	-2.208	0.0273	-2.602, -1.946, -1.613

Table (3): Granger Causality Test Results (Lags: 2 & 1) (Sample: 1960–2023)

Null Hypothesis (Ho)	Obs	F-Statistic	p-value	Conclusion ($\alpha = 0.05$)
GDP does not Granger Cause BCR	62	0.10134	0.9038	Fail to reject Ho (No causality)
BCR does not Granger Cause GDP	62	10.34081	0.0026	Reject Ho (Causality exists)
INV does not Granger Cause BCR	62	0.01065	0.9894	Fail to reject Ho (No causality)
BCR does not Granger Cause INV	62	22.10484	0.0006	Reject Ho (Causality exists)
INV does not Granger Cause GDP	63	4.68545	0.0496	Reject Ho (Causality exists)
GDP does not Granger Cause INV	63	0.14145	0.7082	Fail to reject Ho (No causality)

Table (3) presents the results of the Granger causality test, which is used to identify directional predictive relationships among the variables rather than definitive structural causation. The findings show that bank credit growth (BCR) Granger-causes economic growth (GDP) at the 1% significance level ($p = 0.0026$), and also Granger-causes investment (INV) at the 1% significance level ($p = 0.0006$). In contrast, GDP does not Granger-cause either BCR or INV, while investment Granger-causes GDP at the 5% significance level ($p = 0.0496$). These results suggest that past values of bank credit contain useful predictive information for subsequent movements in investment and economic growth, and that investment may also have predictive content for GDP. However, these findings should be interpreted with caution, since Granger causality does not by itself establish true economic or structural causation. Rather, the results provide preliminary empirical support for the proposed transmission pattern, which is examined more fully in the subsequent VAR and SVAR analysis.

7.2.1. Implementation and Identification Strategy

To put the econometric model into practice, three specific actions were taken. Firstly, the stationarity test findings indicated that all the endogenous variables were $I(0)$, meaning that it was possible to estimate the VAR model in level form and avoid conducting a cointegration test. Secondly, the lag length of the model was set based on traditional criteria for selecting the lag length and then validated using the results of residual tests and stability tests to confirm that the chosen model specification is appropriate for capturing the dynamics of the system without losing too many degrees of freedom. Thirdly, the SVAR model was identified using the recursive Cholesky decomposition, with the order of variables being bank credit growth, investments, and economic growth. The rationale for such a choice lies in the economic theory, which states that the bank credit is an initial financial shock, investments represent the channel of transmission, and economic growth is the final result of the system.

Table (4): Vector Autoregression (VAR) Results (Sample: 1961-2023 | Observations: 63)

<i>Coefficient Estimates</i> <i>(Standard errors in parentheses; t statistics in brackets)</i>			
Regressor	GDP Equation	INV Equation	BCR Equation
Lagged GDP	0.752***(0.112)	0.321**(0.152)	0.456***(0.098)
	[6.714]	[2.112]	[4.653]
Lagged INV	0.284***(0.085)	0.688***(0.124)	0.215**(0.102)
	[3.341]	[5.548]	[2.107]
Lagged BCR	0.198***(0.042)	0.175**(0.087)	0.832***(0.056)
	[4.714]	[2.011]	[14.857]
Constant	2.456***(0.785)	5.321***(1.254)	1.987***(0.642)
	[3.128]	[4.245]	[3.095]
Statistic	GDP	INV	BCR
R-squared	0.872	0.815	0.923
Adj. R-squared	0.865	0.806	0.918
F-statistic	128.654***	95.321***	215.887***
P-value (F)	<0.001	<0.001	<0.001
System Statistics Log Likelihood: -412.356 Akaike IC: 13.532 Schwarz IC: 14.215 Residual Covariance Determinant: 2.15×10^7			

The Vector Autoregression (VAR) estimation results in Table (4) provide further insights into the interdependence of the variables over time. All lagged regressors are statistically significant in the three equations. For example, lagged GDP positively affects current GDP (coefficient = 0.752, $t = 6.714$) and also contributes to INV and BCR. Lagged BCR significantly influences GDP (coefficient = 0.198, $t = 4.714$), reinforcing the Granger causality findings. The model fit is strong, with R^2 values of 0.872, 0.815, and 0.923 for GDP, INV, and BCR equations, respectively. These values indicate that the VAR model captures a substantial portion of the variation in the data. The Akaike and Schwarz information criteria also suggest good model selection. To identify the structural sources of variation in the system, a Structural Vector Autoregression (SVAR) model was estimated using maximum likelihood via Newton-Raphson optimization. As shown in Table (5), the system is just-identified and converged after 41 iterations.

