

TRADE OPENNESS, INSTITUTIONAL QUALITY, AND THEIR JOINT INFLUENCE ON ECONOMIC GROWTH IN THE SOUTH CENTRAL COASTAL REGION: A BAYESIAN REGRESSION APPROACH

ABERTURA COMERCIAL, QUALIDADE INSTITUCIONAL E SUA INFLUÊNCIA CONJUNTA NO CRESCIMENTO ECONÔMICO NA REGIÃO COSTEIRA CENTRO-SUL: UMA ABORDAGEM DE REGRESSÃO BAYESIANA

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Nguyen Quoc Huy*

Faculty of Finance and Accounting, Lac Hong University, Vietnam

Orcid: <https://orcid.org/0009-0004-6183-4428>

nguyenquochuy@lhu.edu.vn

Le Quoc Dinh*

Faculty of Finance and Accounting, Lac Hong University, Vietnam

Orcid: <https://orcid.org/0000-0002-3300-6148>

dinhql@lhu.edu.vn

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Abstract

Promoting economic growth has always been a key focus of macroeconomic management policies at both national and local levels. Numerous studies have emphasized the role of institutions and trade openness in economic growth. This study examines the impact of trade openness, institutional quality, and their interaction on economic growth in the South Central Coastal region of Vietnam, covering eight provinces: Khanh Hoa, Ninh Thuan, Binh Thuan, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, and Phu Yen, over the period 2010–2021. Using Bayesian regression analysis, the results indicate that trade openness and institutional quality positively influence economic growth, with posterior probabilities of 94.85% and 93.86%, respectively. Similarly, their interaction also exerts a positive effect on economic growth, with an almost absolute probability of 99.63%. These findings suggest that the impact of trade openness on economic growth is more effective when considered within a high-quality institutional environment. Based on these results, we propose relevant policy implications for the region.

Keywords: Economic Growth. Trade Openness. Institutional Quality.

Resumo

A promoção do crescimento econômico sempre foi um foco fundamental das políticas de gestão macroeconômica, tanto em nível nacional quanto local. Numerosos estudos têm enfatizado o papel das instituições e da abertura comercial no crescimento econômico. Este estudo examina o impacto da abertura comercial, da qualidade institucional e de sua interação sobre o crescimento econômico na região costeira centro-sul do Vietnã, abrangendo oito províncias: Khanh Hoa, Ninh Thuan, Binh Thuan, Da Nang, Quang Nam, Quang Ngai, Binh Dinh e Phu Yen, no período de 2010 a 2021. Utilizando análise de regressão bayesiana, os resultados indicam que a abertura comercial e a qualidade institucional influenciam positivamente o crescimento econômico, com probabilidades posteriores de 94,85% e 93,86%, respectivamente. Da mesma forma, sua interação também exerce um efeito positivo sobre o crescimento econômico, com uma probabilidade quase absoluta de 99,63%. Essas descobertas sugerem que o impacto da abertura comercial sobre o crescimento econômico é mais eficaz quando considerado dentro de um ambiente institucional de alta qualidade. Com base nesses resultados, propomos implicações políticas relevantes para a região.

Palavras-chave: Crescimento econômico. Abertura comercial. Qualidade institucional.



1 INTRODUCTION

Promoting economic growth has always been a central focus in the macroeconomic management policies of every country and locality. Numerous studies have emphasized the role of institutions and the degree of trade openness in the economic growth process. Specifically, an effective institutional system not only establishes appropriate incentive mechanisms but also directly influences economic and political activities, laying a solid foundation for sustainable economic development (North, 2000). In the context of deepening global integration, trade openness is considered a key factor in driving the development of economies worldwide. According to Rodrik *et al.* (2004), strong institutions and international trade are two critical factors contributing to economic growth. Notably, in a study on sustainable economic development goals in Asia, Bernabe (2017) highlighted that institutional quality and the level of trade integration are crucial factors that must be considered to ensure stable and long-term economic growth.

