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The Causal Nexus between Bank Lending and Economic Growth in Bangladesh: The Vector Error Correction Model Approach

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Abstract. In Bangladesh, banks are crucial for driving economic activities by channeling funds. This makes it essential to understand how bank lending impacts growth. This study offers valuable insights for policymakers to fine-tune financial policies, supporting stable and sustainable development. It delves into the intricate relationship between bank lending and the growth of economy of Bangladesh, emphasizing both short- and long-term effects. This paper looks at the causal relationships between bank lending and economic growth in Bangladesh, focusing on both short-term and long-term effects. To achieve the objectives of this study, time series econometric such as unit root test, Johansen Cointegration test, Vector Error Correction Model (VECM), and Granger causality test are followed. Outcomes from the stationarity test show that all data series become stationary at their first difference. The Johansen Cointegration test confirms a long-term relationship among the variables, while the VECM highlights a bidirectional causal link between bank lending and economic growth over the long term, where causality runs both from GDP to bank lending and vice versa. However, in the short term, no direct causal link is found between GDP and bank lending to the private sector. The study also finds that bank credit may impact GDP indirectly through investment rates, though GDP itself doesn't immediately affect bank lending in the short run. These insights help shed light on the magnificent role of financial sector in supporting Bangladesh's economic growth. Its findings can help shape financial reforms to achieve the country's goal of reaching middle-income status.

Key words: bank lending; economic growth; causality; VECM; Bangladesh.

JEL C32, E44, G21, O11

1. Introduction

In 1971, when Bangladesh emerged as an independent country, many people opined that the country could remain an economic cripple in the years to come. As a newly independent country, it struggled to attract significant foreign investment and had to depend heavily on international aid to support its development [1]. Bangladesh's economy, then labeled the 'bottomless basket' by the former US secretary of state, Henry Kissinger, has undergone a remarkable transformation in recent years [2]. Bangladesh was one of the five poorest countries in the world, with a per capita income of just $190 [3].

However, within the past five decades, all those doubts and statements have been put to respite. Despite being interrupted by a number of difficult issues like poverty, natural calamities, overpopulation, corruption and political turmoil, the

economy of Bangladesh has been flourishing steadily with a satisfactory rate, driven by economic reforms aimed at achieving middle-income status [2]. The gross domestic product (GDP) reached 7.88 % in 2019, which was 5.29 % in 2000 [4]. Since its founding in 1972, Bangladesh Bank has encouraged the economic growth and helped businesses in tandem with approved commercial banks. Bangladesh has forty-three privately owned commercial banks, nine foreign commercial banks, three specialized banks, and six government commercial banks as of 2024. These banks offer a variety of financial services to help in the continuous economic development of a country.

In this era, investment has become a key part of the economy, with banks playing a vital role in funding essential resources. In Bangladesh, bank loans are one of the major contributors to economic growth, as the way credit is distributed across various private sectors has a direct influence on the country's growth rates. However, the relationship between economic development and lending activities by bank remains controversial, with the effect of credit not always being positive. In some European Union countries, bank lending and inflation have been found to negatively affect growth [4].

The debate over the existence and direction of causality can only be resolved through empirical evidence [5]. Numerous scholarly works investigate the actual correlation between bank contributions and economic progress. These investigations scrutinize the association between bank lending and growth in nations such as Malaysia, Nigeria, Nepal, and Pakistan.

However, few empirical studies are found in the geographical context of Bangladesh assessing the causal linkage between these variables based on latest time-series data set. Thus, the lack of prior research on the topic in this geographical context serves as an important opportunity to describe the need for further research.

The main *research questions (RQ)* of this study are:

RQ1: Does a long-term equilibrium relationship exist between bank lending and economic growth in Bangladesh?

RQ2: What is the nature of the causal relationship between bank lending and economic growth in both the short and long term?

This paper aims to explore both the impact and the direction of the causal relationship between bank lending and economic growth in Bangladesh.

The study focuses on two main objectives:

(i) To assess whether a long-term equilibrium relationship exists between bank lending and economic growth in Bangladesh.

(ii) To analyze the causal link between bank lending and economic growth in the country.

To achieve these research objectives, the study is structured around several hypotheses that guide empirical analysis. By testing these *hypotheses*, the study aims to uncover how variations in bank lending may influence sustainable economic growth. Furthermore, understanding the direction of causality in both short-

term and long-term contexts is vital for developing informed financial policies that can support the country's economic stability and progress.

H1: Variables are stationary.

H2: Cointegration is evident in the series.

H3: Bank lending and economic growth have a long-term causal relationship.

H4: Bank lending and economic growth have a short-term causal relationship.

Research structure. The successive section provides a review of previous studies regarding the relationship between bank lending and economic growth and identifies the research gap. The third section provides a short description of variables and methodology used to analyze the data. Section four interprets the empirical results and the fifth section states critical discussions. The last section offers conclusions of the study.

2. Theoretical Linkages and literature review

This section explores how factors like bank lending, inflation, interest rates, government spending, and investment work together to shape economic growth. While studies worldwide have examined these links, there's a need for more research in Bangladesh using recent data. Addressing the literature gap, this section highlights the importance of understanding how these relationships affect the country's growth today.

2.1. Theoretical Linkages among GDP, Bank Lending, Inflation, Government Consumption, Interest Rate and Investment to GDP

The banking sector fulfills some main functions in an economy. It also helps households to outline their consumption behavior over time through increasing saving and borrowing Franklin & Gale [6]. Banking sector also ensure liquidity to the economy by financing illiquid assets with liquid liabilities Diamond & Dybvig [7]. To accelerate the growth of economy and development of Bangladesh, government of Bangladesh and the central bank impose both fiscal and monetary policy. Bangladesh is a developing nation with huge population. But there are not enough employment opportunities in the economy for unemployed people. The government of the country needs to pay attention to creating employment opportunities for unemployed people. For creating employment opportunities, the government is bound to increase investment.

For this purpose, the Central bank increases bank lending both to public and private sectors investors. In such a situation, commercial banks come forward with their funds to provide among both private and public sectors as loan. When the Central bank increase money supply by lowering interest rate, then the inflation rate of the country increases, which could have a possibility of hampering the economic growth and well-being of the people [8]. Thus, it is clearly assumed that there is a possibility of having causal relationship among GDP, bank lending, inflation, interest rate, government expenditure or consumption, and private investment [9].

