

Analyzing the Spillover Effects of Economic and Financial Growth of Developed and Developing Trading Partners on the Economy of Afghanistan: A Panel Vector Autoregression (PVAR) Model Approach

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Abstract:

The importance of trade partners in the economic growth of countries is a central topic in the international economics literature. There are several through which the economic and financial spillovers of countries affect each other. Among these, trade spillovers and exchange rate fluctuations are considered the most important indirect channels through which trade partners influence each other's economic growth and dynamism. This research aims to investigate the impact of economic and financial spillovers from developed and developing countries on Afghanistan's economic growth during the period 2000–2021. For this purpose, data related to per capita GDP, exports of goods and services, and the exchange rates of Afghanistan's selected trade partners—in two groups, developed countries (the United States, Japan, and Germany) and developing countries (China, Malaysia, and Russia)—were analyzed using the Panel Vector Autoregression (PVAR) model and STATA software. The findings indicate that Afghanistan's economic structure is significantly affected by the economic and financial developments of its trade partners. The results of the Granger causality test show that, in the short term, Afghanistan's economic growth significantly depends on the economic and financial growth of developed countries (the United States, Japan, and Germany) and some developing countries (China and Malaysia). This impact is mainly transmitted through the trade channel, especially imports of capital and intermediate goods, and foreign aid. Additionally, the

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results of variance decomposition in the long run indicate that the growth of economic and financial variables in China, compared to other developed and developing countries, has the largest share in explaining the growth of economic and financial variables in Afghanistan.

1. Introduction

The rapid pace of technological advancement, the expansion of infrastructure and production capacities, the facilitation of trade conditions, and the reduction of transportation costs characterize the contemporary global landscape. These developments have effectively transformed international markets into a cohesive global village. As transportation costs decline and technological progress accelerates, countries become increasingly interconnected, and the interdependence of their economies fosters economic globalization—defined by the interaction between domestic and foreign economies. This interconnectedness implies that economic shocks in one country can propagate internationally through multiple channels. Consequently, the economic growth and development of nations are closely linked to their trade structures. Trade liberalization contributes not only to economic growth but also to a country's level of engagement in global trade, its participation in unions and trade cooperation organizations, investment flows, the diversity of its trade partners, and specific attributes such as size and economic performance. Collectively, these factors influence the growth trajectories and development outcomes of partner economies.

The expansion of international trade and investment has increasingly amplified the influence that countries exert on each other's macroeconomic performance. Foreign trade represents a primary channel for such spillovers, as economic interactions between nations occur through exports and imports. By generating export revenues, countries acquire the necessary income to finance their imports; thus, fluctuations in trade cycles across nations often stem from shared shocks or the international transmission of disturbances via trade and financial linkages. In particular, increases in gross domestic product and demand shocks tend to enhance trade flows between countries, thereby impacting the economies of their trade partners (Golmohammadi Tarzam et al. 2024). Furthermore, this commercial exchange fosters the diffusion of knowledge and technology, improves efficiency, shapes consumer preferences, introduces novel financial systems, and facilitates partnerships among economic agents, collectively promoting global growth and development (Mezaal Alag et al, 2024). The intensified mutual influence among economies has heightened sensitivity to conditions in target markets and sources of imports, accompanied by an expansion in the number of trade partners. Countries strategically select trade partners to mitigate the adverse effects of economic fluctuations while maximizing the benefits from positive growth spillovers, thereby broadening

exchanges and lowering import costs to support economic advancement (Mokhtari Shirehjini et al., 2023). Empirical evidence indicates that macroeconomic shocks in one country affect not only its immediate neighbors but also more distant trade partners (Saki et al., 2021). The transmission mechanisms underlying these effects include real economic linkages such as bilateral trade and investment, geographic preferences in investment, and exchange rate movements (Sorenson, 2007). Additionally, political factors—encompassing government communications, labor market dynamics, globalization processes, and growth slowdowns—as well as financial considerations like risk incentives in the financial sector and exchange rate volatility, have been shown to influence countries, particularly their political and trade partners (Felices & Wieladek, 2012).

Afghanistan, despite possessing mineral reserves estimated to be valued between one and three trillion dollars, has remained among the ten poorest countries globally over the past fifty years. This persistent poverty is attributable to several factors, including its landlocked geographical position, ongoing political instability, foreign interventions, and security challenges (Pourgholami, 2023). Beyond these domestic difficulties, Afghanistan is recognized as the world's largest producer of narcotics and a major hub for drug trafficking. The prevalence of an informal economy, coupled with prolonged armed conflicts, has significantly undermined the formal economic sector, facilitating the ease with which terrorist organizations secure funding. Achieving sustainable peace requires more than political agreements; it necessitates comprehensive regional and structural economic reforms (Rubin, 2000). Geographically, Afghanistan occupies a strategic transit position linking Central Asian countries to the north and west with southern regions. This location offers substantial economic and commercial opportunities, particularly within the energy sector, positioning Afghanistan to play a pivotal role in regional economic development by serving as a vital conduit between Central Asia and South Asia (Ahmadzai & McKinna, 2018).

According to World Bank reports, agriculture constitutes the foundation of Afghanistan's economy, accounting for 60% of household income (World Bank, 2021). The country's low agricultural productivity, attributed to limited access to modern equipment and persistent conflict, has necessitated the annual importation of substantial quantities of agricultural products, particularly flour and wheat. The industrial sector remains marginal due to insufficient infrastructure, resulting in a heavy reliance on imported goods. Nevertheless, since the establishment of the new government in 2001, there have been modest improvements; Afghanistan has developed economic relations with multiple countries and secured membership in regional economic organizations such as SAARC and ECO (Mehregan et al., 2022). Between 2001 and 2020,

Afghanistan's gross domestic product nearly doubled, rising from \$4 billion to \$8.19 billion (Fakhari, 2024). Despite this growth, poverty, economic fragility, and declining aggregate demand continue to pose significant challenges. World Bank data further indicate that approximately 15 million Afghans face food insecurity (World Bank, 2024). As a fragile state, Afghanistan persistently endeavors to promote its development by capitalizing on the capacities of trade partners as well as regional and international resources.