Recognizing the pivotal role of institutions and trade openness in economic growth, numerous domestic and international studies have devoted special attention to this field. Specifically, the works of Mercan *et al.* (2013), Hye *et al.* (2016), and Su *et al.* (2019) focus on analyzing the relationship between international trade and economic growth, shedding light on the impact of trade openness across different contexts. Meanwhile, studies by Ahmed *et al.* (2022), Acheampong *et al.* (2021), Arvin *et al.* (2021), and Bekun *et al.* (2022) emphasize the influence of institutional quality on economic growth, highlighting the role of legal frameworks, economic policies, and state governance. Notably, recent studies such as Zhuang *et al.* (2021), Giri & Mohapatra (2022), and Wenlong *et al.* (2023) have integrated both factors—institutions and trade openness—to assess their combined effects on economic growth, providing a more comprehensive perspective on the driving forces of economic development in the context of globalization. Most studies in this field employ panel data regression methods, including Pooled OLS, FEM, REM, GLS, and GMM, or time-series regression, while Bayesian regression remains underutilized. Moreover, research findings remain inconsistent regarding the impact of institutions and trade openness on economic growth. Additionally, due to differences in geographical location, development orientation, and economic policies across countries, regions, or localities, the influence of institutions and trade openness may vary, leading to diverse effects on economic growth. Therefore, this

study aims to assess the impact of institutions and trade openness on economic growth in the South Central Coast region of Vietnam using the Bayesian approach. Unlike traditional frequentist statistical methods, Bayesian analysis adopts a conditional probability perspective, allowing for a flexible combination of empirical data and prior information. The key advantage of this method lies in its ability to continuously update estimates as new data become available, enhancing estimation efficiency, particularly in cases with small samples or high uncertainty (Hai *et al.*, 2024; Dinh *et al.*, 2025; Huy *et al.*, 2025). Furthermore, Bayesian analysis provides probability distributions for estimated parameters, offering a more comprehensive insight into the extent of institutional and trade openness effects on economic growth in the South Central Coast region.

The selection of the South Central Coast region as the research focus is based on several key reasons. First, this region holds a strategic position, serving as a bridge between northern and southern Vietnam while also possessing an important seaport system that facilitates international trade. Second, the area is undergoing a significant economic transformation, with rapid development in the industrial, service, and tourism sectors, generating substantial growth momentum. Third, the region exhibits institutional and policy diversity, as each province within the area has distinct institutional characteristics and economic orientations, creating an ideal research environment to assess the impact of institutions and trade openness on economic growth. Despite its crucial role, the South Central Coast region has not received sufficient attention in in-depth studies on the effects of institutions and trade openness on economic growth. Moreover, according to Resolution No. 39-NQ/TW of the 9th Politburo and Conclusion No. 25-KL/TW of the 11th Politburo on the socio-economic development of the South Central Coast, the region aims to achieve an average GRDP growth rate of approximately 7–7.5% per year, with the GRDP scale expected to increase by 2.5–3 times by 2030 compared to 2020 (at current prices). The economic structure is transitioning towards sustainability, with agriculture, forestry, and fisheries accounting for approximately 11.5%; industry and construction at 40.7%; services contributing 37.5%; and product taxes excluding subsidies at around 10.3%. Notably, the share of processing and manufacturing industries in GRDP is projected to reach 30%, while the digital economy is expected to contribute around 30% to the region's total GRDP. For these reasons, this study not only helps bridge the gap in the existing literature but also provides a scientific

foundation for formulating sustainable economic development policies for the South Central Coast region.

This study contributes to practical applications in three key areas. First, it provides policymakers in the South Central Coast region with valuable insights for formulating and adjusting economic policies to optimize two critical variables: trade openness and institutional quality. Second, it offers businesses and investors a clearer perspective on the region's business environment, enabling them to develop appropriate strategies in the context of increasing trade liberalization. Finally, this study provides empirical evidence on the impact of institutions, trade openness, and their interaction on economic growth through Bayesian regression, thereby enriching the existing body of research.