2.2. Review of Earlier Literature

For centuries, the correlation between lending by banks and the growth of the economy has been considered as a significant Issue of discussion in this academic arena. Numerous investigations have been carried out to examine the connection between bank lending and economic expansion. Previous studies prove the presence of favorable connection between these two elements. Tahir et al. [10] discovered that bank credit plays a significant role in driving economic growth in Pakistan.

Reddy et al. [13] suggested that certain factors, like domestic credit, return on equity, and the capital adequacy ratio each reflecting the bank's operational and financial health are linked to India's GDP growth. From these studies, it is revealed that that bank lending affects the growth of economy, and similarly, bank credit has an association with economic advancement.

Timsina et al. [11] carried out a study in the context of Nepal. In the study, he tried to investigate the relationship between bank lending and economic growth of Nepal and found the impact of bank credit expansion on the economic growth in the short-term Ho & Saadaoui [14].

Another study carried out by Shingjergji & Hyseni [12] discovered that credit growth in the Albanian banking system is inversely correlated with the rate of unemployment, interest rates, non-performing loans, and bank size; and positively correlated with GDP growth, inflation rate, and capital adequacy ratio. Indicators pertaining to banks and economic growth are co-integrated in India.

A study conducted by Alam et al. [15] revealed a strong correlation between economic growth and return on assets and interest margin. It is also found that lending capacity and investment activities do not significantly correlate with economic growth. Jordan's economic growth is strongly influenced by the expansion of the banking industry, and rising lending interest rates have a detrimental effect by Almahadin et al. [16].

Capital formation is one of the few resources necessary for sustainable growth of the economy, according to Schumpeter [17]. The author emphasized that a key component of an economy's long-term success is the effectiveness of financial intermediaries in directing resources toward investments. Schumpeter [17] was supported by additional research conducted by other researchers, for example [18].

Goldsmith [19] acknowledged the banking system's significant role in economic expansion. Roubini & Sala-i-Martinthat [20] shows that governments might choose to repress the financial sector because this policy increases the demand for money and delivers easy inflationary revenues. Two primary roles of the financial industry are the mobilization of domestic savings and the effective deployment of capital, according to research by Okuda [21]. This suggests that one of the main forces behind economic growth is the banking system's crucial role in hastening the conversion of savings into capital accumulation.

The relationship between banks, the stock market, and economic growth in Bangladesh was empirically explored by Banerjee et al. [22]. The author discov-

ered that bank lending to the private sector contributes significantly and favorably to Bangladesh's economic growth.

Azolibe [23] verified a long-term correlation between Nigeria's economic growth and indices of the banking sector's progress. But in the near run, the only factors that significantly boosted economic growth were the expansion of bank branches and total bank assets. This suggests that these particular factors account for a large portion of Nigeria's robust economic performance.

Oyebowale [24], on the other hand, discovered that while sectoral bank lending has a limited positive impact on economic growth, several subsectors- like real estate, construction, transportation, and communication benefit over the long run.

Many empirical studies have focused on general measures of the size of the banking sectors and economic growth (Beck et al. [25]). Moreover, different sectors have different causal relationships between finance and growth; some lend credence to the growth-led finance theory, while others do the opposite.

Recent research has discovered a wealth of historical data regarding the connection between bank lending and economic growth on the brink of financial liberalization and globalization. Bank credit was found to be a major predictor of industrial output in papers by McMillin [26], Romer & Romer [27] and Friedman [28]. The real sector's performance and credit levels were shown to be positively correlated by the authors, who concluded that bank lending served as a conduit for monetary policy's credit expansion.

The direction of causality plays a vital role in understanding this relationship. Patrick [18] not only highlighted the positive link between financial development and economic growth but also introduced the ideas of "supply-leading" and "demand-following" to determine whether financial intermediation drives economic growth or if economic growth triggers financial development. According to the "demand-following" strategy, financial institutions' willingness to provide financial intermediary services is contingent upon the demands that arise from an expanding economy. Patrick [18], on the other hand, provided an explanation of the "supply-leading" approach, which states that the presence of financial institutions and the services they provide has encouraged the economy to utilize these resources for expansion.

In the contrary, some researchers also found insignificant even negative association between bank credit and economic growth. Ho & Saadaoui [4] found negative effect of bank lending and inflation on growth of countries of European Union. In another study Akbar [29] analyzed the effect of internal and external factors on ban lending where GDP showed a negative impact on bank lending during 2017 to 2021.

In Latin America, inflation rates and banks' reserve ratios show a negative correlation with economic growth by Roubini & Sala-I–Martin [20].

Magoma et al. [30] looked into the lending behavior of banks in Tanzania and found GDP having an insignificant effect on ban lending.

So, from the discussion, we can conclude that a positive association between bank lending and economic growth is found in most of the literature. In contrast some researchers also found a negative effect of GDP on bank lending.

2.3. Gaps in Earlier Literature

A notable amount of investigation has been found into the linkage between banking contributions and economic growth. Studies from countries like Malaysia, Nigeria, Nepal, Pakistan, and others have explored the causal link between bank lending and economic development. Some papers have worked on the economic growth on Bangladesh including Begum et al. [31], Banerjee et al. [22], but they attempt to analyze the impact of export, import, stock market human capital.

The relationship between Bangladesh's banks, stock market, and economic growth is empirically investigated by Banerjee et al. [22] using data spanning 38 years, from 1974 to 2012. The author employed the unit root test, cointegration test, and error correction model. However, the underlying causes of the relationship between the variables were not analyzed.

Begum et al. [31] investigated how Bangladesh's exports affected the country's economic expansion. Paul [32] conducted research on Bangladesh's yearly GDP growth rate, industrial production index (IPI), and private sector credit (PC), but he used a different methodology. The author used ARDL model.

Hence, no empirical research has been conducted on Bangladesh's economy to evaluate the impact and causal link between bank lending and economic growth using the most recent time series data. Hence, the present study seeks to determine the long-term relationship between bank lending and economic growth, as well as the direction of causality, using 44 years of updated data in the context of Bangladesh.

3. Methodology

This study picked a time series data set of 44 years. Therefore, time-series econometrics is followed to explore the relationship. The analyses undertaken in this study are described below.

3.1. Data and Variables

A total of six economic variables such as GDP, bank lending to private sectors, inflation, government consumption, interest rate and investment are taken. The private sector's domestic credit is used to evaluate banks' growth contributions (BP). The World Bank and IMF provide the statistics for the control variables, which are inflation (INF), government consumption (GC), interest rate (IR), and investment to GDP (IGDP). Data is collected from the database of the World Bank and International Monetary Fund. Description of the variables and their sources are displayed in Table 1[1].

