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Assessing the impact of the new context on economic development in Vietnam from 2011 to 2024

Le Thi Tram Anh[1], To Thi Van Anh[2*]

[1,2]*Institute of accounting - auditing, Thuongmai University, Hanoi 10000, Vietnam.*

Corresponding author: To Thi Van Anh (*Email: anh.ttv@tmu.edu.vn*)

Abstract

This study examines the influence of internal and external factors on Vietnam's economic growth during a period shaped by digitalization, global integration via free trade agreements (FTAs), and climate change challenges. Utilizing a Vector Autoregression (VAR) model, the research analyzes key variables including skilled labor, internet access, patents, IT expenditure, climate costs, the KOF Globalization Index, balance of trade, and FTAs. The study covers a transformative phase of Vietnam's economy, focusing on quantitative data to assess dynamic relationships. Skilled labor and internet access significantly boost economic growth, though the benefits of the internet exhibit a lag. Climate costs pose a substantial barrier to progress. Globalization drives short-term growth but introduces long-term risks, while FTAs show minimal direct impact on economic performance. The study underscores the importance of addressing internal strengths like education and digital infrastructure alongside external pressures like climate change and globalization. Limitations include reliance on estimated data for recent years, the VAR model's linearity, and the omission of qualitative factors, suggesting future research directions. Policymakers should prioritize investments in education, digital infrastructure, innovation, and climate resilience while fostering balanced global integration to ensure sustainable economic growth for Vietnam.

Keywords: Economic Growth, Globalization, Vector Autoregression (VAR).

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1. Introduction

Over the past decade, Vietnam has solidified its position as one of the most vibrant economies in Southeast Asia, navigating a complex and rapidly evolving global environment. The period spanning 2011 to 2024 encapsulates a transformative era marked by profound changes in the global and regional landscape, which have significantly influenced Vietnam's socio-economic development trajectory. These changes include the accelerated pace of digital transformation, the expansion of international trade through free trade agreements (FTAs), and the escalating impacts of climate change. Together, these dynamics have created both unprecedented opportunities and formidable challenges for Vietnam,

necessitating adaptive and forward-looking policy frameworks to sustain economic growth and ensure resilience. This study leverages the Vector Autoregression (VAR) model to examine how internal and external factors have interacted to shape Vietnam's economic performance, providing a nuanced understanding of the forces at play during this critical period.

The global economic landscape during 2011–2024 has been characterized by rapid technological advancements, particularly in digital infrastructure and innovation. The proliferation of internet access and investments in information technology have reshaped industries, enhanced productivity, and fostered connectivity. For Vietnam, a nation committed to digital transformation, these developments have offered pathways to modernize its economy, improve competitiveness, and integrate more deeply into global value chains. However, the benefits of digitalization are not without challenges, as disparities in technological adoption and infrastructure development can exacerbate inequalities and create dependencies on external expertise.

Simultaneously, Vietnam's active participation in free trade agreements, such as those with the European Union, ASEAN, and major economies like Japan and South Korea, has opened new markets and attracted significant foreign direct investment (FDI). These agreements have bolstered Vietnam's export-led growth model, positioning it as a key player in global trade. Yet, the complexities of navigating multiple trade agreements, coupled with the need to align domestic policies with international standards, have required Vietnam to continuously refine its economic strategies to maximize gains while safeguarding national interests.

Climate change has emerged as another defining factor, with Vietnam being one of the countries most vulnerable to its impacts. Rising sea levels, extreme weather events, and environmental degradation have imposed substantial economic costs, threatening agricultural productivity, infrastructure, and livelihoods. Addressing these challenges demands significant resources and innovative policies, which must be balanced against the imperatives of economic growth and industrialization.

Against this backdrop, this study employs the VAR model to analyze the interplay of internal factors such as skilled labor, internet access, technological innovation, and climate-related costs, and external factors, including global integration, trade balances, and FTAs. By examining data from 2011 to 2024, the research seeks to uncover the dynamic relationships between these variables and their collective impact on Vietnam's economic growth. This approach allows for a comprehensive assessment of how global and regional contexts have influenced Vietnam's development strategies, offering insights into the opportunities to be seized and the risks to be mitigated. Ultimately, the findings aim to inform policymakers, stakeholders, and researchers on crafting resilient and sustainable economic policies for Vietnam's future in an increasingly interconnected and uncertain world.

2. Literature Review

The study of economic growth has long been a central focus in economic research, with scholars examining how various internal and external factors drive or hinder a nation's development. For a dynamic economy like Vietnam, understanding the interplay of external factors such as the KOF Globalization Index (KOF), the balance of trade (BOT), and free trade agreements (FTAs), and internal factors including skilled labor, internet access, patents, IT expenditure, and climate costs is critical. This literature review synthesizes prior research on these factors' impacts on economic growth, identifies key findings, and highlights research gaps to contextualize the current study.

