Do FDI and Institutional Quality Affect the Economic Growth of Local Governments across Vietnam? Insights from Bayesian Modelling

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Abstract
This article aims to analyse the role of FDI and institutional quality in local economic growth in Vietnam. Using a dataset of 63 provinces in Vietnam between 2005 and 2020, the result of the Bayesian linear regression (BLR) method shows that FDI has a negative effect on economic growth, while provinces have a negative effect on economic growth. High institutional quality (IQ) leads to high economic growth. Besides, the result of the article also shows that the interaction between FDI flows, and institutional quality (FDIxIQ variable) positively impacts the economic growth of provinces in Vietnam. This implies that localities with good institutional quality will absorb FDI better. These findings suggest that policymakers should pay more attention to policies to attract FDI and improve institutional quality to promote sustainable GDP growth in the localities of Vietnam, thereby promoting the overall economic growth of Vietnam.

Keywords
Bayesian Linear Regression, FDI, Economic growth, Institutional quality, Provinces of Vietnam

Introduction

For the past decades, the role of foreign direct investment (FDI) flows has increased significantly as a result of globalization, bringing enormous opportunities for most developing nations to achieve a faster growth rate through trade and investment. FDI aids foreign investors in using their assets and resources more efficiently, as well as nations hosting in absorbing technologies in a better manner and participating in international production and trade networks (Duong et al., 2022; Kayani, Al-Ammary, & Sadiq, 2021).

Policymakers in many countries have conducted research and introduced incentives to attract more FDI in order to promote economic expansion and development (Kayani et al., 2021). However, the effects of FDI flows on the performance of the economy have not been consistent with the results of empirical studies. Several studies showed that FDI flows had a positive impact on the economic rise of the host country (Chaudhury, Nanda, & Tyagi, 2020; Mehic, Silajdzic, & Babic-Hodovic, 2013; Nguyen & Duong, 2021; Odhiambo, 2022; Sirag, SidAhmed, & Ali, 2018), but some studies provided opposite results (Herzer, 2012; Ndiaye & Xu, 2016). The researchers also said that the capital-receiving country's ability to absorb FDI depends on its human capital, institutional quality, level of economic development, and financial market (Baiashvili & Gattini, 2020; Sirag et al., 2018). They said that institutional quality is one of the things that is needed to help the national economy grow. Conversely, low-quality countries will hinder the attraction of investment capital from abroad, posing challenges in achieving the objectives of economic growth and development (Nguyen & Duong, 2021).

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In such a context, in 1987, Vietnam adapted an approach to make FDI a key component of its development plan. Besides, in 2006, Vietnam started to assign comprehensive decentralization of licensing and management of foreign investment activities to local authorities (Nguyen, 2022). After 30 years of renovation and opening up, more than USD 182 billion of FDI has been invested in Vietnam. At the same time, the foreign-invested economic sector has accounted for about 25% of the total investment capital of the whole society and 55% of the total industrial production value. As a result of this process, Vietnam has become one of the most successful FDI attractors in Southeast Asia (Ministry of Planning and Investment, 2018).

The benefits of FDI are widely recognized, especially for developing countries. The government of Vietnam has exerted a great deal of effort to attract foreign investments into the country. In this study, the authors fill the gap in previous studies by providing empirical evidence on the role of FDI and institutional quality on the economic growth of locals in Vietnam. In addition, the authors apply BLR, which is more reliable than the traditional approach (frequentist); therefore, the reliability of the estimated results is guaranteed (Briggs, 2019; Wasserstein, Schirm, & Lazar, 2019). Using a dataset of 63 provinces in Vietnam between 2005 and 2020, the results of the BLR method cover that FDI has a negative effect on the economic expansion of provinces. High institutional quality (IQ) leads to high economic growth. Besides, the results of the article also show that the interaction between FDI flows, and institutional quality (FDIxIQ variable) positively impacts the economic progress of provinces in Vietnam. This result implies that localities with good institutional quality will absorb FDI better. Our results are against commonly held beliefs regarding FDI. The results of this research pose serious concerns for the government. It shows that strategies that are not based on empirical research might be misleading and harm the economy. Therefore, policymakers need to be more careful when formulating policies to attract FDI. Also, policymakers must ameliorate institutional quality to promote sustainable GDP growth in the localities of Vietnam, thereby promoting the overall economic growth of Vietnam.

The rest of the paper is structured as follows: In the second section of the paper, we present the literature review. Next, in the third section of the paper, we describe the methodology. Section 4 includes the results. Finally, we provide concluding remarks in the last section.