[1] World Bank (WB). World Development Indicators database (WDI), August 2024. Washington, D.C. https://clck.ru/3GDCnT: International Monetary Fund (IMF). World Economic Outlook database (WEO), April 2024. Washington, D.C. https://clck.ru/3GDCis

Table 1. **Description of the variables and their sources**

Variable	Definition	Symbolization	Sources
Economic growth	GDP growth rate	GDP	World development indicators (WDI), database of World Bank (WB)
Bank lending to private sector	Domestic credit to private sector by banks as % of GDP	BP	World development indicators (WDI), database of World Bank (WB)
Inflation	Average consumer prices index	INF	World economic outlook (WEO) database of International monetary fund (IMF)
Government Consumption	Government final consumption to GDP	GC	World development indicators (WDI), database of World Bank (WB)
Interest Rate	Lending interest rate (%)	IR	World development indicators (WDI), database of World Bank (WB)
Investment	Total investment to GDP	IGDP	World economic outlook (WEO) database of International monetary fund (IMF)

3.2. Trends of GDP, Bank Lending, Inflation, Government Consumption, Interest Rate and Invest to GDP in Bangladesh

The trends of GDP, bank lending, inflation, government consumption, interest rate and invest to GDP in Bangladesh are shown by Fig. 1. From the figure it is revealed that the GDP Fig. 1(a) of Bangladesh has increased over the time with continuous fluctuations. Among all considered variables, investment Fig. 1(f) and bank lending Fig. 1(b) have increased persistently over time. Inflation Fig. 1(c) was high in the early years, then fluctuated significantly and eventually stabilized later-on. Then government consumption Fig. 1(d) initially showed a gradual increase over time, stabilizing at a consistent level after that. Finally, the interest rate Fig. 1(e) is the only variable that declined over time.

3.3. Breusch-Godfrey Serial Correlation LM Test

When the residuals of a time series exhibit correlation with their own lagged values, like at times T and T-1, this phenomenon is known as serial or auto-correlation. This frequently occurs in repeated patterns when the level of one variable influences the level of another. The estimated variances of regression coefficients are biased by serial correlation, which inflates the significance of t-statistics.

Consequently, time series data that exhibit serial correlation is not appropriate for use in subsequent estimate or hypothesis testing.

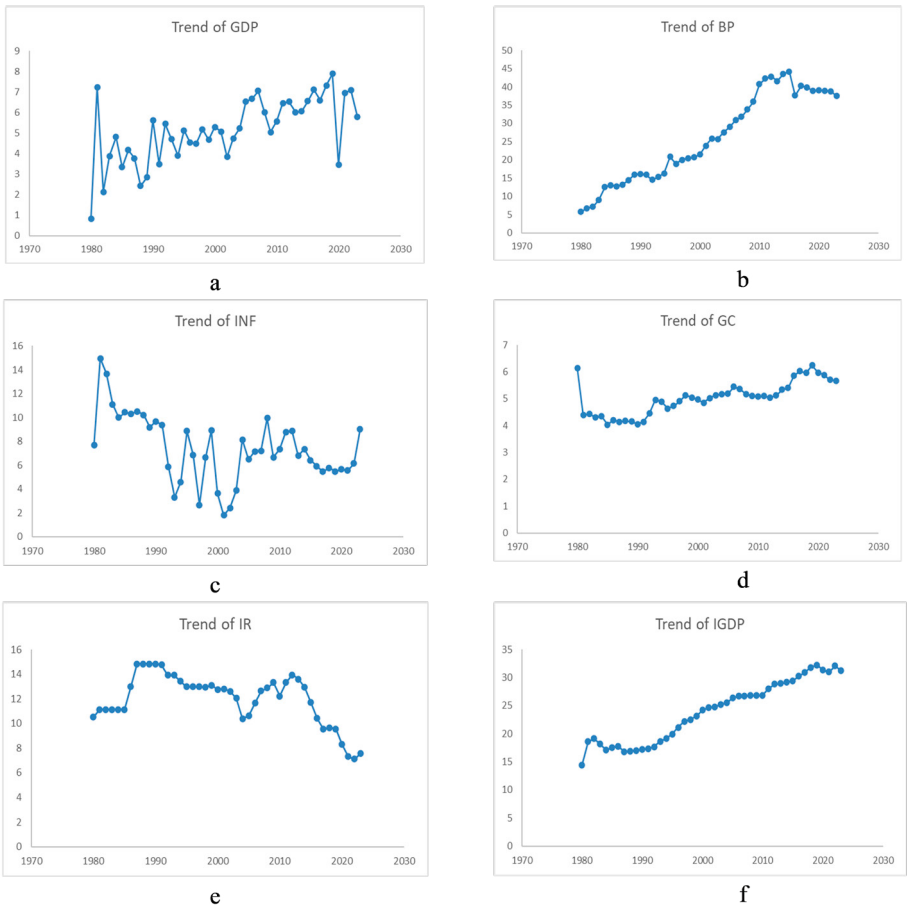

Fig. 1. Trend of the selected variables (1980–2023)

3.4. Unit Root Test

The unit root is used to evaluate whether a data series is stationary. In this study, the Augmented Dickey-Fuller (ADF) test is incorporated to assess the stationarity of each time series. The unit root test is necessary for two key reasons: first, to ensure that the data series is stationary for subsequent analysis, and second, to confirm that the series are integrated at the same order. The following equation represents the ADF test, which incorporates both a constant and a trend.

$$\Delta X_t = \alpha + \delta_t + \beta X_{t-1} + \sum_{i=1}^{n} \theta_i \Delta X_{t-1} + \varepsilon_i, \quad (1)$$

Where: ΔX_t denotes the change in the variable x at time t, α is the constant term (intercept) in the regression equation and δ represent the coefficient associated with the time trend (t), $\sum_{i=1}^{n} \theta_i \Delta X_{t-1}$ is the summation term accounts for the lagged differences of the variable X, allowing for higher-order serial correlation.

Finaly, εi is the error term or residual. For the unit root test, $\beta = 0$ is the null hypothesis. The unit root of *Xt* hypothesis is rejected if the coefficient is statistically significant and distinct from zero.