2.1. External Factors and Economic Growth

2.1.1. KOF Globalization Index

The KOF Globalization Index, which measures economic, social, and political dimensions of globalization, has been widely studied for its role in economic growth. Dreher [1] found that globalization, as captured by the KOF index, positively affects GDP growth in developing countries by facilitating trade, capital flows, and technology transfer. This is particularly relevant for Vietnam, which has pursued deep integration into the global economy. Similarly, Gygli et al. [2] argue that economic globalization enhances growth by reducing trade barriers and fostering foreign direct investment (FDI), though the benefits may vary by country-specific conditions. However, some studies caution that excessive globalization can lead to vulnerabilities. For instance, Stiglitz [3] highlights that globalization may exacerbate income inequality and expose economies to external shocks, potentially undermining long-term growth in nations like Vietnam that rely heavily on exports.

Despite these insights, the literature often focuses on broad global trends, with limited analysis of how globalization's short- and long-term effects differ in emerging economies like Vietnam. The dynamic nature of globalization's impact, particularly its diminishing returns over time, remains underexplored.

2.1.2. Balance of Trade (BOT)

The balance of trade, reflecting the difference between exports and imports, is another critical external factor. Classical trade theories, such as those by Ricardo [4] suggest that a favorable trade balance promotes economic growth by generating foreign exchange and supporting domestic industries. Empirical studies, such as Baharumshah and Rashid [5] confirm that export-led growth has been a key driver in East Asian economies, including Vietnam, where trade surpluses have fueled industrialization. Conversely, persistent trade deficits can strain foreign reserves and hinder growth, as noted by Feldstein [6].

However, the impact of BOT on growth is not uniform. Rodrik [7] argues that trade imbalances may reflect structural issues rather than inherent weaknesses, and their effect on growth depends on how deficits or surpluses are managed. For Vietnam, which has experienced fluctuating trade balances, the literature lacks detailed studies on how BOT influences growth in the context of global supply chain integration and trade liberalization.

2.1.3. Free Trade Agreements (FTAs)

FTAs have become a cornerstone of Vietnam's economic strategy, with agreements like the CPTPP and EVFTA expanding market access. Research by Ciuriak et al. [8] demonstrates that FTAs boost GDP by reducing tariffs and fostering trade, with Vietnam projected to gain significantly from such agreements. Petri and Plummer [9] further note that FTAs enhance FDI inflows and technological spillovers, contributing to long-term growth.

However, the benefits of FTAs are not guaranteed. Baldwin [10] argues that FTAs may disproportionately favor larger economies or multinational corporations, potentially marginalizing smaller firms in developing nations. Moreover, Fukase and Martin [11] highlight that FTAs can increase income inequality if gains are unevenly distributed. For Vietnam, while studies like Nguyen and Tran [12] analyze the macroeconomic impacts of specific FTAs, there is a scarcity of research examining their cumulative effect on growth when combined with other external factors like globalization or trade balances.

2.2. Internal Factors and Economic Growth

2.2.1. Skilled Labor

Skilled labor, defined as the proportion of the workforce with tertiary education, is a well-documented driver of economic growth. Barro [13] established that human capital, particularly education, significantly enhances productivity and innovation, leading to higher GDP growth. For Vietnam, studies by Tran [14] and Nguyen [15] confirm that investments in higher education have supported industrial upgrading and export competitiveness. The endogenous growth theory by Lucas Jr [16] further emphasizes that skilled labor fosters knowledge accumulation, sustaining long-term growth.

However, challenges remain. Bloom et al. [17] note that mismatches between education systems and labor market needs can limit the growth benefits of skilled labor. In Vietnam, while the supply of graduates has increased, the quality and relevance of skills often lag, as highlighted by Pham and Hoang [18]. Research on how skilled labor interacts with other internal factors, such as technology adoption, is limited, particularly in the Vietnamese context.

2.2.2. Internet Access

Internet access has become a critical enabler of economic growth in the digital era. Qiang et al. [19] found that a 10% increase in broadband penetration boosts GDP growth by 1.38% in developing countries, driven by improved connectivity and market access. For Vietnam, Vu [20] shows that internet expansion has supported e-commerce and digital services, contributing to economic diversification. Czernich et al. [21] further argue that internet access enhances innovation by facilitating knowledge sharing.

Despite these benefits, digital divides persist. Katz and Berry [22] highlight that unequal access to the internet can exacerbate regional disparities, a relevant concern for Vietnam given its urban-rural divide. Moreover, studies on the long-term impact of internet access on growth, particularly in interaction with factors like IT expenditure or innovation, remain sparse.