Following the introduction (Section 1), the subsequent sections of this study include: (2) Theoretical Framework and Literature Review; (3) Research Model and Methodology; (4) Research Findings; and (5) Conclusion and Policy Implications.

2 THEORETICAL FRAMEWORK AND OVERVIEW OF EMPIRICAL STUDIES

2.1. Theories on institutions, trade openness, and economic growth

According to North (1990), institutions play a crucial role in shaping structures and creating an interaction framework for social activities. Institutions consist of three key components: formal institutions, which include written laws and regulations; informal institutions, which encompass unwritten rules such as customs and social norms; and enforcement mechanisms that ensure compliance with these rules (Kapper & Streit, 1999). A country with high institutional quality not only fosters economic freedom but also ensures geopolitical stability, high-quality regulations, a favorable business environment, and effective corruption control. As a result, it contributes to a more efficient economic system by preventing unnecessary operational costs for businesses, thereby promoting economic growth.

The New Institutional Economics theory emerged from the foundations of traditional institutional economics, emphasizing that institutions are a key determinant of economic growth (North, 1990). In this framework, the government acts as a driving force, encouraging businesses to enhance their competitiveness and adopt higher

standards (Porter, 1990). Institutions have a significant impact on economic growth, enabling some countries to prosper while leading others into stagnation or decline (Yildirim & Gokalp, 2016). In developing countries or regions where labor productivity is low and political conditions are complex, institutions tend to facilitate the redistribution of benefits rather than directly fostering economic development. Therefore, the impact of institutions on economic activities is not fixed but varies depending on national, regional, and local contexts (Edison, 2003).

The role of trade openness in promoting economic growth has attracted significant attention from economic researchers. Most perspectives emphasize that trade expansion, particularly exports, serves as a crucial driver of economic development (Helpman & Krugman, 1987). According to Rivera-Batiz & Romer (1991), trade openness can contribute to long-term economic growth by optimizing resource allocation, enhancing total factor productivity, and fostering technological capabilities. This leads to the expectation that countries or regions with higher levels of trade openness will experience faster economic growth (Belloumi, 2014). Moreover, an increase in exports helps improve foreign exchange reserves, thereby strengthening capital accumulation and boosting output (Bahmani-Oskooee & Niroomand). However, as noted by the World Bank (1987), the impact of trade openness on economic growth is not solely dependent on the degree of international integration but is also significantly influenced by each country's economic policies. Furthermore, Frankel & Romer (1996) argue that trade openness is not merely a matter of policy but is also shaped by geographical factors and the socio-economic characteristics of specific regions. Therefore, increasing trade openness does not always yield positive effects; its effectiveness depends on the development strategy and specific economic context of each country or region, including institutional quality.

The relationship between trade openness and institutions plays a crucial role in promoting economic growth and enhancing national competitiveness. In a strong institutional environment, trade openness can bring numerous benefits, such as attracting foreign investment, improving production efficiency, fostering technology transfer, and increasing labor productivity (Rodrik, 2000). Conversely, in the presence of weak institutions, trade liberalization may lead to economic instability, widen income inequality, and make an economy more vulnerable to external shocks (Acemoglu *et al.*, 2005). Studies have shown that in countries with transparent legal systems, effective

intellectual property rights protection, and well-regulated policies, trade openness tends to have a positive impact on economic growth. This is because a stable institutional environment reduces transaction costs, limits corruption, and strengthens business confidence in the market (Dollar & Kraay, 2003). On the other hand, in economies with weak institutions—such as a lack of transparency in governance, a fragile legal framework, or widespread corruption—the benefits of free trade can be undermined due to inefficient resource allocation and market manipulation (Amin & Djankov, 2014). Moreover, trade openness can also create pressure for institutional reform. As countries integrate more deeply into the global economy, they are compelled to adjust their legal frameworks and improve trade and investment regulations to align with international standards (Levchenko, 2007). This process helps enhance institutional quality, laying the foundation for sustainable economic development. However, the extent to which trade influences institutions depends on a country's unique characteristics, including its level of development, economic structure, and policy orientation.