3.5. Johansen's Cointegration Test

Cointegration refers to the situation where there exists a long-term relationship between two or more variables. From an economic perspective, a series is considered cointegrated if its distance from the other series is steady and it moves together over time. Still, a correlation does not always imply long-term, and their spread could not be steady. For running cointegration among variables the variables need to be individually non-stationary time series. The cointegration methodology is then used to determine whether there is a stable link between the variables depending on the outcome of stationarity test. Cointegration indicates the presence of a long-term equilibrium that the economy will eventually converge to.

3.6. Vector Error Correction Mechanism (VECM)

When the result of cointegration test provides evidence of having a long-term relationship between variables, the VECM is then run to analyze which variables are connected over in the long run and how short-term changes impact deviations from equilibrium.

If cointegration isn't found, Granger causality tests can explore the causality between variables without using VECM. The VECM also identifies how much and in what direction variables need to adjust to correct imbalances and return to equilibrium, while also considering short-term dynamics. The equations formed for VECM are displayed in equ. (2) to equ. (7).

In the long-run, causality can be emphasized if the coefficient of the ECT is both negative and significant at the same time. This allows us to determine the speed at which the equilibrium will be reached. The Wald test was employed in the study to assess the statistical model's explanatory variables' significance.

3.7. Granger Causality Test

This test is used to identify whether and how one time series can be used to predict another. According to this test, if a variable M, for example, Granger-causes variable N, then past values of M should offer useful information for forecasting N, without needing to rely on past values of N. This approach is mathematically formulated using stochastic process modeling through linear regression:

$$\begin{aligned}\Delta RGDP_t = &\sum_{i=1}^{n} a_{1t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{1t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{1t}\Delta INF_{t-i} + \\ &+\sum_{i=1}^{n} d_{1t}GC_{t-i} + \sum_{i=1}^{n} e_{1t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{1t}\Delta IGDP_{t-i} + \alpha_1 ECT_{t-1} + \varepsilon_{1t},\end{aligned} \tag{2}$$

$$\Delta BP_t = \sum_{i=1}^{n} a_{2t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{2t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{2t}\Delta INF_{t-i} + \sum_{i=1}^{n} d_{2t}GC_{t-i} + \\ + \sum_{i=1}^{n} e_{2t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{2t}\Delta IGDP_{t-i} + \alpha_2 ECT_{t-1} + \varepsilon_{2t}, \quad (3)$$

$$\Delta INF_t = \sum_{i=1}^{n} a_{3t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{3t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{3t}\Delta INF_{t-i} + \sum_{i=1}^{n} d_{3t}GC_{t-i} + \\ + \sum_{i=1}^{n} e_{3t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{3t}\Delta IGDP_{t-i} + \alpha_3 ECT_{t-1} + \varepsilon_{3t}, \quad (4)$$

$$\Delta GC_t = \sum_{i=1}^{n} a_{4t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{4t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{4t}\Delta INF_{t-i} + \sum_{i=1}^{n} d_{4t}GC_{t-i} + \\ + \sum_{i=1}^{n} e_{4t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{4t}\Delta IGDP_{t-i} + \alpha_4 ECT_{t-1} + \varepsilon_{4t}, \quad (5)$$

$$\Delta IR_t = \sum_{i=1}^{n} a_{5t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{5t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{5t}\Delta INF_{t-i} + \sum_{i=1}^{n} d_{5t}GC_{t-i} + \\ + \sum_{i=1}^{n} e_{5t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{5t}\Delta IGDP_{t-i} + \alpha_5 ECT_{t-1} + \varepsilon_{5t}, \quad (6)$$

$$\Delta IGDP_t = \sum_{i=1}^{n} a_{6t}\Delta RGDP_{t-i} + \sum_{i=1}^{n} b_{6t}\Delta BP_{t-i} + \sum_{i=1}^{n} c_{6t}\Delta INF_{t-i} + \sum_{i=1}^{n} d_{6t}GC_{t-i} + \\ + \sum_{i=1}^{n} e_{6t}\Delta IR_{t-i} + \sum_{i=1}^{n} f_{6t}\Delta IGDP_{t-i} + \alpha_6 ECT_{t-1} + \varepsilon_{6t}. \quad (7)$$

4. Analysis of the study

4.1. Description of variables

From Table 2, it is found that the average value of GDP, BP, INF, GC, IR, IGP are 5.168, 25.952, 7.421, 5.022, 12.013 & 23.912, respectively. The skewness is negative for GDP, IGDP and IR, and positive for rest of the variables. BP, GC, IGDP exhibit negative kurtosis, rest of the variables have positive.

Table 2. **Descriptive statistics**

Attributes	GDP	BP	INF	GC	IR	IGDP
Mean	5.168	25.952	7.421	5.022	12.013	23.912
Median	5.208	24.777	7.184	5.057	12.695	24.710
Maximum	7.882	44.204	14.935	6.238	14.846	32.214
Minimum	0.819	5.771	1.812	4.031	7.121	14.440
Stat. dev.	1.563	12.095	2.806	0.619	2.039	5.446

End of table 2

Attributes	GDP	BP	INF	GC	IR	IGDP
Skewness	–0.554	0.030	0.271	0.142	–0.768	–0.027
Kurtosis	0.095	–1.437	0.348	–0.789	0.099	–1.426
Observations	44	44	44	44	44	44

Sources: Author's own calculation

4.2 Unit Root Test Results

Table 3 presents the outcomes of the ADF test for the variables, both at their original level data and at the first derivative. For level data the p-values indicate that the null hypothesis cannot be rejected, meaning the variables are non-stationary at this point. Nevertheless, at first difference, the null hypothesis is rejected, confirming the stationary of the variables. This findings suggest that the variables GDP, BP, INF, GC, IR& IGDP are integrated of same order at I(1).

Table 3. **ADF unit root test results**

Variables	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
GDP	0.0000	0.0000	0.0000	0.0000
BP	0.5323	0.9460	0.0000	0.0000
INF	0.0520	0.0830	0.0000	0.0000
GC	0.2412	0.2912	0.0000	0.0000
IR	0.5693	0.4545	0.0022	0.0075
IGDP	0.6933	0.5519	0.0000	0.0000

Sources: Author's own calculation

4.3. Results of Optimal Lag Selection

It is essential to find the optimal lag as this is precondition for the test of cointegration and VECM. Table 4 shows the result of optimal lag structure capitalizing the var model. According to AIC optimal lag is 3.