Table (5): Structural Vector Autoregression (SVAR) Estimation Results

Structural VAR Estimates				
Sample (adjusted): 1961 2023				
Included observations: 63 after adjustments				
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)				
Convergence achieved after 41 iterations				
Structural VAR is just-identified				
Model: $e = \Phi * Fu$ where $E[uu'] = I$				
F =				
C(1)	0	0		
C(2)	C(4)	0		
C(3)	C(5)	C(6)		
	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	11.26803	1.003836	11.22497	0.0000
C(2)	1.938166	2.693937	0.719455	0.4719
C(3)	55.55812	42.32237	1.312736	0.1893
C(4)	21.33850	1.900985	11.22497	0.0000
C(5)	5.040978	42.02956	0.119939	0.9045
C(6)	333.5803	29.71770	11.22497	0.0000
Log likelihood	-971.1288			
Estimated S matrix:				
14.31996	6.038125	-1.636548		
1.853544	13.85307	0.702732		

58.22762	-5.145496	365.8600	
Estimated F matrix:			
11.26803	0.000000	0.000000	
1.938166	21.33850	0.000000	
55.55812	5.040978	333.5803	

The statistical output confirms the significance of several structural relationships. Coefficient C(1), representing the impact of a shock in bank credit on BCR itself, is significant and large (11.27, $p < 0.001$). Similarly, the impact of investment shock on investment C(4) is substantial and significant (21.34, $p < 0.001$), demonstrating that investment is persistent in nature. However, C(2), C(3), and C(5) – respectively, representing spillover effects between bank credit and investment, bank credit and GDP, and investment and GDP – have relatively large estimates but are statistically insignificant, since all three have p-values larger than those associated with any significance level (greater than 0.05, 0.01, and 0.001). The insignificance of these three coefficients suggests that while credit and investment are persistent in nature, they do not influence each other in any meaningful way. The value of coefficient C(6) is very high (333.58, $p < 0.001$). Thus, it is highly significant, revealing the impact of endogenous variables on GDP level, probably because of oil revenues in Iraq and government spending, among other factors, including macroeconomic volatility. Based on the covariance matrix of structural shocks (matrix S), GDP shocks are characterized by significantly higher variance (365.86), compared to shocks in the case of investment and credit shocks. This can be accounted for by higher sensitivity of GDP growth rates to external and political shocks in the economy. Structural coefficient matrix (matrix F) proves that the specified model is recursive.

Although all coefficients appear to be statistically significant, their practical significance is more than just statistical significance and relates to an economic perspective as well. For instance, when it comes to the case of Iraq, one should point out the fact that positive relation of bank credit growth lags on investments and GDP implies that credit contributes to real activities. Nonetheless, this correlation does not prove a stable transmission mechanism in all periods of observations. Since the GDP series are rather persistent, it could be argued that GDP behavior in Iraq is mainly driven by domestic macroeconomic elements, such as oil rents, government spending, and shocks, and therefore, it dominates the role of finance as a facilitator of economic performance. In dynamic macroeconomic models, the economic meaning of the coefficient, impulse responses, and structural analysis provide better insights than measures of goodness-of-fit. In SVAR model, the recursive restrictions suggest that bank credit shocks affect the level of investment contemporaneously, whereas impacts on GDP arise via the effect on investment as well as macroeconomic adjustment. This interpretation is consistent with the theory, suggesting that financial intermediary services are relevant for economic growth indirectly and with a lag period.

