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FINANCE-GROWTH NEXUS AND ADOPTION OF ARTIFICIAL INTELLIGENCE IN AZERBAIJAN

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Abstract: *This article investigates the relationship between financial development and economic growth in Azerbaijan within 2000–2024 period. Findings from the Autoregressive Distributed Lag (ARDL) Bounds Test reveal a significant long-term cointegration among financial development, physical capital investments, and economic growth, suggesting that access to finance for the private sector is a strong accelerator for economic growth. While domestic credit to the private sector shows a weak positive short-run impact, its long-run impact is negative. The divergence between the positive impact of physical capital and the negative impact of credit expansion in the long run implies that even though physical investments enhance productivity, the financial markets might be inefficient in the allocation of resources by moving funds toward non-productive sectors and creating a misallocation constraint on economic growth. To improve the efficiency in financial markets, digitalisation of financial services and integration of AI-based models were evaluated as key strategic priorities. This study also employs a SWOT analysis to explore opportunities and challenges for successful adoption of AI.*

Keywords: *financial development, economic growth, artificial intelligence, Azerbaijan*

1 Introduction

Nowadays, financial market development plays a role of an engine in the proliferation of economic growth, which leads to better social welfare. The relationship between financial development and economic growth has been a cornerstone of development economics for over a century. The classic theoretical approach claims that financial systems ensure the efficient allocation of resources, promote investment opportunities, and enhance technological innovation. The factors affecting financial market development can vary depending on country-specific implications. Helhel (2026) provides evidence for supply-led growth hypothesis by showing unidirectional causality from stock market development to economic growth in the "Fragile Five" emerging economies experiencing high market volatility. The various dimensions of financial development may alter the growth outcomes differently. For instance, Girma, and Huseynov (2025) find out for African economies that dimension of efficiency has a positive effect which supports the financial intermediation hypothesis.

In parallel with traditional financial development, the global financial sector is undergoing a rapid digital transformation driven by the introduction of artificial intelligence (AI). The widespread adoption of GenAI on a daily basis is a relatively recent trend, emerging only over the past few years. However, engagement of financial sector with AI is more broadly and far from being new. The findings of IMF claim that many participants in financial markets perceive Generative Artificial Intelligence (GenAI) as a tool that can accelerate progress in developing and emerging economies by improving access to credit and strengthening financial development (IMF, 2024). However, if the fixed costs of adopting AI are high, richer countries may benefit from it more quickly than poorer ones.

AI technologies such as machine learning, natural language processing, and predictive analytics are increasingly used in banking and financial services to improve credit assessment, fraud detection, customer service, and risk management. Traditionally, the industry has relied on technology for high-frequency trading and data management; however, currently newly applied tools are fundamentally reshaping the landscape. They propose sophisticated levels of product customization, more intuitive client interfaces like chatbots, and more sophisticated decision-making analytics, meanwhile significantly cutting costs through automation (IMF, 2024).

Compared to asset (wealth) management, banking sector adopted these technologies more gradually. Despite being successful in early innovative applications related to the adoption of ATMs and online banking, the overall progress was initially decelerated by strict data privacy and proprietary concerns. However, the process of adoption is now accelerating as banks face pressure from fintech competitors. Today, AI and machine learning (ML) is being integrated into banking to improve client relationships, personalize product offerings via behavioural data, and facilitate essential functions like risk management, credit underwriting, and back-office operations. AI supports the banking sector with personalized approach for its customers, such as chatbots and virtual assistants, which allow personalized financial and portfolio management advice (Nusrat et al., 2023). While developed economies have made substantial progress in AI adoption, emerging economies such as Azerbaijan face unique economic, technological, and regulatory challenges that influence the pace and effectiveness of AI integration in finance. The potential channels of usage of AI can be customer service and support, investment advice and portfolio management, automation of tasks, risk management, compliance and fraud detection. However, it is important to take into account the risks and limitations of the integration of AI in financial system. There are four main drawbacks of this integration: uncertain markets, discriminatory data and algorithmic biases, cyber and virtual threats, systematic risks and financial accidents (Lin, 2019).

Considering the bank-dominated structure of the financial system and current efforts of Azerbaijan to diversify its economy, this study seeks to explore whether the development of financial markets has contributed significantly to economic growth over the study period. On the other hand, the research focuses on the integration of AI tools in the financial sector of Azerbaijan. Specifically, by applying the SWOT analytical framework, this study aims to determine both the key drivers and the main barriers preventing AI adoption in the financial system.