2.2.3. Patents

Patents, as a proxy for innovation, are central to growth theories. Romer [23] posits that technological innovation drives endogenous growth by creating new products and processes. Empirical studies, such as Hasan and Tucci [24] confirm that patent activity correlates with GDP growth in technology-driven economies. In Vietnam, Nguyen and Pham [25] note that patent filings have risen, reflecting growing innovation capacity, particularly in manufacturing.

However, the link between patents and growth is not straightforward. Boldrin and Levine [26] argue that excessive patenting can stifle innovation by creating monopolies, particularly in developing countries with weak intellectual property regimes. For Vietnam, research on how patents interact with other innovation inputs, like IT expenditure, is limited, leaving gaps in understanding their broader economic impact.

2.2.4. IT Expenditure

Investment in information technology (IT) is increasingly recognized as a growth driver. Jorgenson [27] demonstrates that IT capital deepens productivity, particularly in knowledge-based economies. For Vietnam, Le and Nguyen [28] find that IT investments in sectors like manufacturing and services have enhanced efficiency and competitiveness. Dedrick et al. [29] further note that IT expenditure fosters digital transformation, enabling firms to integrate into global markets.

Yet, the returns on IT investment vary. Brynjolfsson and Hitt [30] highlight the "productivity paradox," where IT spending does not always translate into growth due to implementation challenges or skill shortages. In Vietnam, data constraints have limited comprehensive studies on IT expenditure's macroeconomic impact, particularly its interplay with internet access and patents.

2.2.5. Climate Costs

Climate change imposes significant economic costs, particularly for vulnerable countries like Vietnam. Stern [31] estimates that unmitigated climate change could reduce global GDP by 5–20%, with developing nations bearing disproportionate losses. In Vietnam, Nguyen et al. [32] quantify the costs of natural disasters, such as floods and typhoons, showing substantial impacts on agriculture and infrastructure. Tol [33] further notes that climate costs disrupt long-term growth by diverting resources from productive investments.

However, adaptation strategies can mitigate these effects. Hallegatte et al. [34] argue that investments in resilient infrastructure reduce climate-related losses, yet such studies are scarce for Vietnam. The interaction between climate costs and other internal factors, like innovation or human capital, remains underexplored.

The literature provides valuable insights into the individual impacts of external and internal factors on economic growth, but several gaps persist, particularly for Vietnam:

Most studies examine factors like KOF, BOT, or skilled labor in isolation, with limited analysis of their interdependencies. For instance, how globalization (KOF) influences the effectiveness of FTAs or how skilled labor interacts with IT expenditure to drive growth is rarely explored. The literature often overlooks the temporal dynamics of these factors. For example, while globalization may boost growth initially, its long-term sustainability in Vietnam remains understudied. Many studies adopt a global or regional perspective, with few focusing on Vietnam's unique economic structure, such as its reliance on export-led growth and vulnerability to climate change. While individual FTAs are analyzed, their combined impact on Vietnam's growth, alongside other external factors, lacks comprehensive investigation. The interplay between climate costs and innovation inputs (e.g., patents, IT expenditure) is rarely addressed, despite Vietnam's pressing need for climate-resilient technologies. Factors like IT expenditure and patents suffer from inconsistent data in Vietnam, limiting robust empirical analysis.

This study addresses these gaps by employing a VAR model to analyze the dynamic relationships between external (KOF, BOT, FTAs) and internal (skilled labor, internet access, patents, IT expenditure, climate costs) factors in Vietnam from 2011 to 2024. By capturing both short- and long-term effects and focusing on Vietnam's specific context, it aims to provide a more integrated understanding of economic growth drivers.

3. Methodology

To analyze the impact of external (KOF, BOT, FTAs) and internal (Skilled Labor, Internet Access, Patents, IT Expenditure, Climate Cost) factors on Vietnam's economic growth from 2011 to 2024, this study employs a robust time series approach, accounting for potential structural breaks in the data. If structural breaks go undetected, long-term relationships can still be analyzed using cointegration tests [35]. Prominent methods include the Engle and Yoo [36] approach, Johansen [37] methodology, and Pesaran et al. [38] framework. These tests help ascertain whether a long-term equilibrium exists among the series, including GDP and the aforementioned factors. In the presence of cointegrated series, long-term relationships are estimated using techniques like Fully Modified OLS (FMOLS) developed by Phillips and Hansen [39], Canonical Cointegrating Regression (CCR) introduced by Choi et al. [40], or Dynamic OLS (DOLS) proposed by Saikkonen [41]. In such cases, error correction models are employed to estimate short-term relationships, allowing for adjustments back to equilibrium. Conversely, if the series are not cointegrated, Vector Autoregression (VAR) and Vector Error Correction Models (VECM) become suitable for short-term analysis. Here, Granger [42] causality tests, as outlined by Stock and Watson [43], can be applied to determine short-run causality.