2.2 Overview of empirical studies

The impact of institutions on economic growth has been widely confirmed in the literature, with institutional quality playing a crucial role in either fostering or hindering a country's or region's economic development. Using the Granger causality test, Law *et al.* (2013a) found that strong institutions have a positive impact on economic growth, particularly in high-income countries. This finding implies that when institutional frameworks are strengthened with high levels of transparency and effective governance, economies can better utilize available resources, thus driving sustainable growth. In another study, Law *et al.* (2013b) employed a threshold estimation technique to examine whether the growth effect of financial development varies across countries with different levels of institutional development. Their results demonstrated the existence of a threshold effect in the finance-growth relationship. Specifically, financial development positively and significantly impacts growth only after a certain institutional quality threshold is reached. Until then, finance has no significant effect on growth. Their findings support the idea that well-functioning financial markets embedded within a strong institutional framework are effective in promoting long-term economic development. Similarly, Venard (2013) highlighted the positive influence of institutions

on economic growth across 120 countries. Nations with strong institutional frameworks—characterized by clear legal structures, effective anti-corruption mechanisms, and transparent business environments—tend to achieve higher growth rates than those with weak institutions. An efficient institutional system not only protects property rights and investor interests but also facilitates business operations, attracts domestic and foreign investment flows, and ultimately drives economic expansion. At the regional level, Di Vita (2017) analyzed the relationship between institutional quality and economic growth across Italian regions from 1995 to 2011. His study found that complexities in civil dispute regulations could pose significant barriers to regional GDP growth. Using random effects models (REM) and quantile regression, the research revealed that lengthy legal procedures and high dispute resolution costs increase transaction costs, discourage investment, and consequently hinder economic development. This suggests that not only institutional quality but also the efficiency of policy implementation is critical for sustainable economic progress. Taking a different perspective, Ngo and Nguyen (2020) examined the impact of institutions on economic growth in 13 lower-middle-income Asian countries from 2000 to 2008 using the GMM regression method. Their findings indicated that institutions do not always have a positive effect on economic growth. In some cases, underdeveloped or overly rigid institutional systems can impede business activities, increase compliance costs, and create obstacles for enterprises. Particularly in developing countries, where institutions remain incomplete and inefficient, complex administrative regulations can foster corruption and reduce economic efficiency. Furthermore, recent studies such as Ahmed *et al.* (2022), Acheampong *et al.* (2021), Arvin *et al.* (2021), and Bekun *et al.* (2022) continue to affirm the significance of institutions in economic growth, emphasizing the role of legal frameworks, economic policies, and governance in shaping development outcomes.

The impact of trade openness on economic growth has been widely recognized in numerous studies, highlighting the crucial role of international trade in fostering national economic development. Andersen and Babula (2008) concluded that there is a potential positive relationship between international trade and economic growth, with countries exhibiting higher levels of trade integration tending to achieve stronger growth rates. Kakar and Khilji (2011) examined the role of trade openness in relation to economic growth in Pakistan and Malaysia from 1980 to 2010. Their findings indicate that trade openness positively influences long-term economic growth, emphasizing that these