Table 4. **Results of optimal lag selection**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–426.7685	NA	59.35021	21.11066	21.36143	21.20198
1	–238.1102	312.8967*	0.035328*	13.66391	15.41928*	14.30312*

End of table 4

Lag	LogL	LR	FPE	AIC	SC	HQ
2	–202.0822	49.20903	0.039600	13.66255	16.92251	14.84965
3	–163.0829	41.85288	0.047256	13.51624*	18.28081	15.25123

Notes: The asterisk (*) indicates the lag order chosen based on the specified criteria. The various tests – like the sequential modified LR test statistic (each assessed at a 5 % significance level), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) – are used to evaluate the model's performance and select the appropriate lag length; Author's own calculation.

4.4. Result of Serial Correlation LM Test

The LM test checks serial correlation between the variables. As shown in Table 5, the LM test results indicate a p-value higher than 5 %, meaning the model does not have autocorrelation. As shown in Table 5, the *p-value* of *F-statistics* is 0.255, which is higher than 5 %. So, the null hypothesis cannot be accepted, indicating this model is free from autocorrelation.

Table 5. **Result of LM Test**

F-statistic	1.422	Prob. F(2, 33)	0.255
Obs*R-squared	3.222	Prob. Chi-Square (2)	0.200

Sources: Author's own calculation

4.5. Johansen's Cointegration Test Results

Table 6 presents the trace test, there is evidence of a cointegrating equation at the 5 % significance level. The null hypothesis for "at most 3" is rejected as the trace statistic exceeds the critical value. This suggests that the trace test identifies four cointegrating equations at the 5 % significance level. This conclusion is further validated by the Maximum Eigenvalue Test. As a result, the tests confirm the presence of four series with true long-term equilibrium relationships.

Table 6. **Results of Cointegration Test**

Hypothesis	Trace Statistic Test			Maximum Eigen Value Test		
No. of CE(s)	Trace Statistic	5 % critical value	Prob.	Max-Eigen Statistic	5 % critical value	Prob.
None *	188.1540	103.8473	0.0000	68.91745	40.95680	0.0000
At most 1 *	119.2365	76.97277	0.0000	42.34558	34.80587	0.0053
At most 2 *	76.89096	54.07904	0.0001	36.06172	28.58808	0.0046
At most 3 *	40.82924	35.19275	0.0111	25.79068	22.29962	0.0156

End of table 6

Hypothesis	Trace Statistic Test			Maximum Eigen Value Test		
No. of CE(s)	Trace Statistic	5 % critical value	Prob.	Max-Eigen Statistic	5 % critical value	Prob.
At most 4	15.03857	20.26184	0.2241	10.24101	15.89210	0.3129
At most 5	4.797553	9.164546	0.3063	4.797553	9.164546	0.3063

Notes: The trace test indicates the presence of 4 co-integrating equations at the 0.05 significance level. An asterisk (*) signifies the rejection of the hypothesis at the 0.05 level. The p-values are based on the MacKinnon-Haug-Michelis (1999) approach, Author's own calculation.

4.6. Results of Vector Error Correction Model (VECM)

Cointegration indicates the existence of long run equilibrium relationship between variables. Therefore, we need to apply for the VECM. Otherwise, we could directly run Granger Causality tests. The optimal lag used for estimating the model is 3, determined following Akaike information criterion.

Results of VECM in Table 7 show GDP, BP, GC & IR have negative and significant coefficient. If any error occurs in the short run, then changes in variables should be 14.39 % by GDP, 40.30 % by IR, 11.29 % by GC, 1.15 % by BP in one period to ultimately achieve the long-run equilibrium. INF and IGDP possess negative but insignificant coefficient. A negative and statistically significant coefficient for GDP, BP, GC, and IR also signals the presence of a long-term causal relationship between these variables.

Table 7. **Vector error correction estimates**

	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6
Error Correction: Coint. Eq.	Δ(GDP)	Δ(BP)	Δ(INF)	Δ(GC)	Δ(IR)	Δ(IGDP)
	–0.14039**	–0.01515**	–0.93440	–0.11293***	–0.40307**	–0.17837
	(0.06671)	(0.00718)	(0.48184)	(0.04101)	(0.15529)	(0.11530)
	[–2.10460]	[–2.11058]	[–1.93923]	[–2.75376]	[–2.59567]	[–1.54703]
ΔGDP(–1)	–0.913562	–0.286553	0.751752	–0.087139	–0.296491	0.176483
	–0.25732	–0.51114	–0.49917	–0.04249	–0.16087	–0.11945
	[–3.55027]	[–0.56062]	[1.50600]	[–2.05100]	[–1.84302]	[1.47745]
Δ(GDP (–2)	–0.48566	–0.394243	0.311857	–0.044217	–0.162647	0.063889
	–0.16637	–0.33047	–0.32274	–0.02747	–0.10401	–0.07723
	[–2.91916]	[–1.19296]	[0.96629]	[–1.60970]	[–1.56375]	[0.82725]
Δ(BP(–1)	0.149742	–0.036472	–0.055091	0.00088	0.101062	0.073106