Table (6): SVAR Residual Diagnostic Tests

A. Normality Test				
<i>(Null: Residuals are multivariate normal)</i>				
Test		Statistic	df	p-value
Joint Skewness		$\chi^2 = 1.299$	3	0.2545
B. Serial Correlation LM Tests				
<i>(Null: No serial correlation at lag h)</i>				
Lag	LRE Statistic	p-value	F-Statistic	p-value
1	1.933	0.9925	0.211	0.9925
2	2.278	0.9863	0.249	0.9863
C. Heteroskedasticity Test				
<i>(Null: No conditional heteroskedasticity)</i>				
Test Type		Statistic	df	p-value
Joint (Levels & Squares)		$\chi^2 = 44.697$	36	0.1516

The diagnostics provided in Table (6) demonstrate that the SVAR system has the necessary statistical adequacy. In particular, the residuals meet the assumption of multivariate normality (p-value = 0.2545), they do not have any serial correlation based on the results of the LM test (p-value

> 0.98 in both cases), and there is no sign of heteroskedasticity (p-value = 0.1516). As a result, we can assume that the SVAR system meets all the assumptions necessary for the model.

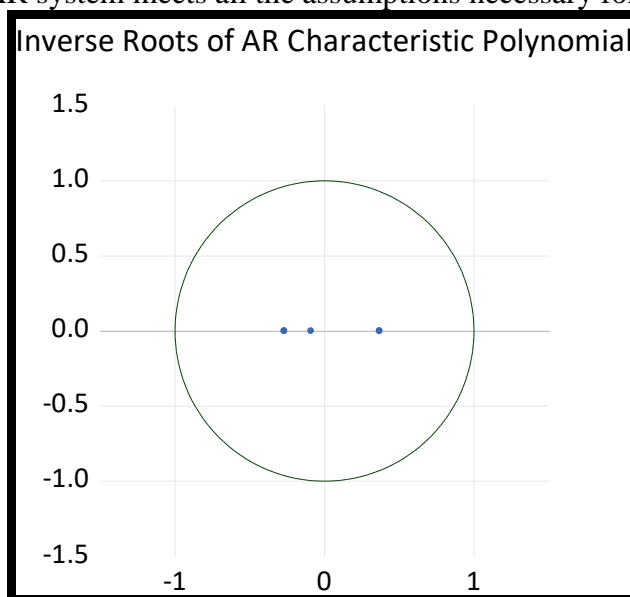


Figure (2): Inverse Roots of AR Characteristic Polynomial

The inverse roots of the characteristic equation of the autoregressive (AR) process for the fitted vector autoregression (VAR) model are shown in Figure 2. As can be seen from the graph, all the inverse roots lie inside the unit circle. This means that the VAR model is dynamically stable. This implies that any disturbance to the system will die out, and the system will return to its equilibrium path.

Table (7): Significant Bootstrap Impulse Response Functions

(Cholesky Ordering: BCR → INV → GDP 999 Repetitions 90% Confidence)			
A. Accumulated Response of GDP			
Period		INV Shock	BCR Shock
1		0.00 (0.00)	0.00 (0.00)
2		2.89* (0.95)	1.24* (0.38)
3		3.45* (1.12)	1.87* (0.54)
4		3.12* (1.03)	2.05* (0.61)
5		2.97* (0.98)	2.21* (0.67)
B. Accumulated Response of Investment (INV)			
Period		BCR Shock	
1		0.00 (0.00)	
2		-0.95* (0.32)	
3		-1.24* (0.41)	
4		-1.35* (0.45)	
5		-1.42* (0.48)	