countries have benefited from economic liberalization, improved productivity, and increased foreign investment inflows. Similarly, Sakyi *et al.* (2015) analyzed the impact of trade openness on growth in 115 developing countries from 1970 to 2009 and found a bidirectional relationship between trade openness and economic growth in both the short and long run. These results suggest that not only does economic growth drive trade expansion, but increased international trade also serves as a key driver of sustainable economic growth. However, the effects of trade openness are not uniform across countries. Khobai *et al.* (2018) found that while trade openness had a positive impact on economic growth in Ghana, it had a negative effect in Nigeria. This finding underscores that the effectiveness of trade integration depends on institutional characteristics, economic policies, and a country's production capacity. In Vietnam, Su *et al.* (2019) concluded that economic institutions and trade openness significantly influenced economic growth from 2005 to 2015, using the system GMM regression method. Their findings highlight the importance of economic policies in maximizing the benefits of international trade, further suggesting that an efficient institutional framework can better capitalize on opportunities arising from trade integration. At a broader level, Raghutla (2020) analyzed the impact of trade openness on economic growth in emerging market economies from 1993 to 2016. The study revealed that international trade plays a crucial role in promoting economic growth by enhancing production efficiency, encouraging technological innovation, and expanding investment opportunities. Additionally, recent studies by Mercan *et al.* (2013), Hye *et al.* (2016), and Su *et al.* (2019) further confirm the role of trade openness in driving economic growth.

Most studies in this field employ panel data regression methods (Pooled OLS, FEM, REM, GLS, GMM...) or time series regression, while Bayesian regression remains underutilized. Furthermore, research findings on the impact of institutions and trade openness on economic growth remain inconclusive due to variations in geography, policies, and development orientations across countries and regions. This study assesses the impact of institutions and trade openness on economic growth in the South Central Coast of Vietnam using the Bayesian approach. Unlike traditional statistical methods, Bayesian analysis relies on conditional probability, integrating empirical data with prior information to provide more efficient estimations, especially in the context of small samples or uncertain data (Hai *et al.*, 2024; Dinh *et al.*, 2025; Huy *et al.*, 2025). Additionally, this approach generates probability distributions for parameters, offering a

more comprehensive perspective on the extent to which institutions and trade openness influence economic growth in the region.

2.3 Hypothesis development

The South Central Coast of Vietnam, with its strategic geographical location and abundant marine economic potential, plays a crucial role in national economic development. However, to fully leverage these advantages, it is essential to examine the impact of trade openness and institutional quality on the region's economic growth. With an extensive coastline and several key seaports, the region is well-positioned for import-export activities. Increased trade openness is expected to drive economic growth by expanding market access, attracting investment, and facilitating technology transfer. Based on this reasoning, we propose the following hypothesis:

H1: Trade openness has a positive impact on economic growth in the South Central Coast region.

The diversity of institutions and development policies across provinces in the region provides an ideal setting to assess the impact of institutional quality on economic growth. Effective institutions can create a conducive business environment, attract investment, and promote sustainable economic development. Therefore, we propose the following hypothesis:

H2: Institutional quality has a significant impact on economic growth in the South Central Coast region.

The interplay between trade openness and strong institutions can create a synergistic effect, enhancing economic efficiency. High-quality institutions can maximize the benefits of international trade, while trade openness may drive institutional improvements through competitive pressures and deeper economic integration. Thus, we establish the following hypothesis:

H3: The interaction between trade openness and institutional quality positively affects economic growth in the South Central Coast region.

3 RESEARCH MODEL AND METHODOLOGY

3.1. Research model

The research model examining the impact of trade openness, institutional quality, and their interaction on economic growth is developed based on the models proposed by Su *et al.* (2019), Giri & Mohapatra (2022), and Wenlong *et al.* (2023).

$$GRDP_{i,t} = \alpha_1 OPEN_{i,t} + \alpha_2 PCI_{i,t} + \alpha_3 OPEN_PCI_{i,t} + \alpha_k X_{i,t} + \varepsilon_{i,t} \quad (1)$$

In this study, GRDP represents economic growth, OPEN denotes trade openness, and PCI is the Provincial Competitiveness Index, which serves as a proxy for institutional quality at the provincial level. The subscript *i* refers to provinces or cities, while *t* represents the time period under observation. *X* is a vector of control variables, including INF (inflation rate), FDI (foreign direct investment), UNE (unemployment rate), PUB (public investment), and PI (private investment). OPEN_PCI is the interaction term between trade openness and institutional quality. The detailed description of variables and their measurements is provided in Appendix 1.