Considering Afghanistan's economic context and the various channels through which trade partners impact a nation's economic growth, the influence of macroeconomic and financial variables from these countries on Afghanistan's development is substantial. This issue warrants particular attention for economically vulnerable countries like Afghanistan, which depends heavily on imports of intermediate and capital goods from both developed and emerging economies to fulfill its requirements. Accordingly, this study aims to investigate how the growth of economic and financial indicators in selected trade partners affects Afghanistan's economy. To explore this relationship, the Panel Vector Auto regression (PVAR) model has been employed, encompassing Afghanistan and its key trade partners. The findings of this research are expected to enhance understanding of the reciprocal economic and financial interactions between Afghanistan and these countries, thereby offering valuable insights for economic policymaking in Afghanistan. The article is structured into six sections: following the introduction, the second section outlines the theoretical framework; the third reviews relevant literature; the fourth details the research methodology and model specification; the fifth presents the empirical analysis and results; and the final section concludes with policy implications and recommendations.

2. Literature review

Although economists disagree about the intensity and extent of foreign trade's impact on countries' economic growth, there is near consensus that foreign trade is a factor in economic growth. Theorists such as Grossman and Helpman (1991), Barro and Sala-i-Martin (1997), Ades and Glaeser (1999), Lee (1995), and Fischer (1993) argue that to achieve rapid economic growth and benefit from various advantages—including access to the knowledge and scientific advances of trading partners, technological spillovers and knowledge transfer, importing capital and intermediate goods, access to large markets, Economies of Scale, enhanced economic stability and sustainability, and improved competitiveness of medium and large enterprises in global markets—the capacities of international trade and trading partners should be utilized (Mokhtari Shirehjini et al., 2023: 75). Among the mechanisms through which foreign trade influences the economic growth of countries, the economic conditions of trading partners play a significant role in shaping long-term growth trajectories. Trading partners affect a

country's economic development through various channels, one of which is trade linkages. Specifically, the economic expansion of a trading partner raises its import demand, thereby enhancing the export performance of the corresponding country. Moreover, this interaction facilitates technology transfer, improved efficiency, and other positive spillover effects between partner nations (Salmani & Fattahi, 2013: 85–86). Empirically, fluctuations in a country's national expenditure and income propagate to other economies via the import channel. Such economic transmissions initiate chain reactions across interconnected countries, which ultimately feed back into the original country's economy, generating reciprocal effects (Applayard et al., 2017: 239). For simplicity in algebraic calculations, this model assumes the absence of a government sector ($G=0$ and $t=0$). In this framework, the variables include the rest of the world (ROW^1) and the country (A). Consumption includes autonomous and induced components in both economies, as does the import function. Investment and exports are assumed to be autonomous. Equations (1) to (10) describe the two economies: Country A and the rest of the world.

$$Y_A = C_A + I_A + X_A - M_A \quad (1)$$

$$C_A = a_A + bY_A \quad (2)$$

$$I_A = \bar{I}_A \quad (3)$$

$$X_A = \bar{X}_A \quad (4)$$

$$M_A = \bar{M}_A + mY_A \quad (5)$$

$$Y_{ROW} = C_{ROW} + I_{ROW} + X_{ROW} - M_{ROW} \quad (6)$$

$$C_{ROW} = a_{ROW} + bY_{ROW} \quad (7)$$

$$I_{ROW} = \bar{I}_{ROW} \quad (8)$$

$$X_{ROW} = \bar{X}_{ROW} \quad (9)$$

$$M_{ROW} = \bar{M}_{ROW} + mY_{ROW} \quad (10)$$

The equilibrium income level for country (A) is determined by substituting the relevant values into Equation (1):

$$Y_A = a_A + bY_A + \bar{I}_A + \bar{X}_A - (\bar{M}_A + mY_A)$$

$$Y_A - bY_A + mY_A = a_A + \bar{I}_A + \bar{X}_A - \bar{M}_A$$

$$(1 - b + m)Y_A = a_A + \bar{I}_A + \bar{X}_A - \bar{M}_A$$

$$Y_A = \frac{a_A + \bar{I}_A + \bar{X}_A - \bar{M}_A}{(1 - b + m)}$$

In this export model of country (A), exports are equal to the imports of other countries; thus, equation (11) can be written as follows:

$$Y_A = \frac{a_A + \bar{I}_A + \bar{M}_{ROW} + mY_{ROW} - \bar{M}_A}{(1 - b + m)} \quad (11)$$

¹ Rest of the World.