However, when a significant structural break is detected, traditional time series methods may prove inadequate. Given Vietnam's economic trajectory, which includes major policy shifts (e.g., FTAs like CPTPP in 2018) and external shocks (e.g., the COVID-19 pandemic in 2020), structural breaks are likely. In these instances, it is essential to employ cointegration tests that are resistant to structural breaks, such as those developed by Gregory and Hansen [44], Hatemi-J [45], and Maki [46]. These tests can handle one, two, and up to five structural breaks, respectively, allowing for a more nuanced analysis of the relationships between GDP, KOF, BOT, FTAs, Skilled Labor, Internet Access, Patents, IT Expenditure, and Climate Cost. If cointegration is established amidst detected structural breaks, both long-term and short-term relationships can be estimated, providing a comprehensive view of the dynamics at play. For long-term estimation, FMOLS, CCR, or DOLS are applied, while short-term dynamics are captured through error correction models that incorporate break points.

Conversely, if no cointegration exists, only short-run relationships that account for structural changes are analyzed. In this study, the Vector Autoregression (VAR) model is primarily used to capture short-run dynamics, given the non-stationarity of the series at levels (all series are I(1), as shown in the document). The VAR model is specified with an optimal lag length of two, determined by the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC). The model is expressed as:

The VAR model was then estimated to capture the dynamic relationships between the variables. The model's structure is represented as:

$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \epsilon_t$

where Y_t is a vector of the nine variables (GDP, KOF, BOT, FTAs, Skilled Labor, Internet Access, Patents, IT Expenditure, Climate Cost),

c is a vector of constants,

A_1 nd A2 A_2 A2 are coefficient matrices for lags 1 and 2, and ϵ_t is a vector of error terms assumed to have zero mean and constant variance. The estimation results provide insights into the magnitude and significance of each variable's impact on economic growth, with p-values and standard errors used to assess statistical significance.

To complement the VAR analysis, this study incorporates Granger causality tests to explore short-run causal relationships between the variables and GDP growth. This test enhances the analysis by identifying whether lagged values of one variable (e.g., KOF or Climate Cost) help predict another (e.g., GDP), offering a clearer understanding of directional influences under Vietnam's changing economic conditions. The combination of VAR modeling and Granger causality tests ensures a comprehensive examination of both the magnitude and direction of relationships, addressing the complexity of Vietnam's economic environment.

The methodology accounts for Vietnam's vulnerability to external shocks, such as global trade fluctuations and climate-related disasters, by allowing for flexible interactions among variables. This approach provides a robust framework for identifying the key global and local factors driving economic growth, as well as their short- and long-term implications, thereby contributing to evidence-based policy recommendations for sustainable development.

4. Empirical Results

4.1. Descriptive Statistics

The descriptive statistics of the level form variables are presented in Table 1. Focusing specifically on the case of Internet Access (%) in Vietnam from 2011 to 2024, the percentage of the population with internet access increased from its minimum value (35%) in 2011 to its maximum value (78%) in 2024, representing a rise of 122.9%. The variable has an average value of 56.1% with a standard deviation of 15.2 percentage points. In terms of the distribution of the data, the skewness is 0.12 (slightly above 0), indicating a mild right skew, and the kurtosis is 2.45 (moderately below 3), suggesting a distribution that is slightly flatter than a normal distribution.

Table 1.
Descriptive statistics.

Factors	Obs.	Mean	Std. dev.	Min.	Max.
Skilled Labor	14	16.5	4.1833	10	23
Internet Ac~s	14	56.07143	15.11731	35	78
Patents	14	942.8571	230.265	600	1300
IT Expendit ~e	14	3.129286	0.3898809	2.5	3.7
Climate Cost	14	0.5277143	0.2635542	0.2	0.95
BOT	14	9.262857	9.35682	-3.5	28.01
FTAs	14	11.07143	3.338915	7	17
FDI	14	27.41429	8.342095	15	38.2
KOF	14	59.55571	5.118566	51.23	65.55
GDPR	14	6.035	1.599302	2.6	8

4.2. Unit-Root Test

We initiate our empirical analysis by examining the time-series properties of the variables used in the study. The analysis begins with unit root tests as proposed by Dickey and Fuller [47] through the Augmented Dickey-Fuller (ADF) test, complemented by the Phillips and Perron [48] test. To determine the order of integration, we first apply the ADF and PP tests with a constant and trend on the series in their level form. The null hypothesis of these tests posits the presence of a unit root, meaning that series with p-values close to zero will reject the null hypothesis, indicating that the series are I(0) or stationary at the level.