1.1 Theoretical Foundations and Empirical Literature

From theoretical perspective economic growth models recognize several leading factors contributing to economic growth. According to the Solow growth model (1956), economic growth is driven by capital accumulation, labour growth, and exogenous technological progress.

Modern endogenous growth models recognize financial development as a key driver of long-term economic growth. The next generation of endogenous growth models emphasized the role of finance-growth nexus for outcomes, showing that financial development can affect total factor productivity by reducing information asymmetries and facilitating innovation (King & Levine, 1993; Levine & Zervos, 1998).

The report provided by the World Economic Forum (WEF, 2012) identifies financial development as the combination of structural conditions, policies, and institutional arrangements that enable efficient financial intermediation, well-functioning financial markets, and widespread access to capital and financial services. Within this framework, financial development can be measured through seven core dimensions:

- Institutional environment
- Business environment
- Financial stability
- Banking financial services
- Non-banking financial services
- Financial markets
- Financial access

These categories reflect the main features of a healthy financial system, such as governance standards, effectiveness, business climate, infrastructure, and so on. Together, these seven pillars provide a multidimensional framework for assessing the depth, efficiency, stability, and inclusiveness of a country's financial system. The most frequently used indicators to assess financial development generally fall into three broad categories: financial depth, the bank ratio, and financial activity (Valickova et al., 2013).

Traditional empirical studies accept the approach that banking sector development plays a crucial role in promoting economic growth, particularly in developing economies where banks are the leading financial intermediaries. Early cross-country studies demonstrated that measures of banking development, such as domestic credit to the private sector and liquid liabilities, are strongly associated with growth outcomes (Beck et al., 2000).

In the context of developing and emerging markets, recent empirical literature further highlights the importance of banking development. Ekanayake and Thaver (2021) analyse panel data from 138 developing countries and find the existence of bi-directional causality between financial development, proxied by four variables and economic growth. Similarly, a study of OECD countries conducted between 1990-2018 confirms that banking sector performance and financial globalization and investments positively influence economic growth, highlighting the continued importance of bank-based measures even in more advanced emerging economies (Sümerli Sarıgül & Avcı, 2024).

Despite robust positive associations, scholars mention that the quality of intermediation also matters: excessive credit growth, if directed toward unproductive sectors or accompanied by weak risk management, can lead to financial instability without contributing to sustainable growth. Nevertheless, in the context of underdeveloped capital markets, the credit channel remains the primary mechanism through which financial systems influence real economic activity. The role of capital markets is less profound in economies with shallow or nascent markets.

In spite of a robust positive association between banking and growth in many emerging markets, this relationship exhibits some heterogeneity across developing and resource-dependent economies. In region-specific framework, capital markets often play a secondary role, largely due to institutional constraints and market imperfections.

Dependence of the economy on natural resources, including those heavily dependent on energy prices, creates additional complexity to the finance–growth nexus through Dutch Disease effects and fiscal dominance. In resource-dependent economies, increasing bank credit to tradable sectors is important for reducing the risk of Dutch Disease by facilitating capital availability for non-oil tradable sectors and enhancing their export capacity (Hasanov & Huseynov, 2013). These patterns suggest that the relative contribution of banking and capital market development to growth is conditional on broader structural and institutional factors, including market maturity, regulatory quality, and the nature of economic specialization.

The financial system of Azerbaijan is characterized by its strong dominance of banking sector and relatively underdeveloped capital markets. Since independence, Azerbaijan has implemented significant reforms aimed at strengthening banking supervision, enhancing

regulatory frameworks, and stabilizing macroeconomic conditions. Despite this progress, the banking sector remains the dominant channel of financial intermediation, with domestic credit to the private sector and bank deposit instruments accounting for the majority of financial activity. In contrast, capital markets develop more slowly.

The financial markets of Azerbaijan are related to the developing financial markets. After the transition to a market economy, the development of the financial market and strengthening of its competitiveness is considered a necessary issue in Azerbaijan.