Continuation of table 7

	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6
Error Correction: Coint. Eq.	Δ(GDP)	Δ(BP)	Δ(INF)	Δ(GC)	Δ(IR)	Δ(IGDP)
	–0.14039**	–0.01515**	–0.93440	–0.11293***	–0.40307**	–0.17837
	–0.10917	–0.21684	–0.21177	–0.01802	–0.06825	–0.05068
	[1.37170]	[–0.16820]	[–0.26015]	[0.04883]	[1.48081]	[1.44264]
Δ(BP(–2)	0.116777	0.055652	0.042596	0.027297	–0.033639	0.084579
	–0.10894	–0.21639	–0.21133	–0.01799	–0.06811	–0.05057
	[1.07195]	[0.25718]	[0.20156]	[1.51762]	[–0.49392]	[1.67249]
Δ(INF(–1)	0.031228	–0.112428	–0.149439	–0.016358	0.062654	0.016841
	–0.08916	–0.17711	–0.17296	–0.01472	–0.05574	–0.04139
	[0.35025]	[–0.63480]	[–0.86401]	[–1.11117]	[1.12402]	[0.40690]
Δ(INF(–2)	0.101055	–0.008306	–0.451178	7.14E-05	–0.068611	0.050224
	–0.09087	–0.18049	–0.17627	–0.015	–0.05681	–0.04218
	[1.11213]	[–0.04602]	[–2.55961]	[0.00476]	[–1.20778]	[1.19068]
Δ(GC(–1)	0.653881	0.699855	–3.392107	0.344399	0.328118	0.275536
	–1.39308	–2.7672	–2.7024	–0.23001	–0.87093	–0.64668
	[0.46938]	[0.25291]	[–1.25522]	[1.49732]	[0.37675]	[0.42608]
Δ(GC(–2)	0.580743	–0.133298	–0.74118	0.291396	–0.258401	0.405957
	–0.84986	–1.68815	–1.64863	–0.14032	–0.53132	–0.39451
	[0.68334]	[–0.07896]	[–0.44957]	[2.07665]	[–0.48634]	[1.02901]
Δ(IR(–1)	–0.331875	0.299658	0.642444	–0.105689	0.306395	–0.277812
	–0.27858	–0.55336	–0.5404	–0.046	–0.17416	–0.12932
	[–1.19133]	[0.54152]	[1.18882]	[–2.29781]	[1.75927]	[–2.14830]
Δ(IR(–2)	–0.586025	0.252776	–0.282334	–0.008144	–0.17474	0.075881
	–0.28499	–0.56609	–0.55284	–0.04705	–0.17817	–0.13229
	[–2.05632]	[0.44653]	[–0.51070]	[–0.17307]	[–0.98075]	[0.57358]
Δ(IGDP(–1)	–0.127303	–0.113957	–0.171741	0.084248	0.502284	0.210854
	–0.39465	–0.78392	–0.76557	–0.06516	–0.24673	–0.1832
	[–0.32257]	[–0.14537]	[–0.22433]	[1.29294]	[2.03579]	[1.15095]
Δ(IGDP(–2)	0.088729	0.353201	0.368391	0.021109	–0.231741	–0.099508
	–0.28261	–0.56137	–0.54822	–0.04666	–0.17668	–0.13119
	[0.31397]	[0.62918]	[0.67197]	[0.45240]	[–1.31164]	[–0.75851]
C	–0.130779	0.67816	–0.152262	–0.046213	–0.172409	0.110643

End of table 7

	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6
Error Correction: Coint. Eq.	Δ(GDP)	Δ(BP)	Δ(INF)	Δ(GC)	Δ(IR)	Δ(IGDP)
	–0.14039**	–0.01515**	–0.93440	–0.11293***	–0.40307**	–0.17837
	–0.27149	–0.53928	–0.52665	–0.04482	–0.16973	–0.12603
	[–0.48171]	[1.25754]	[–0.28912]	[–1.03097]	[–1.01579]	[0.87794]
R-squared	0.594166	0.180037	0.391325	0.39652	0.512016	0.5552
Adj. R-squared	0.398764	–0.21476	0.09826	0.105955	0.277061	0.341037
F-statistic	3.04074	0.456025	1.335283	1.364651	2.17921	2.59242
Number of observations: 41 after adjustments; Standard errors in () & t-statistics in []						

Notes: An asterisk (*) indicates statistical significance at the 10 % level, while two asterisks (**) represent significance at the 5 % level, and three asterisks (***) denote significance at the 1 % level; Author's own calculation

The VECM also reveals short-term behavior of the first and second differences of the variables. To confirm the result, a Wald test is employed based on the short-run dynamics from VECM.

The findings in Table 8 show that the null hypothesis of "no short-run causality between variables" can be rejected at the 5 % significance level, as the Chi-square probability falls below this threshold indicating the existence of short-run causality between the variables.

Table 8. **Wald Test result (Short run causality between BP and GDP)**

Test Statistic	Value	Probability
F-statistic	1.268	0.298
Chi-square	2.537	0.281
Null Hypothesis: C(4)=C(5)=0		
Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.150	0.109
C(5)	0.117	0.109

Notes: Restrictions are linear in coefficients; Author's own calculation

Furthermore, the Wald test was applied to the first and second lags of bank lending to the private sector, with the GDP growth rate as the dependent variable. According to the results in Table 9, there is no evidence of short-run causality between BP and GDP.

Table 9. **Wald Test result**

Test Statistic	Value	Probability
F-statistic	3.703	0.0050
Chi-square	37.028	0.0001
Null Hypothesis: C(4) = C(5) = C(6) = C(7) = C(8) = C(9) = C(10) = C = (11) = C(12) = C(13) = 0		
Normalized Restriction (=0)	Value	Std. Err.
C (4)	0.150	0.109
C (5)	0.117	0.109
C(6)	0.031	0.089
C(7)	0.101	0.091
C (8)	0.654	1.393
C(9)	0.581	0.850
C (10)	–0.332	0.279
C (11)	–0.586	0.285
C(12)	–0.127	0.395
C (13)	0.089	0.283

Notes: Restrictions are linear in coefficients; Author's own calculation

4.7. Granger Causality Test

Granger causality is more about short run causation and prediction than usual causation. The findings of the granger causality test have been presented in Table 10. Null hypothesis indicates variables do not granger cause each other. If p value is less than 0.10 the null hypothesis is rejected at a 10 % significance level, meaning that one variable granger cause another.

Table 10. **Results of Granger causality test**

Null Hypothesis	F Statistic	Probability	Decision
Δ(BP) does not Grangert Cause Δ(GDP)	0.5527	0.6499	Accepted
Δ(GDP) does not Grangert Cause Δ(BP)	1.4929	0.2345	Accepted
Δ(INF) does not Grangert Cause Δ(GDP)	0.4456	0.7220	Accepted
Δ(GDP) does not Grangert Cause Δ(INF)	0.4044	0.7508	Accepted
Δ(GC) does not Grangert Cause Δ(GDP)	0.4670	0.7073	Accepted
Δ(GDP) does not Grangert Cause Δ(GC)	2.1014	0.0189	Rejected
Δ(IR) does not Grangert Cause Δ(GDP)	2.9880	0.0451	Rejected
Δ(GDP) does not Grangert Cause Δ(IR)	0.3957	0.7569	Accepted