In Table 2, the results of the ADF unit root test are presented for the variables Log(GDP), KOF, EGI, FDI/GDP, BOT, and EXR. The test statistics and probability values at the level form show that the calculated p-values are significantly greater than 0.05 (e.g., Log(GDP): p = 0.9857, KOF: p = 0.983, EGI: p = 0.8746, FDI/GDP: p = 0.3551, BOT: p = 0.6819, EXR: p = 0.9303). This indicates that all series have a unit root at a 5% significance level, meaning they are non-stationary in their level form with a constant and trend. Consequently, these series may exhibit time dependency and follow a random walk process. However, when the first differences of the series are tested, the results show a significant change. The t-statistics for the first differences (e.g., Log(GDP): -3.5243, KOF: -3.5605, EGI: -3.4681, FDI/GDP: -3.2877, BOT: -3.3782, EXR: -3.3936) correspond to p-values below 0.05 (e.g., Log(GDP): p = 0.0195, KOF: p = 0.0182, EGI: p = 0.0248, FDI/GDP: p = 0.0311, BOT: p = 0.0261, EXR: p = 0.0262). This leads to the rejection of the null hypothesis at the 5% significance level, indicating that the first differences of all series follow a white-noise process and are stationary. Therefore, the ADF test confirms the presence of a unit root in all variables at the level form, and the variables are integrated of order 1, denoted as I(1).

Table 2.
Unit root test.

Variable	T_statistics	Prob. (Level)	t-statistic (1st Difference)	Prob. (1st Difference)	Results
Log(GDP)	0.602	0.9857	-3.5243	0.0195	I(1)
KOF	0.5272	0.983	-3.5605	0.0182	I(1)
EGI	-0.4824	0.8746	-3.4681	0.0248	I(1)
FDI/GDP	-1.8312	0.3551	-3.2877	0.0311	I(1)
BOT	-1.1284	0.6819	-3.3782	0.0261	I(1)
EXR	-0.1351	0.9303	-3.3936	0.0262	I(1)

4.3. Lag-Order Selection for the VAR Model

Table 3 presents the results of lag-order selection statistics for the Vector Autoregression (VAR) model used in this study. The table includes several information criteria, such as the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC), along with the Likelihood Ratio (LR) test statistic, to determine the optimal lag length for the VAR model. The results indicate that the FPE, AIC, HQIC, and SBIC criteria recommend using p=2 p = 2 p=2 lags in the VAR model, as these criteria achieve their minimum values at this lag length (e.g., FPE = -531.809, AIC = -534.796, HQIC = -529.086, SBIC = -529.086). Conversely, the Likelihood Ratio (LR) test statistic suggests a higher lag length of p=4 p = 4 p=4, with a value of 37.597, though the p-value of 1.0 at this lag indicates a lack of statistical significance for additional lags beyond the earlier ones.

Table 3.
Lag length selection in VAR model.

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-154.65				1332.99*	32.73	32.4313	33.0024
1	2641.71	5592.7	82	0.0	-510.342	-513.33	-507.619	-507.619
2	2749.04	214.67%	81	0.0	-531.809	-534.796*	-529.086*	-529.086*
3	2713.07	-71.951	81	.	-524.614	-527.601	-521.891	-521.891
4	2731.87	37.597	81	1.0	-528.373	-531.361	-525.65	-525.65

Following Nakajima [49], the selection of lag length should prioritize a parsimonious representation of the variables in the system to avoid overfitting while ensuring the model captures the essential dynamics. Given the consistency of the FPE, AIC, HQIC, and SBIC criteria in recommending p=2, this lag length is deemed the more parsimonious choice compared to the LR test's suggestion of p=4. Therefore, the VAR model with p=2 lags is adopted for this study. We estimate the VAR(2) model using Stata, and the results are used to analyze the relationships between the variables (GDP, KOF, BOT, FTAs, Skilled Labor, Internet Access, Patents, IT Expenditure, and Climate Cost) over the period from 2011 to 2024. The estimated coefficients and their significance are further visualized and discussed in subsequent sections to explore the time-varying dynamics of these relationships.

Table 4.
VAR model of External factors.

	Variable	Coefficient (L1)	Coefficient (L2)	Standard Error (L1)	Standard Error (L2)	P-Value (L1)	P-Value (L2)
a	GDPR	-0.0024058	0.0138991	0.1875934	0.1797759	0.99	0.938
b	KOF	0.6444033	-1.014524	0.1613191	0.1754978	0	0
c	BOT	-0.0614029	0.1196366	0.0436505	0.0601981	0.16	0.047
d	FTAs	0.2392986	0.3733489	0.6324261	0.5475941	0.705	0.495

The results of the VAR model for the GDP equation, as presented in Table 4, provide significant insights into the dynamic effects of various external factors on economic growth in Vietnam over the period from 2011 to 2024. This methodology captures the relationships between GDP and external variables such as KOF (Globalization Index), BOT (Balance of Trade), and FTAs (Free Trade Agreements) at different lags, allowing for a clearer analysis of how these factors influence economic growth in a time-dependent manner. Notably, the variables in the GDP equation at their first and second lags exhibit varying degrees of significance and impact, underscoring the complex nature of economic growth drivers in Vietnam.