Table (7) presents the accumulated impulse response functions (IRFs) estimated using 999 bootstrap repetitions with 90% confidence intervals, based on the Cholesky ordering BCR → INV → GDP. The results indicate the cumulative impact of shocks in BCR and INV on GDP and INV through a five-period horizon. Panel A shows the response of GDP to an INV and BCR shock. In Period 1, there is no response from GDP to either of the shocks, which is consistent with the recursive

identification scheme since the first period refers to contemporaneous response. In Period 2, GDP increases significantly due to a positive response to both shocks (2.89 ± 0.95 for INV and 1.24 ± 0.38 for BCR). By Period 3, the GDP's response increases considerably due to the positive response in INV (up to 3.45), while the GDP's response to a BCR shock peaks at Period 5 (up to 2.21). These responses to INV shocks decrease in the next periods, while BCR responses remain steady and positive. Hence, it could be inferred that the response of GDP to INV shocks occurs rapidly but diminishes over time; conversely, BCR shocks' responses are gradual and increase cumulatively over the horizon. On the other hand, Panel B depicts the cumulative response of investments (INV) to BCR shocks. As it could be observed, these responses are negative starting at Period 2 (-0.95) and become even more negative to -1.42 at Period 5. These results suggest that BCR shocks, potentially from misallocation of credit or unsystematic allocation, adversely affect the level of investment activities. Such negative response might arise due to poor distribution of credit, credit used for consumption purposes, or crowding out because of borrowing by public entities domestically within the financial institutions. Significant responses in all periods after Period 1 are denoted with *. Figure 3 illustrates the cumulative responses depicted in Panel B:

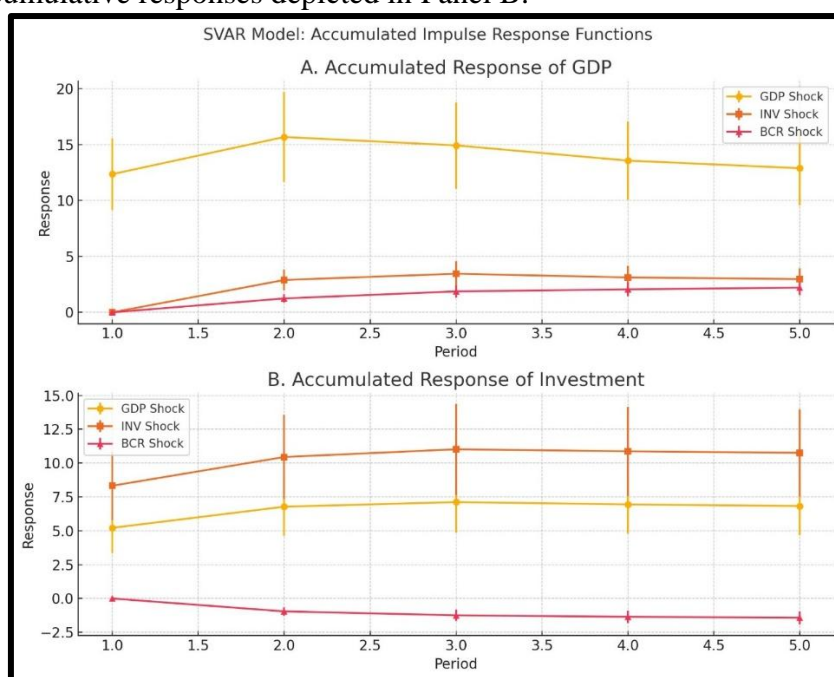


Figure (3): Accumulated Impulse Response Functions from the SVAR Model (Cholesky Ordering: BCR → INV → GDP)