End of table 10

Null Hypothesis	F Statistic	Probability	Decision
Δ(IGDP) does not Grangert Cause Δ(GDP)	0.6608	0.5820	Accepted
Δ(GDP) does not Grangert Cause Δ(IGDP)	0.9693	0.4189	Accepted
Δ(INF) does not Grangert Cause Δ(BP)	1.1666	0.3372	Accepted
Δ(BP) does not Grangert Cause Δ(INF)	0.0847	0.0679	Rejected
Δ(GC) does not Grangert Cause Δ(BP)	0.4370	0.7280	Accepted
Δ(BP) does not Grangert Cause Δ(GC)	1.0407	0.3874	Accepted
Δ (IR) does not Grangert Cause Δ(BP)	1.2106	0.3212	Accepted
Δ(BP) does not Grangert Cause Δ(IR)	1.3175	0.0852	Rejected
Δ(IGDP) does not Grangert Cause Δ(BP)	0.9938	0.4078	Accepted
Δ(BP) does not Grangert Cause Δ(IR)	0.9192	0.4423	Accepted
Δ(GC) does not Grangert Cause Δ(INF)	0.4892	0.6922	Accepted
Δ(INF) does not Grangert Cause Δ(GC)	0.6494	0.5889	Accepted
Δ(IR) does not Grangert Cause Δ(INF)	0.4453	0.7222	Accepted
Δ(INF) does not Grangert Cause Δ(IR)	1.5622	0.2170	Accepted
Δ(IGDP) does not Grangert Cause Δ(INF)	0.2946	0.8290	Accepted
Δ(INF) does not Grangert Cause Δ(IGDP)	1.0470	0.3847	Accepted
Δ(IR) does not Grangert Cause Δ(GC)	0.6754	0.5733	Accepted
Δ(GC) does not Grangert Cause Δ(IR)	1.1848	0.3305	Accepted
Δ(IGDP) does not Grangert Cause Δ(GC)	1.0209	0.3959	Accepted
Δ(GC) does not Grangert Cause Δ(IGDP)	3.8448	0.0183	Rejected
Δ(IGDP) does not Grangert Cause Δ(IR)	1.5764	0.2136	Accepted
Δ(IR) does not Grangert Cause Δ(IGDP)	2.2377	0.1022	Rejected

Sources: Author's own calculation

The table 10 shows, "BP does not granger cause GDP" and "GDP does not granger cause BP" are accepted. It shows the absence of direct short run causality between the variables. In the short run bank credit to the private sector has a causal effect on GDP growth rate. In contrast, the null hypothesis of "GDP does not granger Cause GC" & "GC does not granger Cause IGDP" is rejected at 10 % significance level. Causal relationship runs from GDP to GC and GC to IGDP in short run. Rejection of "BP does not granger Cause INF" reveals that in the short run there is unidirectional causal relationship between bank credit and inflation and causality runs from bank credit to inflation. BP granger causes INF as well and IR. IR granger causes IGDP and GDP afterwards.

5. Discussion

Author analyzed time series data of 44 years with an aim of assessing the effect of bank credit on economic growth of the economy in Bangladesh, while also exploring the existence of both short- and long-term causal relationships. Furthermore, it examines how bank lending contributes to economic growth within the country. To achieve these objectives, various analytical methods are utilized, including unit root testing, the multivariate cointegration approach, the (VECM), and the Granger causality test. The Unit root test indicates that all variables are not stationary in their original form but become stationary at first derivative. For level data the p-values indicate that the null hypothesis cannot be rejected, meaning the variables are non-stationary at this point.

Nevertheless, at first difference, the null hypothesis is rejected, confirming the stationarity. As the variables are individually non-stationary time series and all the variables are stationary at the same level, this is an indication towards having long term equilibrium relationship among the variables. This is the reason why the author adopted cointegration test. The Johansen cointegration test proves the existence of long-term equilibrium relationships among the variables.

Rejecting the 3rd null hypothesis, four cointegrating relationships are identified between economic growth, bank lending, inflation, interest rates, government consumption, and the investment to GDP in Bangladesh. In the subsequent step the VECM identifies which four series among the six variables are cointegrated. The error correction term (ECT) suggests the rate at which any imbalance is corrected, guiding the system back towards its long-term equilibrium.

Results of VECM show economic growth, bank lending, government consumption & interest rate have negative and significant coefficient. If any error occurs in the short run, then changes in variables should be 14.39 % by GDP, 40.30 % by IR, 11.29 % by GC, 1.15 % by BP in one period to ultimately achieve the long-run equilibrium. If any disequilibrium is found Bank ending will change by 1.15 % towards equilibrium each year to correct the disequilibrium. Inflation and investment possess negative but insignificant coefficient which indicates that they are less possible to be in equilibrium in the long run.

A negative and statistically significant coefficient for GDP growth rate, bank lending, government consumption, and interest rate also signals the presence of a long-term causal relationship between these variables. Both economic growth rate and bank lending are statistically significant, this describes the bidirectional causality between economic growth and bank lending to the private sector. In the long run economic growth causes bank lending and bank lending also causes economic growth. Also, causality runs from inflation, government consumption, interest rate, investment and bank lending to economic growth as well as causality runs from inflation, government consumption, interest rate, investment and economic growth to bank lending. Causality runs from both directions in between economic growth, bank lending, government consumption and interest rate as all the

four variables are statistically significant. In addition, Unidirectional Causality is running from inflation, investment to government consumption and interest rate. So, the null hypothesis 3 is rejected.

To test the Null hypothesis 4, the Wald test is executed based on the result of short-run dynamics of VECM. It identifies whether there is short run causality among variables. The null hypothesis of every component equals zero is rejected indicating the presence of short run causality among variables and the direction of causality is confirmed with the result of granger causality. In the short term, private sector bank lending can be used to predict economic growth, but economic growth does not predict bank lending in Bangladesh. Subsequently, interest rates cause economic growth and investment. So, it can be said that bank lending indirectly causes economic growth in the short run through interest rate. Moreover, unidirectional causality flows from economic growth to government consumption and Government consumption to Investment.

The above findings lead to the conclusion that there is a two-way causal relationship between bank lending and economic growth in the long run. In contrast, there is the absence of direct causal relationships in the short run. Bank lending granger causes inflation and interest rates in the short run. An increase in bank lending to stimulate the economy may cause inflation in the short run. This outcome, and the above findings have significant contribution to the theoretical understanding of the finance-growth nexus, and managerial implication particularly within the context of developing economies like Bangladesh.

The findings of this study align with the principles of endogenous growth theory by showing a two-way long-term causal relationship between bank lending and economic growth. This underscores the importance of a robust financial sector for sustainable development. In the short run, however, expanding bank credit may drive inflation, suggesting a trade-off between credit growth and price stability. These results also reflect Keynesian theory, which highlights the impact of government spending on economic growth, particularly during slowdowns by Keynes [33].