Since the Marginal propensity to save (s) in country (A) is replaced by $(1-b)$, because (b) is the Marginal Propensity to consume in country (A).

$$Y_A = \frac{a_A + \bar{I}_A + \bar{M}_{ROW} + mY_{ROW} - \bar{M}_A}{s + m} \quad (12)$$

A similar method for obtaining income equilibrium in other countries yields Equation (13):

$$Y_{ROW} = \frac{a_{ROW} + \bar{I}_{ROW} + \bar{M}_A + mY_A - \bar{M}_{ROW}}{s + m} \quad (13)$$

As demonstrated by the equations above, macroeconomic activity in countries worldwide is interdependent, with a nation's income level positively influenced by the income levels of other countries. The economic growth of country (A) is therefore a function of the growth experienced by other nations. This interconnection was particularly evident during the global economic recession of 2007–2008. Economic expansions or contractions in one country tend to propagate to others and subsequently feedback to the originating country (*ibid.*: 240–241). While foreign trade and financial interactions provide numerous advantages, they also facilitate the transmission of economic crises. Consequently, the greater a country's integration into the global economy, the more susceptible it becomes to such crises (Mokhtari Shirehjini et al., 2023: 76). Accordingly, the mutual effects of countries on each other and the transmission of economic shocks are important issues in today's economies. The most significant spillovers in the economic literature are external spillovers resulting from the interaction between one country and others, as well as spillovers arising from shocks caused by the economic policies of one country on others. Spillovers can directly affect a country's economy through trade links or indirectly through exchange rate and interest rate channels. External spillovers resulting from trade links have two effects: demand and competition. The demand effect means that changes in income are likely to translate into changes in demand for imported goods and services, creating spillover effects. The competitive effect of shocks influences a country's competitiveness, leading to changes in trade conditions and affecting the flow of exports and imports (Saki et al., 2021: 25-26).

3. Literature Review

Certain economists, including Krugman (1994) and Rodrik (1995), contend that the influence of trade openness on economic growth may be negligible or potentially misleading (Mokhtari Shirehjini et al., 2023: 75). Nonetheless, empirical research conducted since the 1990s generally supports a positive relationship between trade openness and economic growth. Notable contributions to this body of literature include the works of Edwards (1992), Sachs et al. (1995), Harrison (1996), Edwards (1998), Dollar (1992), Frankel and Romer (1999), Yanik Kaya (2003), Barro and Sala-i-Martin (2004), Harrison and Hanson (1999), and Wacziarg (2001). Conversely, some studies, such as

Clemens and Williamson (2004), did not identify a significant association between domestic economic growth and the growth of trading partners over the period 1869 to 1999. In contrast, Orlova (2005) found that, for a subset of countries, the economic growth of trading partners exerts a positive and statistically significant effect on domestic economic performance. Some of the most important studies are listed in Table (1).

Table 1. Summary of Previous Studies

Researcher	Topic	Methodology	Key Findings
Qian (2023)	Analysis of China's economic growth impact on Silk Road countries	Global Vector Autoregression (GVAR)	China's economic growth has a positive and significant effect on the economic growth of Silk Road countries.
Abosedra et al. (2019)	GDP growth spillovers in 120 countries	Panel Vector Autoregression (PVAR)	High-income countries are net transmitters of growth fluctuations, while low-income countries are net receivers. The variance-based spillover index indicates strong dynamics of growth fluctuations.
Alizadeh Janvisloo & Sherafatian-Jahromi (2019)	External shocks on emerging Southeast Asian economies	Global Vector Autoregression (GVAR)	Dependence on exports and financial markets increases vulnerability to external shocks (from the US, Eurozone, China, South Korea, Singapore, and oil prices). Stock prices, exchange rates, and production are the main channels for shock transmission.
Allen et al. (2017)	Spillovers from trading partners on Australia's economy	Diebold-Yilmaz index and Vector Autoregression (VAR)	The US and Hong Kong markets have the greatest spillover effects on Australia's economic growth. Trade and financial shocks from China and Japan have a more limited impact.
Hassan et al. (2017)	Transmission of international shocks in East Asia	Global Vector Autoregression (GVAR)	Stock markets, real output, and exchange rates are the main channels of connection to the global economy. In the long term, China has the greatest shock transmission in the real sector, and the US in stock markets.
Golmohammadi Tarzam et al. (2024)	Impact of trading partners' uncertainty on Iran's trade	Global Vector Autoregression (GVAR)	Iran's exports and imports react negatively to uncertainty shocks from major trading partners.
Mehregan & Khashee (2021)	Analysis of Afghanistan's economic growth response to neighboring	Vector Autoregression (VAR)	There is a positive and long-term relationship between Afghanistan's economic growth and that of Iran and Pakistan.

	countries' growth		
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Saki et al. (2021)	Impact of trade and exchange rate shocks on Iran's economy	Global Vector Autoregression (GVAR)	Increased trade with China boosts Iran's trade volume, while trade with Brazil reduces it. An increase in China's exchange rate initially decreases and then increases Iran's real exchange rate.
Salmani & Fattahi (2013)	Importance of trading partners' economic growth for OPEC countries' growth	Panel Data	Trading partners' growth, investment, human capital, and economic openness positively affect economic growth, while inflation and government spending have negative effects.

Drawing on a review of previous innovation studies and recognizing the significance of this research in analyzing the distinct spillover effects of economic and financial growth from developed and developing countries on Afghanistan's economic growth through the Panel Vector Auto regression (PVAR) model, this study aims to disentangle the sources of spillovers and conduct a dynamic analysis. It addresses a gap in the existing literature, which has predominantly focused on regional or global spillovers in a general context. Given Afghanistan's substantial reliance on trade and foreign aid, the study offers novel empirical insights that can assist policymakers in formulating strategies to harness positive spillovers while mitigating the adverse impacts of global shocks—an essential consideration for the country's sustainable economic development.

4. Research Methodology

This research seeks to investigate the spillover effects of the economic and financial growth of Afghanistan's trading partners on its economy during the period from 2000 to 2021, using annual data. To align with the theoretical foundations and existing literature on the subject, the panel vector auto regression (PVAR) model is employed. This method combines the vector autoregressive model approach with panel data analysis. In this approach, all model variables are treated as endogenous within a panel data framework (Love & Zicchino, 2006). The model utilizes the mean group (MG) method, as well as the Holtz-Eakin et al. (1988) method, to estimate, infer, and extract impulse response functions (IR) and variance decomposition (VD) (Ashrafzadeh and Mehregan, 2014). For greater flexibility in PVAR modeling, it is assumed that there are constant individual-specific effects in the model (Holtz-Eakin et al., 1988). Panel vector auto regression models have been applied in contexts where the time series length is short. However, a short time series does not imply that the data are non-stationary or not cointegrated.