Table 4a examines the short-term effect of lagged GDP on the current GDP growth rate. The coefficients for lagged GDP at the first lag (L1: -0.0024058) and second lag (L2: 0.0138991) are statistically insignificant, with p-values of 0.990 and 0.938, respectively. This suggests that past GDP growth does not have a strong direct influence on current growth in Vietnam, indicating that other external and internal factors may play a more dominant role in driving economic growth during this period. The lack of significance could also reflect the resilience of Vietnam's economy to its own past performance, potentially due to adaptive policy measures or external influences that overshadow autoregressive effects.

Table 4b highlights the effect of the lagged KOF Globalization Index on GDP growth, revealing a more complex and significant pattern. At the first lag, the coefficient is positive (L1: 0.6444033) and highly significant (p = 0.000), indicating that increased globalization in the short term strongly boosts economic growth in Vietnam. This aligns with Vietnam's strategy of integrating into global markets through trade and investment. However, at the second lag, the coefficient turns negative (L2: -1.014524) and remains highly significant (p = 0.000), suggesting that the positive effects of globalization diminish over time and may even become detrimental in the longer term. This reversal could be attributed to over-reliance on global markets, exposing Vietnam to external shocks, or the challenges of sustaining growth amidst global competition.

Table 4c explores the impact of lagged BOT on GDP growth. The coefficient at the first lag is negative (L1: -0.0614029) but statistically insignificant (p = 0.160), indicating that trade imbalances in the short term do not significantly affect economic growth. However, at the second lag, the coefficient becomes positive (L2: 0.1196366) and significant (p = 0.047), suggesting that a trade surplus or improved trade balance over a longer period contributes positively to GDP growth. This delayed effect may reflect the time needed for trade surpluses to translate into increased domestic investment and consumption, supporting economic expansion in Vietnam.

Table 4d examines the influence of lagged FTAs on GDP growth, showing a lack of significant impact. The coefficients at both the first lag (L1: 0.2392986, p = 0.705) and second lag (L2: 0.3733489, p = 0.495) are statistically insignificant. This suggests that the cumulative number of free trade agreements does not have a notable direct effect on Vietnam's economic growth during the study period. The lack of significance could be due to the time lag required for FTAs to fully impact the economy, or it may indicate that the benefits of FTAs are more indirect, such as through increased FDI or export growth, which are captured by other variables like BOT.

Overall, the VAR model results highlight the varying impacts of external factors on Vietnam's economic growth. While globalization (KOF) shows a strong but diminishing effect over time, BOT demonstrates a delayed positive impact, and FTAs appear to have limited direct influence. These findings underscore the need for Vietnam to balance the benefits of global integration with strategies to mitigate long-term risks, such as diversifying trade partners and strengthening domestic

economic resilience. The analysis also suggests that policymakers should focus on leveraging trade surpluses to sustain growth while addressing the potential challenges posed by over-reliance on globalization.

Table 5.
VAR model of Internal factors.

	Table 4: VAR model of External factors	Table 4: VAR model of External factors	Table 4: VAR model of External factors	Table 4: VAR model of External factors	Table 4: VAR model of External factors	Table 4: VAR model of External factors	Table 4: VAR model of External factors
a	GDPR	-1.322441	-1.241939	3.79E-12	6.65E-12	0	0
b	IT Expenditure	0 (omitted)	0 (omitted)	-	-	-	-
c	Internet Access	-0.4388011	1.233716	4.57E-12	8.49E-12	0	0
d	Patents	-0.2859072	-0.1183021	1.13E-12	1.08E-12	0	0
e	Skilled Labor	24.22521	0	1.68E-10	-	0	-
f	EDB	0.4175071	1.151439	4.06E-12	8.79E-12	0	0
g	Climate Cost	-1.602035	-51.01569	7.75E-11	1.27E-10	0	0

Table 5a highlights the short-term effect of lagged GDPR on the current GDP growth rate, which is consistently negative at both lags (L1: -1.322441, L2: -1.241939), with p-values of 0.000 for both lags, indicating statistical significance. This suggests that past GDP growth exerts a negative influence on current growth, potentially reflecting a mean-reverting tendency in Vietnam's economic growth. High growth in previous periods may lead to overheating, prompting a slowdown as the economy adjusts. This effect remains significant throughout the period, though the slightly smaller coefficient at L2 suggests a diminishing impact over time, possibly due to stabilizing economic policies or external shocks like the COVID-19 pandemic in 2020–2021.

In Table 5b, the effect of IT Expenditure on GDPR is omitted at both lags, with coefficients of 0 and p-values of 1.000, indicating no significant impact. This lack of influence may stem from the limited contribution of IT spending to GDP growth during the sample period, possibly due to data constraints or the indirect nature of IT investments' impact on economic output. Vietnam's IT sector, while growing, may not yet be a primary driver of GDP growth, or its effects may be captured through other variables like Internet Access.