Empirical evidence on financial development in Azerbaijan offers mixed insights but generally underscores the importance of the banking sector. Seyfullayev (2023) examines the relationship between financial development and non-oil economic growth and finds that improvement in non-oil lending rates are associated with higher growth rates in non-oil sector, even though the study does not extensively analyse capital markets due to data. A complementary study by Zeynalova (2023) provides an econometric analysis of the impact of domestic credit volume on money supply and growth outcomes, further reinforcing the central role of credit expansion and admits the important role of oil sector for driving the credit volume in Azerbaijan. The limited role of capital markets in Azerbaijan can be attributed to several structural factors, including low levels of private sector listings, shallow investor participation, and limited liquidity. These findings are consistent with the broader pattern observed in oil-dependent economies, where financial systems tend to be bank-centric and capital markets remain shallow. However, the absence of extensive time-series evidence that simultaneously evaluates banking and market channels in Azerbaijan highlights a significant gap in the literature.

2 Research Design and Methodology

The economic transition in Azerbaijan was accompanied by reliance on bank-dominated financial system, which makes efficiency important in this context. By analysing both financial activity and efficiency, this study provides a more detailed investigation of the finance–growth nexus in Azerbaijan, while also setting the frame for examining AI adoption as a complementary driver of financial modernization.

Despite rich cross-country evidence on the finance–growth nexus, country-specific research on Azerbaijan remains limited, particularly in terms of distinguishing the separate effects of banking sector development and capital market development.

To address this gap, this study proposes an empirical analysis using ARDL bounds testing to capture long-run and short-run relationships between financial development indicators and economic growth. Specifically, this analysis will test the following hypothesis:

H1: Financial sector development positively affects economic growth in Azerbaijan.

This hypothesis was built on the theoretical and empirical foundations reviewed above and ensures a structured basis for the subsequent econometric analysis.

This study utilizes a mixed-methods research design, combining quantitative econometric analysis with qualitative analysis. The quantitative component examines the impact of financial market development on economic growth in Azerbaijan using time-series data, while the qualitative component explores AI adoption in the financial sector through SWOT analysis.

2.1 Model Specification

We integrate a general functional form to examine the relationship between variables. The conceptual model represents a form where GDP growth is a function of three explanatory variables:

$GDPgrowth_t$= f ($Domestic\ credit_t, Exports_t, Gross\ Capital_t$)

Where:

- $GDPgrowth_t$: GDP Growth (Annual %) at time t
- $Domestic\ credit_t$,: Domestic Credit to the Private Sector by banks (% of GDP) at time t
- $Exports_t$: Exports of Goods and Services (% of GDP) at time t
- $Gross\ Capital_t$: Gross Capital Formation (% of GDP) at time t

The advantage of the ARDL model is the possibility to apply regardless of whether the underlying regressors are purely I(0), purely I(1), or a mixture of both. The time horizon for research lies between 2000 and 2024.

The Error Correction Model (ECM) can be represented by the following equation (1):

$$\Delta GDPgrowth_t = \alpha_0 + \Sigma_{i=1}^{p}\beta_i \Delta GDPG_{t-i} + \Sigma_{j=0}^{q_1}\gamma_j \Delta DCPS_{t-j} + \Sigma_{k=0}^{q_2}\delta_k \Delta EXG_{t-k} + \Sigma_{m=0}^{q_3}\theta_m \Delta GCF_{t-m} + \lambda ECT_{t-1} + \varepsilon_t \quad (1)$$

Notation:

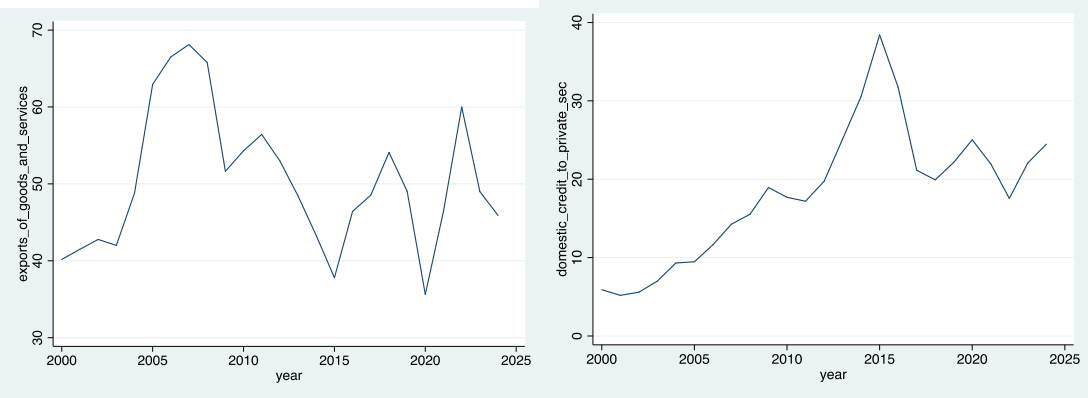
- $GDPgrowth_t$: annual GDP growth rate at time t.
- $DCPS_t$: Domestic credit to the private sector by banks as a percentage of GDP at time t.
- EXG_t: Exports of goods and services as a percentage of GDP at time t .
- GCF_t: Gross capital formation (Investment) as a percentage of GDP at time t.
- α: The intercept or constant term of the model.
- λ: coefficient of Error Correction Term (ECT), representing the speed of adjustment.
- ECT_{t-1}: lagged error correction term, derived from the long-run cointegrating relationship.
- ε_t: The stochastic error term, assumed to be normally distributed with zero mean and constant variance

3 Results

Before starting with a long-term modelling, it was crucial to check the integration properties of the time-series variables. The study employed Augmented Dickey-Fuller (ADF) test to check for the presence of unit roots (Dickey & Fuller, 1981).

The initial testing of 'Exports of Goods and Services' in levels yielded a p-value of 0.16, indicating a failure to reject the null hypothesis of non-stationarity. Graphically and statistically, the series exhibits a stochastic trend characterized by significant volatility and structural shifts, notably around 2015 and 2020 rather than a smooth linear trend (see Figure 1). According to the Figure 1, domestic credit provided to the private sector by banks as a percentage of GDP exhibits a visible upward drift between 2000 and 2015, and then we observe a subsequent structural break and volatility until the end of 2024. This pattern implies a stochastic rather than a deterministic trend. The Augmented Dickey-Fuller test with a drift term for domestic credit yielded a p-value of 0.07. In this case, the null hypothesis of a unit root could not be rejected at the conventional 5% level. To ensure the robustness of the ARDL bound test, the variable was first-differenced. The consequent test on the differenced series I(1) was highly significant ($p < 0.01$). This approach justifies treating the variable as I(1) and utilizing the ARDL bounds test to distinguish between its persistent growth path and short-term fluctuations. These obtained results confirm that the variables are integrated of order one, I(1). When it comes to plots of investment levels and GDP growth represented in Figure 2, the series also do not show any deterministic trend.

Figure 1. *Ts line for export of goods and services*



Source: Calculation of authors

Figure 2. *Ts line – Gross capital formation and GDP growth*

Source: Calculation of authors

Diagnostic Tests

To ensure the reliability of the statistical model, we test the residuals of the ARDL regression for normality (see Table 1). After applying the Jarque-Bera test, the model shows a p-value of 0.71. Since this value is substantially higher than the standard 5% significance level, we accept the null hypothesis of normality. This indicates that the error terms are normally distributed, confirming that the t-statistics and F-statistics used for hypothesis testing are valid and that the model does not suffer from significant bias. As Bounds Test under Pesaran et al. (2001) assumes that the residuals are serially uncorrelated and normally distributed, obtaining p-value of 0.71 provides a strong evidence in favour of our critical values. Another task is to check for serial correlation, therefore we use the Breusch-Godfrey test. The resulting p-value of 0.10 indicates that we fail to reject the null hypothesis of no serial correlation. Given the annual frequency of the data and the relatively small sample size, the first-order test confirms the model is sufficiently specified to provide reliable long-run and short-run estimates.