When using fixed effects models with the quasi-maximum likelihood (QML) method, attention should be given to potential violations of consistency

assumptions. This is because, with a short time dimension in the panel, problems such as ambiguous and redundant parameters, as well as issues related to modeling initial observations, arise—similar to the single-equation panel data model setting (Ashrafzadeh and Mehregan, 2014). To address these challenges, the standard generalized method of moments (GMM) (Holtz-Eakin et al., 1988; Arellano and Bond, 1991), the developed generalized method of moments (Ahn and Schmidt, 1995; Arellano and Bover, 1995; Blundell and Bond, 1998), and the quasi-maximum likelihood fixed effect (FE-QML) and random effect (RE-QML) methods (Binder et al., 2005) have been proposed. If the time dimension of the panel is large, the mean group method is applied, whereby the parameters of the VAR equation are estimated separately for each cross-sectional unit. Subsequently, impulse response functions and variance decomposition are calculated individually for each unit. The averages of the coefficients from the impulse response functions and variance decomposition are then computed, and inferences are drawn accordingly. Impulse response functions illustrate the reactions of endogenous variables over time to shocks in each variable within the system. Variance decomposition indicates the contribution of each variable to the variations in other variables over time (Ashrafzadeh and Mehregan, 2014). The general form of the panel vector autoregression model is shown in equation (14):

$$Y_{it} = \alpha_i + \sum_{j=1}^p \beta_p Y_{i,t-j} + \gamma X_{it} + e_{it} \quad (14)$$

Where: $i \in \{1 \dots N\}$, $t \in \{1 \dots N\}$

i : Number of cross-sections

j : Time periods

Y_{it} : Vector of endogenous variables in the model (e.g., countries)

α_i : Fixed effects for unit i (optional)

β_p : Coefficient matrix for the p -th lag

X_{it} : Control variables (optional)

e_{it} : Vector of error terms

Since the purpose of the panel vector autoregression model is to provide a flexible structure for various applications in examining economic shocks (Pesaran, et al., 2004), the present study uses the panel autoregression model to investigate the effect of the growth of economic and financial variables of trading partners on the economy of Afghanistan. This study includes Afghanistan and its trading partners (the United States, Japan, Germany, China, Malaysia, and Russia) over the period 2000–2021 on an annual basis. The information on the variables used in the model is presented in Table (2).

Table (2): Description of Model Variables

	Variables	Data Source
Economic Variables	GDP per capita (constant 2015 US\$)	https://data.worldbank.org
	Exports of Goods and Services (constant 2015 US\$)	https://data.worldbank.org/tradingeconomics.com
Financial Variable	Real effective exchange rate (CPI-based)	http://www.bruegel.org/publications

Considering that Afghanistan's trading partners include both developed and developing countries, two models are estimated to examine the impact of economic and financial growth spillovers from these countries on Afghanistan's economy: one model for developed countries, including variables from the United States, Germany, and Japan, and another for developing countries, including China, Malaysia, and Russia. Therefore, all variables are included in the model in logarithmic form, as using the logarithmic form causes the estimated coefficients to be independent of the units of measurement of the variables, representing relative changes (Gujarati, 2011). The variables are defined as follows:: Logarithm of Afghanistan's economic and financial $Ln(AFG)$ variables, $Ln(USA)$: Logarithm of the United States' economic and financial variables, $Ln(DEU)$: Logarithm of Germany's economic and financial variables, $Ln(JPN)$: Logarithm of Japan's economic and financial variables, $Ln(CHN)$: Logarithm of China's Economic and financial variables, $Ln(MYS)$: Logarithm of Malaysia's Economic and financial variables and $Ln(RUS)$: Logarithm of Russia's economic and financial variables. Since the objective of this study is to analyze the growth of economic and financial variables of developed and developing countries on Afghanistan's economic and financial variables, i represents the cross-sections (GDP, exports and exchange rate), and the endogenous variables in the model consist of developed and developing countries. The study examines and analyzes the economic and financial spillovers of these countries on Afghanistan's economy. The first estimated model, which examines the spillover effects of developed countries on Afghanistan's economy, is given by Equation (15):

$$Ln(AFG)_{it} = \alpha_{i0} + \sum_{j=1}^p \beta_{1j} Ln(AFG)_{it-j} + \sum_{j=0}^q \beta_{2j} Ln(USA)_{it-j} + \sum_{j=0}^r \beta_{3j} Ln(DEU)_{it-j} + \sum_{j=0}^s \beta_{4j} Ln(JPN)_{it-j} + e_{it} \quad (15)$$

The second estimated model, which examines the spillover effects of developing countries on Afghanistan's economy, is given by Equation (16):

$$Ln(AFG)_{it} = \alpha_{i0} + \sum_{j=1}^p \beta_{1j} Ln(AFG)_{it-j} + \sum_{j=0}^q \beta_{2j} Ln(CHN)_{it-j} + \sum_{j=0}^r \beta_{3j} Ln(MYS)_{it-j} + \sum_{j=0}^s \beta_{5j} Ln(RUS)_{it-j} + \varepsilon_{it} \quad (16)$$

5. Model estimation and results

Considering the characteristics of panel data, the reliability of the variables was initially assessed through unit root tests to confirm the robustness of the results. Subsequently, the optimal lag length and causal relationships among the variables were established using the Granger causality test. Finally, the stationarity of the variables was examined.