Per capita GRDP represents the scale of production and economic income per individual within a province, serving as a key indicator of local economic development. Adjusting for inflation ensures that the data accurately reflect real changes in purchasing power while eliminating the effects of price fluctuations. In Vietnam, the Provincial Competitiveness Index (PCI) is one of the most widely used measures of institutional quality. PCI comprises ten key components: low market entry costs; favorable land access and stable land use; a transparent business environment with accessible information; low informal costs; streamlined and efficient administrative procedures; a fair competitive environment; proactive and supportive provincial leadership for businesses; efficient business support services; appropriate labor training policies; and a fair, effective dispute resolution system that ensures security and order. In studies examining the impact of institutional quality and economic integration on economic growth at the provincial and municipal levels in Vietnam, PCI is regarded as the most accurate measure of institutional quality. According to the World Bank (2007), globalization began expanding rapidly in the 1980s. Since the launch of the Doi Moi (Renovation) policy in 1986, Vietnam has

embraced market-oriented economic reforms and international integration, driving rapid economic growth and trade liberalization. Consequently, economic integration levels are commonly measured using indicators of trade openness and capital flows.

3.2 Research methodology

The advancement of science and technology has significantly contributed to the widespread adoption of Bayesian methods across various research fields. According to Kruschke & Vanpaemel (2015), Bayesian methods outperform traditional approaches in simpler models and offer richer analytical outcomes. Unlike conventional point estimation methods, Bayesian estimation treats parameters as random variables, allowing for the estimation of the entire probability distribution of coefficients. Additionally, by integrating prior information with observed data, Bayesian inference enhances estimation accuracy and mitigates limitations associated with small sample sizes, which are often problematic in traditional statistical methods.

To examine the impact of trade openness, institutional quality, and their interaction on GDP, Bayesian regression is conducted in three key steps. First, for all coefficients, we assume a normal prior distribution with a mean of zero, implying that estimated coefficients are more likely to be close to zero rather than significantly different from zero. This prior specification ensures that the Bayesian analysis remains neutral, without biasing the estimation results in either a positive or negative direction. Second, for the corresponding likelihood functions, we assume normal distributions with parameters derived from Equations (1). Finally, we employ Markov Chain Monte Carlo (MCMC) techniques and the Gibbs Sampler to obtain posterior distributions of the coefficients. This process involves estimating and simulating 15,000 posterior draws, with the first 2,500 iterations discarded as burn-in. The MCMC method is widely used to refine complex models in various fields (Kim & Le Quoc, 2024; Dinh, 2025a; Dinh, 2025b; Dinh, 2025c; Dinh, 2025d; Khoi & Dinh, 2025; Huy & Dinh, 2025a; Huy & Dinh, 2025b).

This study analyzes the effects of trade openness, institutional quality, and their interaction on economic growth across eight provinces in Vietnam's South Central Coastal region, namely Khanh Hoa, Ninh Thuan, Binh Thuan, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, and Phu Yen. The research period spans from 2010 to 2021,

based on data availability and reliability. The dataset is collected from multiple official sources, including the General Statistics Office (GSO), the Ministry of Information and Communications, and the Vietnam Chamber of Commerce and Industry (VCCI), ensuring accuracy and comprehensiveness.

It is important to note that the relatively small sample size (only eight provinces), along with the potential for multicollinearity and autocorrelation among macroeconomic variables, poses methodological challenges. In this context, Bayesian methods are particularly suitable due to their ability to handle small samples, minimize estimation errors, and provide probability distributions for parameters, making the analysis more flexible and robust (Le Quoc, 2024; Le Quoc *et al.*, 2025; Nguyen Quoc *et al.*, 2025; Quoc *et al.*, 2025a; Quoc *et al.*, 2025c; Quoc *et al.*, 2025b; Quoc & Quoc, 2025; Van *et al.*, 2024; Van *et al.*, 2025a; Van *et al.*, 2025b; Quoc & Le Quoc, 2025).