Table 1. *Jargue-Bera tests for Normality*

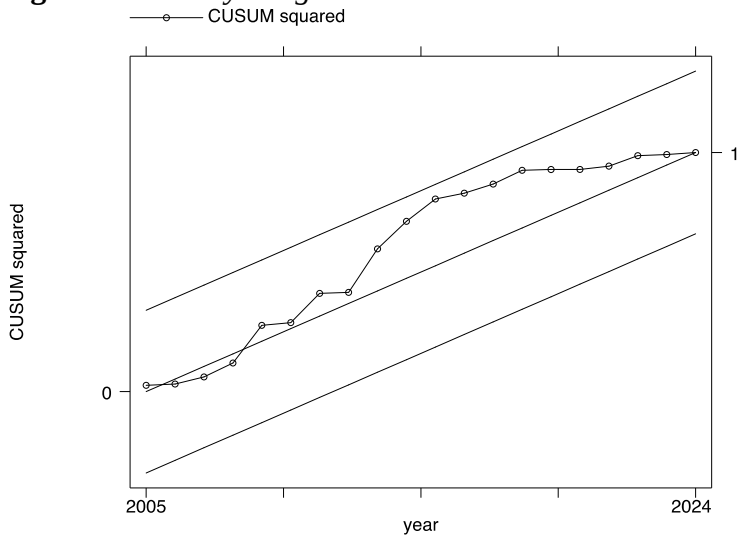
Test	**Result**	**Validity**
Jarque-Bera	p = 0.71	Passed (Normality confirmed)
Breusch-Godfrey Test	p = 0.10	Passed (No serial correlation)

Source: Calculation of authors

The validity of the ARDL model was checked for the structural stability by Cumulative Sum of Squares (CUSUMSQ) test. As illustrated in Figure 4, the CUSUMSQ statistic remains

strictly within the 5% critical values within the sample period (2000–2024). This indicates that the coefficients in a time-series regression are stable over time and that the model is not subject to structural instability or parameter shifts. Consequently, the evidence from long-run and short-run coefficients reported in this study can be considered relevant for policy recommendations.

Figure 4. *Stability Diagnostics*



Source: Calculation of authors

To investigate the long-run and short-run dynamics between GDP growth and its determinants, this study applies the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al. (2001). Given the sample size (T=24), the ARDL framework stands as relevant because it provides more reliable outcomes in small samples compared to traditional cointegration tests like Johansen Test. Although the VAR Selection Order Criteria suggested an optimal lag length of four based on the AIC, given the limited sample size, using four lags would severely affect the degrees of freedom and lead to risk of overfitting. Therefore, we limited the maximum lag to 1 given the annual frequency of the data and the sample size. The model was estimated using the Bayesian Information Criterion (BIC) to ensure parsimony and prevent overfitting, resulting in ARDL (1, 1, 0, 1) specification.

The existence of a long-run relationship is tested using the ARDL Bounds Test for cointegration (see Table 2). If the F-statistic exceeds the upper critical bound, we reject the null hypothesis of no cointegration and proceed with the Error Correction Model to interpret the long-run coefficients. The results indicate that F-statistic is 8.95, and it significantly exceeds the upper bound critical value of 4.35 at the 5% significance level. Consequently, the null hypothesis of no cointegration is rejected. This finding reveals a stable, long-term relationship between GDP growth, domestic credit to the private sector, exports, and gross capital formation.

Table 2. *ARDL Bounds Test*

Test Statistic	**F-statistic**	**I(0) bound**	**I(1) bound**
K (3)	8.95	3.23	4.35

Source: Calculation of authors

3.1 Descriptive Statistics

Initial investigation of the key descriptive features in Table 3 provides several important insights about the data:

- GDP growth exhibits relatively high volatility, with a standard deviation 9.4% that actually slightly exceeds its mean 7.4%. The large difference between a minimum and a maximum confirms the presence of significant structural shocks in the economy.
- The high mean value of 50.3% for exports indicates that the economy of Azerbaijan is highly open and export-oriented.
- Domestic credit to the private sector issued by banks has a mean of 18.3%, but its maximum achieves 38.4% proposing about the period of extensive credit growth.
- Gross Capital Formation averages 25.6% of GDP, which is a good level for the development of economy with its peak at 57.9% suggesting about periods of massive capital investment.

Table 3. *Descriptive statistics*

Variable	**Obs.**	**Mean**	**Std. Dev**	**Min**	**Max**
Domestic credit to private sector by banks	25	18.3%	8.5%	5.1%	38.4%
Exports	25	50.3%	8.9%	35.6%	68.1%
GDP growth	25	7.4%	9.4%	-4.1%	34.4%
Gross capital formation	25	25.6%	10.8%	12.0%	57.9%

Source: Calculation of authors

Expectations regarding a sign of coefficients are summarized in Table 3.