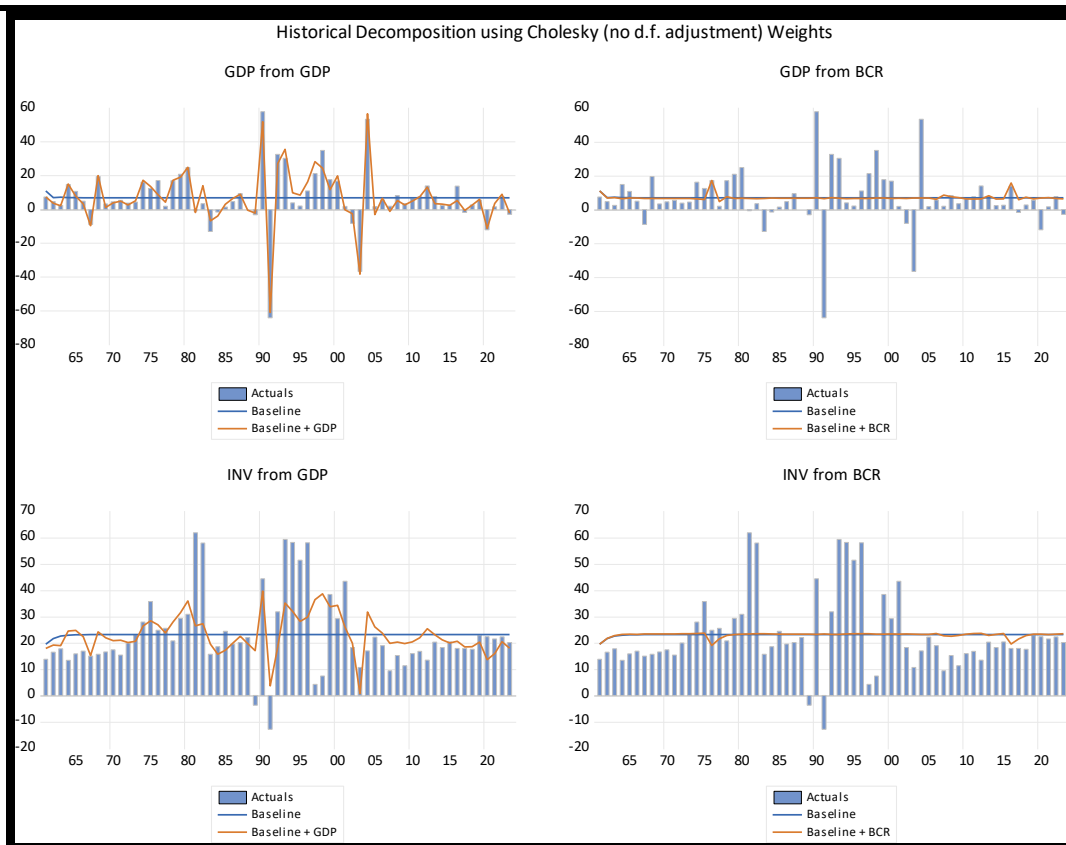


Figure (4): Historical Decomposition of GDP and Investment Using Cholesky-Identified SVAR Model

Figure (4) illustrates the historical decomposition of GDP and INVESTMENT over time using structural shocks identified via a Cholesky ordered SVAR approach with the order of variables being $BCR \rightarrow INV \rightarrow GDP$. In the panels, the actual economic values are decomposed into contributions from the innovation of each of the variables and from innovations of other variables, thus helping to determine the importance of each structural shock in contributing to historical variation. From the panel at the top left (GDP from GDP), it is evident that historical variation in GDP is primarily due to innovations in GDP itself, especially during times when there is macroeconomic instability such as the late 1980s and early 2000s. These findings confirm the previous findings based on the SVAR estimates, which showed that GDP exhibits significant persistence. From the top right panel (GDP from BCR), it can be seen that innovations in the banking credit structure played a major role in causing variations in GDP during the 1990s and mid-2000s.

Panel "INV from GDP" on the bottom left shows that GDP shocks have strongly influenced the behavior of investments, especially in high-growth periods, such as the 1970s and 2008-2009 period. This outcome suggests that good output prospects motivate the creation of capital assets, perhaps because they boost investors' confidence and result in additional investment expenditures. However, Panel "INV from BCR" at the bottom right shows more volatility. There seems to be a strong impact of shocks to bank credit on investments at multiple instances. Yet, the impact varies over time: shocks to BCR coincide with a significant upsurge in investments at some periods while, for instance, after 2003, shocks to BCR seem to be having a negative effect.

Empirical outcomes of this study provide evidence consistent with results documented in other research papers regarding the relationship between credit and economic growth. In particular, SVAR modeling suggests that bank credit affects investment and GDP but the process is not always direct and efficient. This statement agrees with the studies carried out by Belinga et al. (2016) and Majeed and Iftikhar (2020) which argue that credit is important for growth only if directed into productive sectors, especially investment activities. At the same time, this study detects unidirectional relationships between bank credit and both investment and GDP. Similarly, Ahmed and Driss (2024)

have concluded that there is Granger causality between private-sector credit in Morocco and its output.