Additionally, the short-term inflationary effect mirrors the Phillips Curve, indicating that higher credit expansion may temporarily increase inflation [34]. Thus, a balanced approach to fiscal and monetary policy is essential for fostering stable and sustainable growth in Bangladesh, ensuring that bank lending fuels investment and economic activity without triggering inflationary pressures [35]. While formulating policies based on the finding of bidirectional causal relationship between bank lending to private sector and economic growth in Bangladesh in long run, greater attention should also be paid on the short run implications on inflation and interest rate. If the policy makers increase the bank lending with a view to stimulate economic activity and GDP it may also increase the inflation in Bangladesh.

So, if the monetary authority does not want Inflation to rise, they should take some offsetting steps to prevent inflation from fluctuating. These findings also emphasize how crucial it is to have a stable and effective financial system be-

cause more credit is available and can result in lower borrowing rates, which encourage investment and economic growth.

Furthermore, it appears that economic growth stimulates government expenditure, which in turn encourages investment and GDP growth, given the unidirectional correlation between GDP and government consumption and government consumption and investment. The consequences emphasize the need for integrated fiscal and monetary policies to maximize growth, with an emphasis on promoting public and private investments to guarantee long-term, sustainable development.

While the study provides valuable insights into the relationship between bank lending and economic growth in Bangladesh over a 44-year period, it's important to consider some limitations when applying its findings. First, the financial landscape in Bangladesh has evolved significantly in recent years, and the study may not fully capture these recent shifts.

This means the conclusions drawn might not be as relevant in the current economic environment. Furthermore, the focus on broad macroeconomic indicators means that microeconomic factors and sector-specific dynamics are not taken into account. These smaller scale, yet important, elements could also influence the relationship between bank lending and growth in ways that the study does not explore. Another point to consider is that the study does not factor in external variables, such as global economic disruptions or international financial trends, which could impact Bangladesh's economy.

The absence of these external influences might limit the robustness of the conclusions, especially in a globally interconnected financial world. By acknowledging these limitations, we can better interpret the study's conclusions and consider areas for further research to refine our understanding of the complex relationship between bank lending and economic growth.

6. Conclusions

This report delves into the causal association between bank lending and growth of economy in Bangladesh from 1980 to 2023, focusing on how these variables influence each other. Variables are stationary at first derivative. Johansen's cointegration test identifies four cointegrating equations, signaling a long-term connection between the variables.

The study finds bidirectional causality between bank lending and economic growth over the long run, with both GDP influencing bank lending and vice versa. The Error Correction Term coefficient says that, in cases of disequilibrium, GDP adjusts at a rate of 14.39 %, interest rates at 40.30 %, government consumption at 11.29 %, and bank lending at 1.15 % per period. In the short run, while there is no direct causal link between bank lending and economic growth, an increase in bank lending can drive up inflation and influence interest rates.

The study demonstrates that in Bangladesh, bank lending and economic growth are mutually reinforcing in the long term, aligning with endogenous growth the-

ory. However, expanding credit in the short term may trigger inflation, indicating a need for balanced monetary policies to maintain stability. These findings also reflect Keynesian economics, where government spending can boost growth during economic slowdowns.

A balanced approach to fiscal and monetary policy is crucial for sustainable growth in Bangladesh, as expanding bank lending can boost economic activity but may also drive inflation. Policymakers should carefully manage credit expansion to prevent inflationary pressures while still promoting investment. The findings emphasize that a stable financial system can lower borrowing costs, supporting long-term growth.

Additionally, economic growth tends to increase government spending, which further stimulates investment. Thus, integrated fiscal and monetary strategies are vital for achieving sustainable development and encouraging both public and private sector investments.

There is vast opportunity of further research on this extensive background of Bank Lending and economic growth in context of Bangladesh. Due to time constraint, this study could not include some other control variables other than the five variables that have been chosen for this study which may have effect on the result. Researchers may incorporate some other control variables to identify more precisely exactly how bank lending influences GDP of Bangladesh.

Future research can look into how global economic trends, regulatory changes, and advancements in technology influence the banking sector and growth in Bangladesh. By delving deeper into these areas, we can better inform policies that support sustainable economic development for the country.

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Причинно-следственная связь между банковским кредитованием и экономическим ростом в Бангладеш: подход модели векторной коррекции ошибок

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Аннотация. В Бангладеш банки играют решающую роль в стимулировании экономической деятельности путем направления средств, поэтому крайне важно понимать, как банковское кредитование влияет на экономический рост. Данное исследование предлагает директивным органам ценную информацию для тонкой корректировки финансовой политики, поддерживающей стабильное и устойчивое развитие. В статье подробно рассматривается сложная взаимосвязь между банковским кредитованием и ростом экономики Бангладеш, уделяя особое внимание как краткосрочным, так и долгосрочным эффектамю В данной статье рассматриваются причинно-следственные связи между банковским кредитованием и экономическим ростом в Бангладеш, при этом особое внимание уделяется краткосрочным и долгосрочным эффектам. Для достижения целей данного исследования используются эконометрические временные ряды, такие как критерий единичного корня, критерий коинтеграции Йохансена, векторная модель коррекции ошибок (VECM) и тест причинно-следственной связи Грейнджера. Результаты теста на стационарность показывают, что все ряды данных становятся стационарными при первой разнице. Коинтеграционный тест Йохансена подтверждает долгосрочную взаимосвязь между переменными, в то время как VECM подчеркивает двунаправленную причинно-следственную связь между банковским кредитованием и экономическим ростом в долгосрочной перспективе, где причинно-следственная связь простирается от ВВП к банковскому кредитованию и наоборот. Однако в краткосрочной перспективе прямой причинно-следственной связи между ВВП и банковским кредитованием частного сектора обнаружено не было. Исследование также показало, что банковский кредит может влиять на ВВП косвенно через темпы инвестиций, хотя сам ВВП не оказывает непосредственного влияния на банковское кредитование в краткосрочной перспективе. Эти выводы помогают пролить свет на особую роль финансового сектора в поддержке экономического роста Бангладеш. Выводы исследования могут помочь в обосновании финансовых реформ, которые позволят Бангладеш достичь своей цели – получения статуса страны со средним уровнем дохода.

Ключевые слова: банковское кредитование; экономический рост; причинно-следственная связь; VECM; Бангладеш.

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