Table 4. *Expectations on sign of coefficients*

Variable	Expected sign
Exports (Trade openness)	(+) because of export-led growth
Capital Formation (Investments)	(+) reflects productive capacity
Domestic credit to private sector by banks (Financial Development)	(+/-) depending on the efficiency of allocation

Source: Calculation of authors

Table 5. *Correlation analysis*

	GDP growth	**Domestic credit**	**Exports**	**Gross capital formation**
GDP growth	*1.00*			
Domestic credit	*-0.56*	*1.00*		
Exports	*0.60*	*-0.24*	*1.00*	
Gross capital formation	*0.29*	*-0.34*	*-0.14*	*1.00*

Source: Calculation of authors

To identify the existence of multicollinearity, we perform correlation analysis in Table 5 and find out that independent variables do not exhibit strong correlation among each other. Notably, there is a strong negative correlation between economic growth and domestic credit to private sector with a coefficient of -0.56.

3.2 ARDL model: Empirical Results

Table 6. Regression Output

Adjustment Term	**Coefficient**	**p-value**
GDP growth (Lag 1)	-0.6264***	0.000
Long-Run Coefficients (LR)		
Domestic Credit	-0.6657*	0.010
Exports of Goods and Services	0.0045	0.987
Gross Capital Formation	0.3653*	0.042
Short-Run Coefficients (SR)		
Δ Domestic Credit	0.4683	0.087
Δ Gross Capital Formation	-0.7082***	0.001
Constant	5.8775	0.587
R-squared	0.71	

Source: Calculation of authors

Table 6 represents both long-run coefficients and short-run coefficients for ARDL (1, 1, 0 ,1) regression model. Attained results in the long run correspond to our expectations and align with previous findings from descriptive statistics. Error correction term, which reflects our adjustment term stands out as a very important indicator, because it is estimated at -0.62 and is statistically significant ($p < 0.05$). The negative sign and significance admit the stability of the model. This coefficient shows the speed of adjustment, where 62% of the deviation from the long-run equilibrium in one period is corrected in the following year.

Meanwhile, a capital investment appears to be a prominent driver of growth in Azerbaijan in the long run. Interestingly, the change in the amount of capital investments had a negative impact in the short run, presumably because of the fiscal burden from large-scale projects especially in oil and gas sectors of the economy. Unexpectedly, exports did not stand as significant factor contributing to economic growth in Azerbaijan. To be more precise, under the period of study, the 'export-led growth' hypothesis was not valid for this economy. While the descriptive statistics show that exports account for a large portion of GDP with a mean value of 50.3%, export volume does not appear to be a primary driver of long-term GDP growth when compared to capital investment and credit volume. In the context of Azerbaijan, the main exported goods are raw materials that low-value added and as a result do not create spillover effects on growth. In typical Dutch Disease framework, the reliance on low-value-added raw materials prevents the development of a well-diversified manufacturing sector, which is the primary engine of sustainable export-led growth. As a result, this concentration in the sector of natural resources triggers currency appreciation, making non-resource exports uncompetitive.

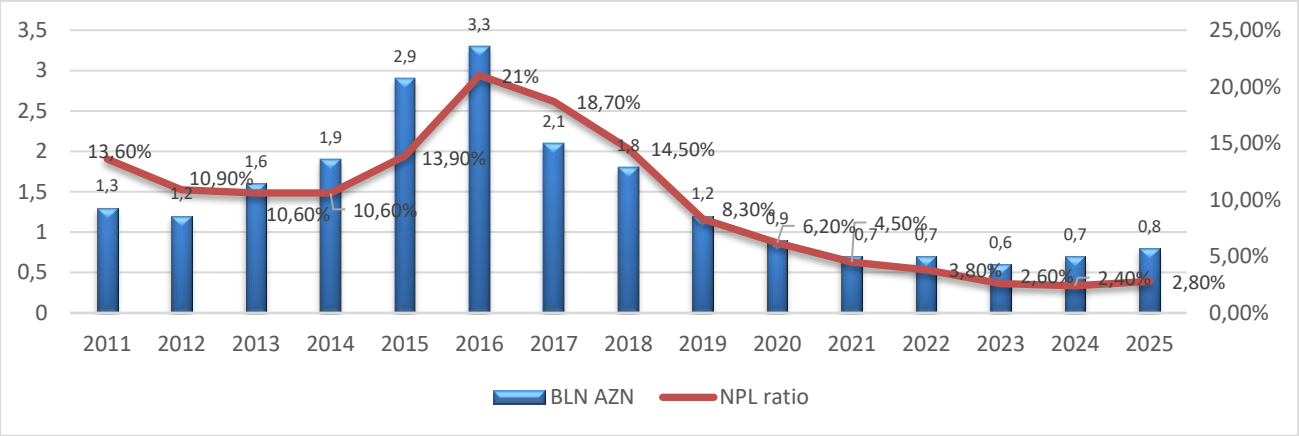
When it comes to credit volume provided by banks to the private sector, we find remarkable results. According to regression findings, a credit volume has a significant detrimental impact in the long run. Empirical evidence suggests that excessive levels of debt relative to GDP in the observed period might hampered long-term growth. But in the short run, a change in credit volume affected GDP growth in a positive way even though not significant. Negative long run coefficient for domestic credit can be explained as debt overhang when lending by banks and non-bank financial institutions directed towards unproductive sectors. Under the "Debt Overhang" hypothesis, credit expansion initially facilitates economic growth primarily via increased spending and consumption; however, after a while, accumulation of