5-1. Unit root testing

Prior to estimating the PVAR model, it is essential to assess the stationarity of the variables through a unit root test appropriate for panel data, as the existence of a unit root may result in misleading outcomes and spurious regressions. Given the panel structure of the dataset, the Im, Pesaran, and Shin (IPS) unit root test—designed specifically for combined data—was employed to evaluate variable stationarity. The findings are summarized in Table 3.

Table 2. Probit estimates of propensity scores

Variables	The value of the test statistic at the level	p-value	Result
<i>LnAFG</i>	2.2816	0.988	I(1)
<i>LnUSA</i>	1.7632	0.961	I(1)
<i>LnJPN</i>	-0.4452	0.3281	I(1)
<i>LnDUE</i>	-1.2432	0.106	I(1)
<i>LnCHN</i>	-0.6220	0.267	I(1)
<i>LnMYL</i>	0.2707	0.606	I(1)
<i>LnRUS</i>	0.1660	0.563	I(1)

Source: Research findings

Based on the results of Im, Pesaran, and Shin panel unit root test, which presumes a common unit root across all cross-sectional units, the variables under study exhibit non-stationarity in their levels but attain stationarity following first differencing. Therefore, the null hypothesis of a unit root at the level cannot be rejected.

Optimal Lag Selection

Panel vector auto regression analysis is performed with model specification and moment selection guided by the optimal lag length. Andrews and Lu (2001) proposed a combined criterion for generalized method of moments (GMM) estimation grounded in Hansen's (1982) J test. This criterion closely resembles model selection approaches based on maximum likelihood, including those developed by Akaike (1969), Bayesian (1978), and Hannan-Quinn (1979). The

findings for identifying the optimal lag order, capped at two lags, are presented in Table (3).

Table 3. Optimal Lag Selection

	<i>Lag</i>	<i>CD</i>	<i>J</i>	<i>J pvalue</i>	<i>MBIC</i>	<i>MAIC</i>	<i>MQIC</i>
The model of developed countries	1	0.3415663	39.66948	0.1652259	-84.20895	-24.33052	-46.95867
	2	-2.25959	20.23027	0.210028	-41.70895	-11.76973	-23.0838
The model of developing countries	1	0.6456901	37.71876	0.2240757	-86.15967	-26.28124	-48.90938
	2	0.2399229	31.42439	0.256962	-38.25723	-4.575614	-17.30395

Source: Research findings

Based on the results in Table (3), lag one is selected as the optimal lag. The probability value of the J statistic indicates that, at lag one, the null hypothesis of over-identification of the model is rejected (Koop & Korobilis, 2013). Thus, the model is selected with one lag.

Granger Causality Test

In this section, the Granger causality test has been used to confirm the existence of a relationship between the variables in the introduced model. The results are as follows:

Table 4. Causal Relationships Between Studied Variables Using the PVAR Approach

	Variables	Test Hypothesis	Chi-Square Statistic	Result
Developed Countries	Ln_{USA}	The growth of economic and financial variables of the United States is not a cause of Afghanistan's economic growth.	78.689	Confirm
	Ln_{JPN}	The growth of economic and financial variables of Japan is not a cause of Afghanistan's economic growth.	14.296	Confirm
	Ln_{DUE}	The growth of economic and financial variables of Germany is not a cause of Afghanistan's economic growth.	105.713	Confirm
Developing Countries	Ln_{CHN}	The growth of economic and financial variables of China is not a cause of Afghanistan's economic growth.	13.848	Confirm
	Ln_{MYL}	The growth of economic and financial variables of Malaysia is not a cause of Afghanistan's economic growth.	3.753	Confirm
	Ln_{RUS}	The growth of economic and financial variables of Russia is not a cause of	1.962	Reject

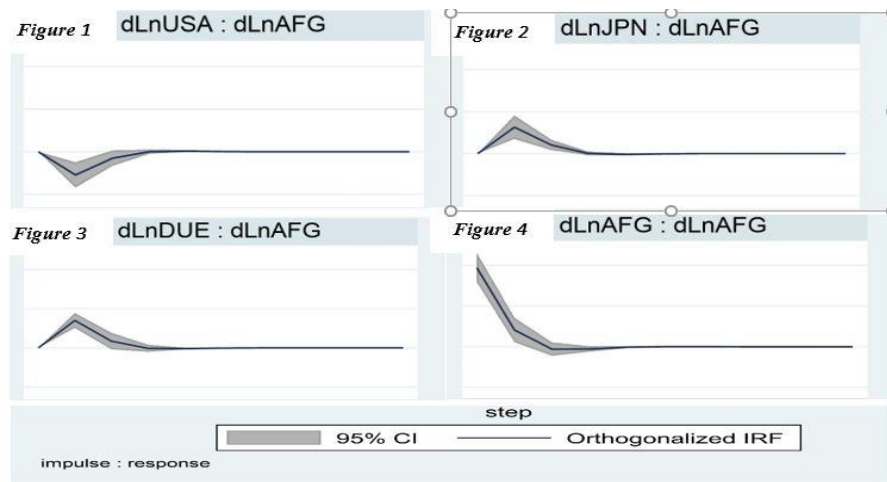
		Afghanistan's economic growth.		
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Source: Research findings

The results of the Granger causality test, obtained with an optimal lag, show that in the first model, there is a causal relationship from developed countries to Afghanistan's economic and financial variables. In other words, the economic and financial growth of developed countries causes Afghanistan's economic growth. The results of the second model also confirm a causal relationship from the economic and financial variables of China and Malaysia, except for Russia. Specifically, the null hypothesis—that there is no causal relationship from the financial and economic variables of developing countries, except Russia, to Afghanistan's economic and financial variables—is rejected at a significance level of 0.0003 percent.