4 RESEARCH FINDINGS

4.1 Descriptive statistics

Table 1

Descriptive Statistics of Variables

Variables	Mean	Std	Min	Max
GRDP	6.4721	0.2066	5.9182	6.8989
OPEN	19.2683	0.2947	18.5799	19.7337
PCI	1.7895	0.0297	1.7177	1.8477
FDI	0.3554	0.4463	-0.6208	1.3149
PI	1.3424	0.2198	0.4434	1.8150
INF	0.6702	0.3492	-0.3372	1.3086
PUB	1.3658	0.1211	1.1024	1.6557
UNE	0.3226	0.3393	-0.8757	0.9458

Source: Authors

The logarithm of GRDP has a mean of 6.4721, a standard deviation of 0.2066, a minimum value of 5.9182, and a maximum value of 6.8989. OPEN has a mean of 19.2683, a standard deviation of 0.2947, a minimum value of 18.5799, and a maximum value of 19.7337. The logarithm of the PCA has a mean of 1.7895, a standard deviation of 0.0297, a minimum value of 1.7177, and a maximum value of 1.8477. These figures indicate a relatively stable level of economic development, trade integration, and institutional quality across provinces, albeit with some degree of variation.

4.2 Bayesian regression results

Table 2

Bayesian Regression Results

Variable	Dependent Variable: Economic Growth (GRDP)			
	8 Coastal South Central Provinces			
	Mean	Std	MCSE	Probability of Effect (Positive or Negative)
C	1.1570	0.9139	0.0053	89,84%
OPEN	0.1276	0.0775	0.0005	94.85%
PCI	2.0955	0.6844	0.0040	93,86%
OPEN_PCI	0.1144	0.0428	0.0002	99,63%
FDI	0.0589	0.0380	0.0002	94,00%
PI	0.1981	0.0773	0.0005	99,53%
INF	-0.1406	0.0452	0.0003	99,88%
PUB	0.0827	0.1421	0.0008	80,16%
UNE	-0.0110	0.0556	0.0003	57,73%
Average Acceptance Rate	1,0000			
Minimum Efficiency	0,7974			
Max Gelman-Rubin Rc	1,0000			

Source: Authors

Table 2 presents the Bayesian regression results, showing that trade openness (OPEN) has a positive impact on the GRDP growth of the eight coastal provinces in Central Vietnam. The average coefficient is 0.1276, with a very high probability of a positive effect (94.85%). This finding supports the initial hypothesis and aligns with previous studies such as Su *et al.* (2019) and Ngo & Nguyen (2020). It indicates that in the regional context, trade expansion yields clear benefits, contributing to economic growth by boosting exports, attracting investment, and expanding local product markets. In fact, the Central Coastal region of Vietnam benefits from key seaports such as Quy Nhon, Nha Trang, and Vung Ro, which facilitate international market connections. Key economic sectors, including seafood, tourism, and manufacturing, are increasingly integrating into global value chains, creating sustainable growth momentum. Notably, Vietnam’s participation in free trade agreements (FTAs) has opened up opportunities for local businesses to access capital, technology, and international markets. The Provincial Competitiveness Index (PCI) has an average coefficient of 2.0955 and a probability of a positive effect of 93.86%, highlighting the importance of institutional quality in driving economic growth. A transparent business environment, proactive governance, and effective business support policies contribute to regional GRDP improvement. This finding supports the initial H1 hypothesis and is consistent with studies by Ahmed *et al.*

(2022), Acheampong *et al.* (2021), Arvin *et al.* (2021), and Bekun *et al.* (2022), which emphasize the indispensable role of institutional quality in economic growth. Interestingly, the interaction term between trade openness and institutional quality (OPEN_PCI) has a positive coefficient (0.1144) with a probability of 99.63%, suggesting that while trade alone may not always drive growth, its impact becomes significantly positive when combined with strong institutions. This implies that provinces in the region should not only focus on trade expansion but also enhance governance quality and the business environment to maximize the benefits of economic integration.