private sector debt might be the case due to inefficient allocation of financial resources or high debt-servicing costs that eventually suppress long-term growth.

The divergence between the positive impact of physical capital and the negative impact of domestic credit implies a "financial-real sector gap." While physical assets contribute to the productive capacity, the financial tools may be inefficient or directed toward non-productive sectors, creating a long-term constraint on economic expansion.

To revise the historical background of the banking sector and support debt overhang hypothesis we decided to analyse asset quality of the banking sector from 2011 to 2025 in Azerbaijan (Central Bank of the Republic of Azerbaijan, 2024b). As it becomes clear from the descriptive graph (Figure 3), there was an upward trend in the ratio of non-performing loans (NPL) with a peak in 2016 at 21%. Only after 2018, asset quality improves and NPL drops below 9%. A high NPL ratio indicates that a significant portion of domestic credit was not used for productive, income-generating activities. Instead, it suggests financial resources might be allocated to projects that failed to generate the growth needed to pay the interest.

Figure 3. *Dynamics of non-performing loans in the banking sector*



Source: Central Bank of the Republic of Azerbaijan. Financial Stability Report (2024)

3.3 SWOT Analysis on adoption of AI in Azerbaijan

The adoption of AI in the financial sector of Azerbaijan reflects a broader goal of transition toward data-driven, automated, and increasingly digitalised financial systems. A critical factor affecting this transition is the strategic policy framework, reflected particularly in the Financial Sector Development Strategy 2024–2026 and the Artificial Intelligence Strategy for 2025–2028.

The Financial Sector Development Strategy 2024–2026 focuses on the modernization of financial infrastructure, the expansion of digital payment systems, the strengthening of financial stability, and the promotion of innovation within the banking and fintech ecosystem (Central Bank of the Republic of Azerbaijan, 2024a). Within this framework, AI is implicitly perceived as a capable technology that can enhance efficiency, improve supervisory capabilities, and support more resilient financial systems. At the same time, the AI Strategy (2025–2028) provides a more explicit roadmap for the adoption of artificial intelligence across sectors, including finance.

“Azerbaijan 2030: National Priorities for Socio-Economic Development" offers a great chance to introduce AI in the financial sector with a focus on digital transformation, development of human capital, innovation-based competitiveness, and restructuring of the economy in a sustainable way (Isayev, 2025).

Within the context of Azerbaijan's Financial Sector Development Strategy, the adoption of such technologies responds to broader goals of digital transformation and innovation. However, these advancements also introduce new risks, including model opacity, algorithmic bias, and the potential for market volatility caused by high-frequency trading strategies. These challenges underscore the importance of integrating these technologies with robust SupTech and RegTech frameworks, ensuring that regulators can effectively monitor algorithmic behaviour through real-time data analytics. The strong data management systems are particularly critical, as AI models need large volumes of high-quality data to function accurately.

The advantages of the implementation of AI in the financial industry include the ability to enhance financial stability through the improvement of risk management, liquidity optimization, as well as the improvement of operational efficiency, as they are capable of analysing enormous amount of data quickly and accurately compared to human beings. Therefore, they enable the bank or any player in the market to make the most appropriate decisions taking into account the dynamics of the market. Moreover, the existence of ML, deep learning, and natural language processing presents great opportunities to switch from linear or historical precedents to the analytics that autonomously identify emerging patterns and continuously refine their predictive accuracy as new data becomes available (Sarna et al., 2025).