Table 5c shows the effect of lagged Internet Access on GDPR, which follows a varied pattern. At L1, the coefficient is negative (-0.4388011, p = 0.000), suggesting that an increase in internet access initially hampers growth, possibly due to high initial investment costs or a digital divide that limits immediate economic benefits. However, at L2, the effect turns positive (1.233716, p = 0.000), indicating that over time, internet access contributes positively to growth as the economy adapts to digitalization, enhancing productivity and market access. This shift underscores the lagged benefits of digital infrastructure in Vietnam's economic development.

In Table 5d, the effect of Patents on GDPR is consistently negative at both lags (L1: -0.2859072, L2: -0.1183021, p = 0.000 for both), suggesting that increased patent activity does not translate into immediate economic growth. This could reflect Vietnam's early-stage innovation ecosystem, where patent filings may not yet result in widespread commercial applications that drive GDP. The smaller negative coefficient at L2 indicates a slight reduction in this adverse effect over time, possibly as innovation begins to yield marginal economic benefits.

Table 5e examines the impact of Skilled Labor on GDPR, revealing a strong positive effect at L1 (24.22521, p = 0.000), while the L2 coefficient is omitted due to insignificance. This indicates that a higher proportion of skilled labor significantly boosts economic growth in the short term, aligning with Vietnam's focus on education and human capital development. The absence of a significant L2 effect suggests that the benefits of skilled labor are more immediate, with diminishing returns over longer lags as the labor market adjusts.

Table 5f highlights the influence of EDB (Ease of Doing Business) on GDPR, with positive coefficients at both lags (L1: 0.4175071, L2: 1.151439, p = 0.000 for both). This suggests that an improved business environment consistently supports economic growth, with the effect strengthening over time (larger coefficient at L2). A better business climate likely attracts investment and fosters entrepreneurship, driving sustained GDP growth in Vietnam.

Lastly, Table 5g illustrates the impact of Climate Cost on GDPR, showing a significant negative effect at both lags (L1: -1.602035, L2: -51.01569, p = 0.000 for both). The increasingly negative coefficient at L2 indicates that the economic burden of climate-related costs intensifies over time, severely hampering growth. This aligns with Vietnam's vulnerability to climate change, where rising costs from natural disasters like floods and typhoons divert resources from productive investments, posing a growing challenge to economic development.

5. Discussion

The study provides a comprehensive analysis of the impact of external (KOF, BOT, FTAs) and internal (Skilled Labor, Internet Access, Patents, IT Expenditure, Climate Cost) factors on Vietnam's economic growth from 2011 to 2024 using the Vector Autoregression (VAR) model. Several key insights emerge from the findings, which offer both theoretical and practical implications for understanding Vietnam's economic development trajectory.

First, the significant positive effect of Skilled Labor on GDP growth at the first lag (coefficient = 24.22521, p = 0.000) underscores the critical role of human capital in driving economic growth. This aligns with endogenous growth theories [16], which emphasize that investments in education enhance productivity and innovation. However, the absence of a significant

effect at the second lag suggests that the benefits of skilled labor may not be sustained over longer periods, possibly due to labor market saturation or mismatches between skills and industry needs. This highlights a potential limitation in Vietnam's education system, where the quality and relevance of tertiary education may not fully meet the demands of a rapidly evolving economy.

Second, the dual nature of Internet Access's impact is negative at the first lag (-0.4388011, p = 0.000) but positive at the second lag (1.233716, p = 0.000)—reveals the lagged benefits of digitalization. The initial negative effect may reflect the high costs and infrastructure challenges associated with expanding internet access, particularly in rural areas, as well as the time required for businesses and individuals to adapt to digital technologies. The positive effect at the second lag indicates that, over time, internet access enhances productivity, market access, and innovation, supporting Vietnam's digital transformation goals. This finding is consistent with Qiang et al. [19], who note that broadband penetration boosts GDP growth in developing countries, but it also highlights the need for patience in realizing these benefits.

Third, the consistently negative impact of Patents on GDP growth (L1: -0.2859072, L2: -0.1183021, p = 0.000) is surprising, as innovation is typically a driver of growth [23]. This could indicate that Vietnam's innovation ecosystem is still nascent, with patent filings not yet translating into commercial applications that drive economic output. Alternatively, it may reflect inefficiencies in the intellectual property system, such as delays in patent processing or a focus on quantity over quality of innovations. This finding contrasts with studies in more developed economies [24], suggesting that Vietnam's innovation policies need to be tailored to its specific stage of development.

Fourth, the strong negative effect of Climate Cost on GDP growth, which intensifies over time (L1: -1.602035, L2: -51.01569, p = 0.000), underscores the severe economic burden of climate change. Vietnam's vulnerability to natural disasters like floods and typhoons diverts resources from productive investments, hampering growth. This aligns with Stern [31], who warns of the disproportionate impact of climate change on developing nations and highlights the urgent need for climate resilience strategies in Vietnam.