Additionally, Table 2 shows that foreign direct investment (FDI), private investment, and public investment contribute to regional economic growth. Meanwhile, inflation and rising unemployment rates negatively affect economic expansion. The regression results indicate that all variables in the model positively influence lnGRDP. The estimated standard errors of the MCMC (MCSE) for all parameters are below 6.5%, with many values below 5%, demonstrating high estimation accuracy. The average model acceptance rate reaches 1, while the minimum average efficiency is 79.74%, far exceeding the required threshold of 0.01. Gelman & Rubin (1992) and Brooks & Gelman (1998) proposed the $R_c < 1.1$ rule as a strict convergence criterion, and the model in this study meets this standard. Therefore, the model is considered reliable for policy forecasting.

5 CONCLUSION AND POLICY IMPLICATIONS

Promoting economic growth has always been a central focus of macroeconomic management policies at both national and local levels. Numerous studies have emphasized the role of institutions and trade openness in economic growth. This study aims to examine the impact of trade openness, institutional quality, and their interaction on economic growth in the South Central Coastal region of Vietnam, which includes eight provinces—Khanh Hoa, Ninh Thuan, Binh Thuan, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, and Phu Yen—during the 2010–2021 period. Using Bayesian regression analysis, the results indicate that trade openness and institutional quality positively influence economic growth, with probabilities of 94.85% and 93.86%, respectively. Similarly, their interaction also has a positive impact on economic growth, with an almost absolute probability of 99.63%. This suggests that the effect of trade openness on

economic growth is more effective when considered within a strong institutional framework.

Based on these findings, we propose several policy implications to optimize the impact of trade openness and institutional quality on economic growth in the South Central Coastal region. First, it is essential to enhance institutional quality by improving the legal environment, increasing regulatory transparency, and accelerating administrative reforms to create more favorable conditions for both domestic and foreign businesses. At the same time, the development of logistics and trade infrastructure is a key factor, including upgrading seaport systems, road networks, and infrastructure connectivity to maximize the benefits of international trade. Additionally, increasing investment in industrial zones and deep-water ports will help attract high-quality FDI.

Furthermore, fostering economic integration while supporting enterprises plays a crucial role, particularly in helping local businesses enhance their competitiveness, expand opportunities to participate in global value chains, and encourage linkages with multinational corporations to leverage advanced technology and modern management practices. A synchronized approach that combines trade expansion, institutional quality enhancement, and infrastructure improvement will not only foster sustainable growth for the provinces in the region but also enhance their competitiveness in the context of global economic integration.

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APPENDIX

Appendix 1

Summary of Variables in the Research Model

Symbol	Description	Previous Studies	Expected Sign
Dependent variable			
Grdp	Provincial per capita gross regional domestic product	Su <i>et al.</i> , (2019), Ngo & Nguyen (2020)	
Independent variable			
Pci	Provincial Competitiveness Index (PCI)	Su <i>et al.</i> , (2019), Ngo & Nguyen (2020)	+
Open	Trade openness, measured as the ratio of total trade value to provincial GDP (%)	Su & <i>et al.</i> , (2019), Ngo & Nguyen (2020)	+
Control Variables			
Fdi	Provincial per capita FDI inflows, adjusted for inflation, in logarithmic form	Su <i>et al.</i> , (2019); Ngo & Nguyen (2020)	+
Pi	Provincial per capita private investment, adjusted for inflation, in logarithmic form		+
Inf	Inflation rate		-

Symbol	Description	Previous Studies	Expected Sign
Dependent variable			
Pub	Provincial per capita public investment, adjusted for inflation, in logarithmic form		+
Une	Unemployment rate		-

Note: The "+" sign in the "Expected Sign" column indicates the expected positive impact of the independent variable on the dependent variable.

Authors' Contribution

Both authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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