Analysis of Impulse Response Function (IRF) in PVAR

The impulse response function is a key tool in the dynamic analysis of economic systems, enabling the identification of the timing of variables' responses to a structural shock. In the context of the real economy, this function shows the lag with which the effects of an economic shock occur, how long they last, and the period in which they peak. Examining and scheduling shocks is a method for dynamic economic analysis that helps policymakers better understand how shocks affect the entire economic system (Mohammadi & Salmani, 2005: 186). In impulse response functions, the effect of a shock on a variable is examined; that is, if a sudden change occurs in a variable, the impact of that change on the variable itself and on other variables over different periods is analyzed. The impulse response functions (IRFs) tracking the economic response of Afghanistan over a 10-period horizon to a one-standard-deviation shock from the economies of the United States, Japan, and Germany are illustrated in Figures 1 to 4:

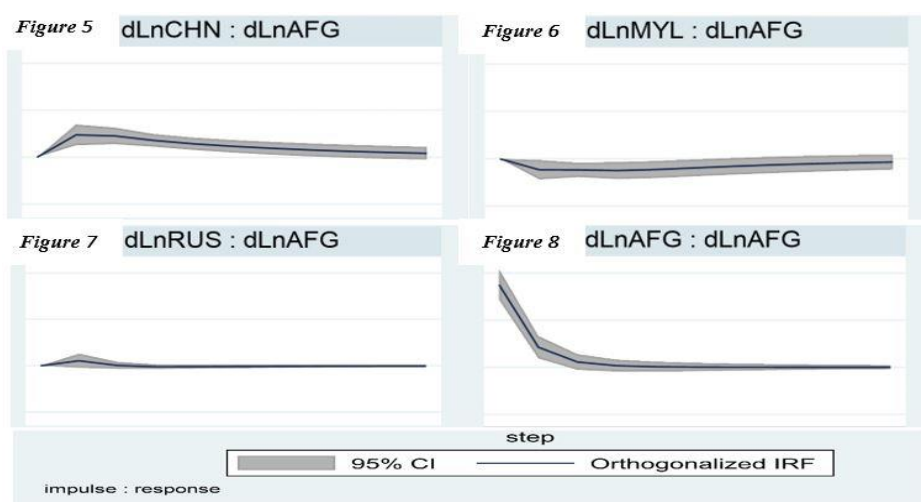


Impulse Response Functions (1): Impact of Shocks from Developed Countries on Afghanistan's Economy

Source: Research findings

Figure 1 displays the impact of economic shocks originating from the United States on Afghanistan's economy. A one-standard-deviation shock to the Gross Domestic Product (GDP) of the United States induces a contraction in Afghanistan's economy by 0.054 percent in the first period and 0.015 percent in the second period. From the third to the fifth period, the response turns positive; however, beyond this phase, the shock exercises a negative effect. Over time, this impact exhibits a diminishing trend, asymptotically approaching zero and eventually dissipating in the long run. This indicates that US economic shocks generate volatile, fluctuating effects on Afghanistan's economy in the short run, while their impact fades away over the long-term horizon. Figure 2 illustrates the transmission of economic shocks from Japan to Afghanistan. The effect is positive in the first and second periods, expanding the economy by 0.06 percent and 0.02 percent, respectively. Subsequently, the impact on Afghanistan's economy diminishes, gradually moving toward zero in the long run, demonstrating a transitory nature. In other words, while Japanese economic shocks stimulate Afghanistan's economic growth in the short run, the effect completely dissipates in the long run, allowing the economy to return to its initial steady state. Figure 3 indicates that the impact of economic shocks from Germany on Afghanistan's economic growth is positive in the first two periods, amounting to 0.069 percent and 0.017 percent, respectively. From the second to the fifth period, the effect turns negative but remains marginal and extremely close to zero, suggesting that the shock has virtually died out. Furthermore, Figure 4 depicts the domestic response to shocks from Afghanistan's own

economic and financial variables. It reveals an initial expansion of 0.04 percent in the first period, followed by a steady decline over time. The response continuously approaches zero, ultimately fading out completely in the long run as the system reverts to its initial baseline state. Following the previous analysis, the impulse response functions illustrating the impact of economic variables from developing countries on Afghanistan's economy over a ten-period horizon are presented in Figures (5) to (8):



Impulse Response Functions (2): Impact of Shocks from Developing Countries on Afghanistan's Economy

Source: Research findings

Figure 5 illustrates the impact of shocks originating from China's economic growth on Afghanistan's economy. A one-standard-deviation shock to China's GDP induces a 0.047 percent expansion in Afghanistan's economy in the first

period and a 0.045 percent expansion in the second period. Subsequently, the impact of these shocks on Afghanistan's economy remains positive; however, it follows a diminishing trajectory, gradually approaching zero over time and eventually dissipating. This indicates that while the shock from the Chinese economy stimulates Afghanistan's economic growth in the short run, its effect completely fades away in the long run. Figure 6 depicts the impact of economic shocks transmitted from Malaysia's economic growth to Afghanistan's economy. A one-standard-deviation shock to Malaysia's GDP causes a contraction in Afghanistan's economy by 0.023 percent in the first period and 0.0239 percent in the second period. Following this, the impact of these shocks remains negative but exhibits a downward trend, continuously moving toward zero over time and ultimately vanishing in the long run. Based on the impulse response results shown in Figure 7, which outlines the transmission of economic shocks from Russia to Afghanistan, the effect on Afghanistan's economy is positive during the first and second periods. Thereafter, the response turns negative with a declining trend, gradually approaching zero in the long run and exhibiting a transitory nature. In other words, these shocks accelerate Afghanistan's economic growth in the short run, but the effect eventually dies out over the long-term horizon, allowing the economy to return to its initial steady state. Furthermore, the results in Figure 8 indicate that a domestic one-standard-deviation shock to Afghanistan's own GDP leads to an immediate expansion of 0.17 percent in the first period. Subsequently, the response remains positive but follows a diminishing path, asymptotically approaching zero over time until the domestic shock completely dissipates.