Finally, the external factors reveal mixed dynamics. The KOF Globalization Index shows a strong short-term positive effect on GDPR (L1: 0.6444033, p = 0.000) but a negative long-term effect (L2: -1.014524, p = 0.000), suggesting that while globalization initially boosts growth through trade and FDI, over-reliance on global markets may expose Vietnam to external shocks, such as trade disruptions or geopolitical tensions. The lack of significant impact from FTAs (p > 0.05) is also noteworthy, indicating that the economic benefits of trade agreements may not yet be fully realized, possibly due to implementation challenges or limited capacity to meet international standards.

6. Policy Recommendations for the Government

Based on the findings, several policy recommendations can be proposed to support Vietnam's economic growth in the context of global and regional challenges:

Enhance the Quality and Relevance of Education: Given the strong short-term impact of Skilled Labor, the government should prioritize improving the quality of tertiary education to better align with industry needs. This could involve revising curricula to emphasize skills in emerging fields like technology and green industries, as well as fostering partnerships between universities and businesses to ensure graduates are job-ready. Additionally, lifelong learning programs can help upskill the existing workforce, ensuring sustained benefits from human capital investments.

Accelerate Digital Infrastructure Development: The lagged positive effect of Internet Access highlights the importance of digitalization, but the initial negative impact suggests barriers to adoption. The government should invest in expanding high-speed internet access, particularly in rural areas, to bridge the digital divide. Subsidies for small and medium enterprises (SMEs) to adopt digital technologies, coupled with digital literacy programs, can help maximize the economic benefits of internet access more quickly.

Strengthen the Innovation Ecosystem: The negative effect of Patents on growth indicates a disconnect between innovation and economic impact. The government should streamline the patent process, reduce bureaucratic delays, and provide incentives for commercialization of innovations, such as tax breaks or grants for startups. Establishing innovation hubs and fostering collaboration between research institutions, businesses, and international partners can also help translate patents into marketable products and services.

Invest in Climate Resilience: The intensifying negative impact of Climate Cost necessitates urgent action. The government should allocate greater resources to climate adaptation measures, such as building resilient infrastructure (e.g., flood-resistant roads, sea walls) and promoting sustainable agricultural practices. International partnerships and climate finance mechanisms, such as the Green Climate Fund, can provide additional funding for these initiatives. Moreover, integrating climate risk assessments into national planning can help mitigate the economic costs of natural disasters.

Balance Globalization with Economic Resilience: The dual nature of KOF's impact suggests that while globalization offers growth opportunities, over-reliance on global markets poses risks. The government should diversify export markets and products to reduce dependency on specific regions, while also strengthening domestic industries to enhance self-sufficiency. Trade policies should focus on building resilience against external shocks, such as through strategic reserves or supply chain diversification.

Maximize FTA Benefits: The insignificant impact of FTAs indicates untapped potential. The government should improve its capacity to meet FTA standards, particularly in areas like product quality, environmental regulations, and labor rights. Support programs for SMEs to access FTA markets, such as export training and financing, can help ensure that the benefits of trade agreements are more widely distributed across the economy.

7. Conclusion

The period from 2011 to 2024 marks a transformative phase for Vietnam, characterized by rapid integration into the global economy and significant strides in digitalization and human capital development. This study, using the Vector Autoregression (VAR) model, reveals that internal factors like skilled labor and internet access, alongside external factors such as globalization, play pivotal roles in driving economic growth, while climate costs pose a substantial challenge. Skilled labor emerges as a key growth driver in the short term, underscoring the importance of education, whereas the lagged benefits of internet access highlight the need for sustained digital investments. Conversely, the negative impact of climate costs and the limited influence of patents and FTAs signal areas requiring urgent policy attention. These findings provide a roadmap for policymakers to leverage Vietnam's strengths in human capital and digital potential while addressing vulnerabilities like climate change and innovation gaps.

However, the study is not without limitations. First, the reliance on estimated data for 2021–2024 due to unavailable official statistics may introduce inaccuracies, potentially affecting the reliability of the results. Second, the VAR model assumes linear relationships between variables, which may oversimplify the complex, non-linear dynamics of economic growth in Vietnam, particularly amidst structural breaks like the COVID-19 pandemic. Third, the study does not account for qualitative factors, such as policy implementation effectiveness or socio-political stability, which could significantly influence growth outcomes. Future research should incorporate more recent and comprehensive data, explore non-linear models like threshold VAR, and integrate qualitative analyses to provide a more holistic understanding of Vietnam's economic development. By addressing these limitations, subsequent studies can build on this foundation to offer deeper insights and more robust policy recommendations for Vietnam's sustainable growth in an increasingly interconnected and uncertain global landscape.

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