Table 7 summarizes the key strengths, weaknesses, opportunities and threats expected from adoption of AI in the financial sector.

Table 7. *SWOT analysis*

Strengths	**Weaknesses**
Strong policy framework (Financial Sector Development Strategy 2024–2026 and AI Strategy 2025–2028)	Limited availability of specialsits in this field
Rapid digitalisation of financial infrastructure and development of payment systems	Skills gap in AI, data science, and interdisciplinary expertise
Risk-based supervision approach	Dependence on foreign AI technologies
Government commitment to digitalisation, innovation, and fintech growth	Early-stage adoption of advanced AI (e.g., generative AI, robo-advisory)
Growing data generation due to digital payments and banking platforms	Limited domestic research in AI
Opportunities	**Threats**
Strategic promotion for AI adoption under AI Strategy (2025–2028)	Insufficient regulatory framework regarding AI governance
Expansion of cashless economy and digital financial services	Imperfections of AI-based systems (hallucinations, opacity, bias, lack of explainability)
Development of SupTech and RegTech under financial sector reforms (integration of AI and ML in risk scoring)	Cybersecurity risks and vulnerabilities in AI-driven systems
Potential to build a regional fintech and AI innovation hub	Over-reliance on global AI providers and technological dependency
Human capital development and AI education initiatives	Global competition from technologically advanced economies
Adoption of open-source AI to localize solutions and reduce costs	Low acknowledgment and adoption barriers among users and institutions

4 Discussion

This article provides a comprehensive framework for studying dynamics and implications of financial development in Azerbaijan. The research design of study consists of time series regression analysis and qualitative SWOT analysis. The main research question is to find out the impact of financial development on economic growth in Azerbaijan within 2000-2024 period. The results of regression analysis reveal that in the short run credit expansion facilitates access to finance as it is supported by classical financial intermediation theory, whereas in the long run enlarging size of debt burden influences the economic growth rate in detrimental way. This pattern implies that debt overhang can cause emergence of Ponzi Finance (Minsky, 1975). These results coincide with empirical finding of Deryag and Khalifa (2024) where the financial development exhibited a negative relationship with economic growth across selected Arab economies. In these countries, financial systems might be oriented toward servicing government and resource-related sectors and possess weak institutions.

Besides that, another important finding demonstrates the existence of gap between real and financial sector stemming from possible inefficient allocation of financial resources in the economy when funding was not channelled to the productive sectors. Such inefficiency might imply about prevalence of costly intermediation or weak monitoring measures similarly discussed in the study of Moemeke et al. (2025). In addition to these findings, our estimates did not confirm the export-led growth hypothesis for the economy despite initial expectations. This contradiction can be explained by the tendency of resource-based economies to concentrate most of the factors of production in resource sector (crude oil, natural gas, minerals) and to appreciate real exchange rate thus making domestic production uncompetitive.

We can conclude that economic diversification is essential in this case through targeted investments in infrastructure, manufacturing, human capital, and technology to improve a competitiveness of non-oil sector. A stable real exchange rate and effective counter-cyclical fiscal rules can help a country to reach a path to sustainable and long-term development. The role of financial markets in achieving this goal is crucial as there is a clear evidence on positive effect of financial intermediation on economic growth. The public authorities can achieve this target by introducing policy incentives to stimulate investments in productive sectors.

Nowadays automated and digitalised financial systems can promise fast and long-lasting development phase for developing nations by removing liquidity constraints, ensuring efficiency and stability, and enhancing supervisory capability in financial markets. AI appears to be a significant modifier and contributor to digitalization of financial services. The implementation of AI-based models in financial sector promotes innovation and profitability, however, their execution is accompanied with a lot of challenges such as cyber-attacks, algorithmic bias, opacity, hallucinations, black-box problem and etc. To preserve financial stability, integration of AI and ML into financial sector requires strict supervisory and regulatory framework. A SWOT analysis shows that there is a necessity to establish comprehensive regulatory framework for AI governance to overcome these challenges for foreseeable future in Azerbaijan.

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