Variance Decomposition

Variance decomposition is an important part of the Vector Auto regression (VAR) model. The table in this section examines the extent to which changes in the dependent variable can be explained by the explanatory variables; in other words, variance decomposition analyzes economic variables over time to determine how much each variable in the economy contributes to changes in another variable (Abbasinejad & Goodarzi Farahani, 2016: 287). The results of the variance decomposition of economic and financial variables of Afghanistan and its trading partners (developed and developing countries) over a 10-year period are as follows:

Table (5): Results of Variance Decomposition

Variance Decomposition for the Model of Developing Countries					Variance Decomposition for the Model of Developed Countries			
Course	<i>LnAFG</i>	<i>LnCHN</i>	<i>LnMYL</i>	<i>LnRUS</i>	<i>LnAFG</i>	<i>LnUSA</i>	<i>LnJPN</i>	<i>LnDUE</i>
1	1	0	0	0	0	0	0	0
2	.9178608	.0638244	.0150678	.003247	.7704231	.0576365	.0767429	.0951974
3	.8554842	.1130828	.0284045	.0030284	.7565778	.060859	.0835131	.099058
4	.8150856	.1395354	.0423733	.0030057	.756705	.0608213	.0834648	.0990088

5	.7888479	.1547424	.0534	.0030097	.7565807	.0608513	.0835075	.0990605
6	.7719473	.1642151	.0608319	.0030057	.7565697	.060854	.0835128	.0990636
7	.761045	.1702984	.0656546	.003002	.7565697	.0608539	.0835127	.0990636
8	.753961	.174248	.0687913	.0029998	.7565697	.0608539	.0835128	.0990636
9	.749326	.1768302	.0708454	.0029984	.7565697	.0608539	.0835128	.0990636
10	.7462783	.1785274	.0721967	.0029975	.7565697	.0608539	.0835128	.0990636

Source: Research findings

The results in Table 5 for Model 1 illustrate how fluctuations in Afghanistan's economic and financial variables are explained by its developed trading partners (the United States, Japan, and Germany). In the first period, 100% of the changes in Afghanistan's economy are explained by its own variables, with no contribution from the model's explanatory variables. However, in subsequent periods, the explanatory power of Afghanistan's own variables decreases, reaching 75.6% by the tenth period. Meanwhile, the contribution of the explanatory variables increases over time, with the economic and financial variables of the United States, Japan, and Germany accounting for 6%, 8.3%, and 9.9%, respectively, of the changes in Afghanistan's economic growth by the tenth period. This indicates that, over time, the ability of Afghanistan's own variables to explain their own changes diminishes, while these changes are increasingly explained by other variables, highlighting the endogeneity of these variables.

The results of Table (5) for Model (2) demonstrate how fluctuations in Afghanistan's economic and financial variables are explained by its developing trading partners (China, Malaysia, and Russia). According to Table (5), in the first period, 100% of the changes in Afghanistan's economic growth are explained by its own variables, with no contribution from the economic and financial growth of China, Malaysia, and Russia. However, in subsequent periods, the explanatory power of Afghanistan's own variables decreases, reaching 74.6% by the tenth period. Meanwhile, the contribution of the explanatory variables increases over time, with the economic and financial variables of China, Malaysia, and Russia accounting for 17.8%, 7.2%, and 2.9%, respectively, of the changes in Afghanistan's economy by the tenth period. This suggests that over time, the ability of Afghanistan's own variables to explain their own changes diminishes, and these changes are increasingly explained by other variables. The overall results from the variance decomposition in the long term for both models indicate that China's economic and financial growth has the largest share, while Russia has the smallest share, in explaining the fluctuations in Afghanistan's economic growth. Additionally, the results of the Granger causality test in the short term show that developed countries (the United States, Japan, and Germany) and developing countries (China and Malaysia) are drivers of Afghanistan's economic growth.

6. Conclusion and Recommendations

Based on the theoretical framework of the study, foreign trade serves as a key channel for the spillover of economic growth among countries. Changes in income are likely to translate into changes in demand for imported goods and services, generating spillover effects (Saki et al., 2021: 25). This process contributes to economic development by supplying national capabilities to global markets and fostering international competition. Export and import activities have widespread impacts on various sectors of the economy. Additionally, imported and exported goods are qualitatively categorized into capital goods, intermediate goods, and consumer goods, which influence investment, production, and societal consumption. Notably, imports of capital and intermediate goods enhance a country's production and serve as a conduit for technology transfer (Eltejaie & Pourbagher, 2014: 123). The results of the Granger causality test in this study indicate that, in the short term, Afghanistan's economic growth depends on the economic and financial growth of its trading partners, including developed countries (the United States, Japan, and Germany) and developing countries (China and Malaysia). In the long term, the economic and financial variables of China have the most significant impact on Afghanistan's economy. These findings align with the theoretical framework of economic and financial spillovers in developing countries, where spillovers are transmitted through channels such as foreign trade, foreign aid, exchange rates, and financial markets. The theory of external spillovers suggests that productivity can be enhanced through the transfer of knowledge and technology (Saki et al., 2021).