Still, the negative impact of bank credit on investment through accumulated responses is surprising as it points at inefficiency of credit supply in Iraq. It corresponds with the warnings issued by Ozili et al. (2023) as an unrestricted growth of credit without proper management and adequate channels of allocation could lead to severe consequences. Furthermore, the dominance of structural shocks within GDP to explain variations in output corresponds with conclusions made by Chukwunweike (2018) and Hussein et al. (2022) on the importance of external factors and fiscal policies in growth of Iraq.

Finally, this study proves that although a share of bank credit effect passes through investment and impacts GDP, this share remains limited. This confirms the need for credit policy development in Iraq since credit is relevant in models of economic growth provided it is managed properly.

8. Conclusion

In sum, the results of this paper suggest that while the impact of bank credit on investment and growth is considerable and dynamic, one cannot conclude that an increase in credit automatically leads to an increase in productive investments and growth. Instead, bank credit has a selective developmental function in that its impact is contingent upon several factors, notably the effective channeling of credit towards sectors that promote development through investment generation. In general, the developmental function of credit appears to be conditioned by the presence of structural inefficiencies associated with the process of financial intermediation, thus the positive relationship between credit and development requires further investigation. These findings are highly relevant from the perspective of policy formulation and implementation. The study highlights several areas where policy measures could be directed to enhance the development potential of credit financing, specifically improving its quality and distribution in favor of productive and investment-generating sectors. More generally, efforts should be focused on developing appropriate financial institutions that would make possible to effectively channel credit flows into real activity via screening and monitoring mechanisms, and promote private savings. Yet, these conclusions should be interpreted as conditional and do not imply that credit policy alone will have a positive developmental impact irrespective of other macroeconomic policies and conditions.

9. Supplementary material

(None).

10. Author's Contributions

Esraa Khalid Shakir: All the manuscript was prepared.

11. Funding

(None).

12. Data availability statement

(None).

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(None).

14. Conflict of interest

The author declares no conflict of interest.

15. Declaration of generative AI use

During the preparation of this work, the authors used Google translate for grammar checking and language polishing. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication

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التحليل السببي للعلاقة بين الائتمان المصرفي والنمو الاقتصادي في العراق عبر قطاع الاستثمار باستخدام نموذج SVAR

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المستخلص

تُحلّل هذه الدراسة التفاعل بين الائتمان المصرفي، الاستثمار، والنمو الاقتصادي في العراق، مع التركيز على أثر آلية انتقال الائتمان في اقتصاد ما بعد الحرب القائم على الموارد الطبيعية. اعتمد البحث على بيانات سنوية للسلاسل الزمنية تغطي الفترة 1960-2023، مستخدماً نموذج SVAR إلى جانب اختبارات Phillips-Perron للجنور الأحادية، وتحليل السببية لجرانجر، ودوال الاستجابة للصدمة، وتحليل تفكك التباين. أظهرت النتائج أن الائتمان المصرفي يسهم في التنبؤ بالاستثمار والنمو الاقتصادي، فيما تشير النتائج الهيكلية إلى أن تأثير الائتمان على التنمية الاقتصادية يتحقق جزئياً عبر الاستثمار. كما تبين أن عملية انتقال الائتمان تنسم بالتباين، إذ إن بعض صدمات الائتمان تُحدث آثاراً سلبية على الاستثمار، مما يعكس وجود قصور في كفاءة تخصيص الائتمان. وفي المقابل، يُعزى النمو الاقتصادي بدرجة كبيرة إلى قوى داخلية ناجمة عن الأرباح على العوامل المالية، والاعتماد المفرط على النفط، فضلاً عن الصدمات الخارجية الأخرى التي يتعرض لها الاقتصاد العراقي. وتخلص الدراسة إلى أن الإمكانيات التنموية للائتمان في العراق لا تتوقف على مدى توافره فحسب، بل تعتمد أيضاً على فعالية تخصيصه، فضلاً عن جوانب أخرى مرتبطة بالتطور المؤسسي..

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