The short-term results show that the economic and financial spillovers from developed and developing countries are among the most important factors affecting Afghanistan's economic growth. Based on the theoretical foundations of foreign spillovers, the transfer of knowledge and technology, as well as direct foreign aid, have played a decisive role in improving Afghanistan's economic performance. Statistical data also clearly confirm this dependence: during the period from 2002 to 2021, international aid constituted about 40% of the gross domestic product and nearly 75% of the general budget of the Afghan government (Cordesman, 2022: 3). According to World Bank reports, Afghanistan received \$77 billion in development aid between 2001 and 2019. The United States, as the largest donor, provided about 54% of the aid during that period, while Japan, Germany, and the European Union were the next largest donors (Clair, 2021: 3). These statistics are consistent with the theoretical foundations of economic and financial spillovers, which suggest that foreign aid can remove economic and financial constraints and promote economic growth in the short term. Additionally, the effect of foreign trade, particularly through intermediate and capital goods, confirms the trade spillover from developed and

developing countries such as China and Malaysia in low-income countries (Ashraf et al., 2022). Developed countries (the United States, Japan, and Germany) and developing countries (China and Malaysia), as important trading partners of Afghanistan, play a key role in meeting the production and consumption needs of the country. According to global trade statistics in 2019, intermediate and capital goods together constituted about 40% of Afghanistan's total imports (World Bank, 2019). Since these goods are an integral part of the production and investment processes, it can be concluded that the trade spillover from these countries, mainly in the form of imports of intermediate and capital goods, is one of the key factors in Afghanistan's economic growth. In other words, Afghanistan's economic growth largely depends on the continued flow of imports of these types of goods from its main trading partners.

Based on the results of the Impulse Response Functions (IRF) from both models, shocks from China's economic variables have a positive effect on Afghanistan's economy in the short term, leading to economic growth. However, over time, this effect diminishes and eventually dissipates, as is evident when comparing the figures. Additionally, the results of the variance decomposition in the long term indicate that, in the first period, the majority of changes in Afghanistan's economic growth are explained by its own variables, with no contribution from the economic and financial growth of its trading partners. However, the explanatory power of the models' variables increases over time in both models, with China's economic and financial variables having the greatest impact on explaining changes in Afghanistan's economy. In the long term, China's role through trade and infrastructure investment channels is particularly significant for Afghanistan. China's share of Afghanistan's imports increased from 5% in 2001 to 17.43% in 2019 (Afghanistan Ministry of Commerce, 2019). Furthermore, initiatives such as the Belt and Road Initiative (BRI) (Zhai, 2018), investments in oil extraction from the Amu Darya basin (D'Souza, 2023), and the expansion of the China-Pakistan Economic Corridor (CPEC), valued at \$60 billion (Standish, 2025), are significant for Afghanistan's economy and generate positive spillovers. Infrastructure investments facilitate technology transfer and job creation, ultimately contributing to sustainable growth. Based on the findings of this study, it is recommended that, in the short term, optimizing the use of foreign aid to strengthen infrastructure and domestic capacities is essential. In the long term, focusing on managing relations with China, diversifying trading partners, and strengthening domestic industries can contribute to achieving sustainable economic growth.

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تحلیل سرریز رشد اقتصادی و مالی شرکای تجاری توسعه یافته و در حال توسعه بر اقتصاد افغانستان: رویکرد مدل خودرگرسیون برداری پانلی (PVAR)

چکیده

اهمیت شرکای تجاری در رشد اقتصادی کشورها یکی از موضوعات محوری در ادبیات اقتصاد بین الملل است. سازوکارهای متعددی وجود دارند که از طریق آنها سرریزهای اقتصادی و مالی کشورها بر یکدیگر تأثیر می گذارند. در این میان، سرریزهای تجاری و نوسانات نرخ ارز از مهم ترین کانال های غیرمستقیم به حساب می آید که از طریق آنها شرکای تجاری بر رشد و پویایی اقتصادی یکدیگر اثر می گذارند. این پژوهش باهدف بررسی اثر سرریز اقتصادی و مالی کشورهای توسعه یافته و در حال توسعه بر رشد اقتصادی افغانستان طی دوره زمانی ۲۰۲۱-۲۰۰۰ انجام شده است. برای این منظور، داده های مربوط به تولید ناخالص داخلی سرانه، صادرات کالا و خدمات، و نرخ ارز شرکای تجاری منتخب افغانستان در دو گروه کشورهای توسعه یافته (ایالات متحده، ژاپن و آلمان) و کشورهای در حال توسعه (چین، مالزی و روسیه) با استفاده از مدل خودرگرسیون برداری پانلی

(PVAR) و نرم‌افزار (STATA) مورد تحلیل قرار گرفت. یافته‌های این تحقیق نشان می‌دهد که ساختار اقتصادی افغانستان به طور قابل توجهی تحت تأثیر تحولات اقتصادی و مالی شرکای تجاری خود قرار دارد. نتایج آزمون علیت گرنجر بیانگر آن است که در کوتاه‌مدت، رشد اقتصادی افغانستان به رشد اقتصادی و مالی کشورهای توسعه‌یافته (ایالات متحده، ژاپن و آلمان) و برخی کشورهای در حال توسعه (چین و مالزی) وابستگی معناداری دارد. این تأثیر عمدتاً از طریق کانال تجارت و به‌ویژه واردات کالاهای سرمایه‌ای و واسطه‌ای و کمک‌های خارجی منتقل می‌شود. همچنین، نتایج تجزیه واریانس در بلندمدت حاکی از آن است رشد متغیرهای اقتصادی و مالی چین در مقایسه با سایر کشورهای توسعه‌یافته و در حال توسعه، بیشترین سهم را در توضیح رشد متغیرهای اقتصادی و مالی افغانستان دارند.

کلمات کلیدی: سرریز اقتصادی و مالی، رشد اقتصادی افغانستان، شرکای تجاری و مدل خودرگرسیون برداری پانلی (PVAR)

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