Theoretical Framework

In the early 1990s, FDI capital began to increase steadily, which promoted an increase in the economic literature that studied FDI flows and their impact on economic growth (Baiashvili & Gattini, 2020). The neoclassical growth model viewed FDI as an exogenous component that contributed to economic expansion by increasing investment volume or efficiency (Sala-i-Martin, 1996). According to endogenous growth theory, FDI is more productive than domestic investment in the long run because it drives a host country's new technological production process (Herzer, 2012). Therefore, FDI may be essential in promoting long-term economic growth through technology transfer and spillover (Lucas, 1988; Romer, 1986).

In theory, the contribution of FDI flows to economic progress has been widely recognized, but empirical studies cover that the effect of FDI flows on economic progress is contradictory. Many empirical studies around the world show that FDI positively affects economic expansion. Specifically, Mehic et al. (2013) investigated the effect of FDI flows on economic growth in seven transitional nations in Southeast Europe during the 1998–2007 period. The authors used the Prais-Winsten regression method with panel-corrected standard errors (PCSE) and showed that FDI had a positive and statistically significant effect on economic growth. Sirag et al. (2018) investigated the effect of financial development and FDI flows on economic growth in Sudan using an annual dataset between 1990 and 2014. The findings from the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) methods showed that FDI and financial development were both good for Sudan's economic growth. Financial development was found to be more helpful to economic growth than FDI. Interestingly, the findings of Sirag et al. (2018) showed that FDI inflows further enhanced the effect of financial development on the economic increase.

In Asia, Chaudhury et al. (2020) measured the overall effect of FDI flows on the economic expansion of eight South Asian nations between 1990 and 2014. Using panel data regression, they showed that FDI positively affected these eight countries' economic growth. A study with a sample of BRICS countries also found that FDI positively affected economic growth. Specifically, Nguyen and Duong (2021), by using the BLR method to examine the factors influencing the growth of the BRICS group in the 1991–2017 period, showed that FDI had a positive role in promoting the growth of these five countries. In addition, they also found that countries with good corruption control also experienced higher economic growth. Their result again confirmed the role of FDI and institutional quality in economic growth. Odhiambo (2022) also re-considered the linkage between FDI flows and economic increase in 27 Sub-Saharan African nations (SSAs) in the 1990–2019 period. He divided SSA countries into two groups: middle-income and low-income nations. Both FMOLS and DOLS techniques bolster the positive effect of FDI flows on economic growth in low-income nations. Only the DOLS algorithm supports this finding in middle-income countries. This result suggested that FDI inflows played a bigger role in stimulating the economic increase in low-income SSA nations than in middle-income nations. Duong et al. (2022) examine the impact of total factor

productivity (TFP), trade openness, and FDI on economic growth in 90 middle-income nations from 1990 to 2020. They employ the Generalized Method of Moments (GMM), and findings indicate a percentage increase in net FDI inflows and trade openness improves economic growth; meanwhile, TFP has a negative effect on economic growth. Kusairi et al. (2023) also confirmed similar results in developing countries. Specifically, Kusairi et al. (2023) used regression for static and dynamic panel data on a dataset of 16 developing countries for the period 2006–2019, which showed that FDI has positively contributed to the growth of these countries. Chibalamula et al. (2023) examine the significance of FDI and trade openness in five African countries, namely Ghana, Morocco, Kenya, Uganda, and Zambia. Chibalamula et al. (2023) employed the panel data analysis method using data from the World Bank for the period 1994–2019 for the five selected countries. The result from the random effect model (REM) indicated that FDI positively supports growth, whereas trade openness harms economic growth in these countries. At the local level of a country, Hosseinzadeh (2022) examines the direct and indirect (spatial) effects of FDI on GDP growth in different provinces of Iran. Hosseinzadeh (2022) used a spatial econometric model to process a panel dataset of 30 Iranian provinces for the period 2010–2018. The results of Hosseinzadeh (2022) cover that FDI has a positive spillover and direct effect on the growth of regions in Iran. The spillover effects of FDI and financial development are significant. Meanwhile, the spatial (indirect) impact of FDI is positive, but the indirect (spillover) effect of financial development is negative.

Although studies showed a positive effect of FDI flows on national economic development, they also showed that FDI had a negative effect on economic growth in particular and social development in general (Herzer, 2012; Ndiaye & Xu, 2016). The "Race to the Bottom" hypothesis refers to the impacts of FDI on the environment and sustainable development. This hypothesis proposes that multinational corporations from developed countries may seek to exploit lower environmental standards and weaker regulations in developing countries to reduce production costs, allowing them to engage in environmentally harmful activities that contribute to increased pollution levels in the countries in which they operate (Tran et al., 2023). Many empirical studies also provided evidence that pollution may "migrate" from developed countries to developing countries through FDI. Specifically, Herzer (2012), using the DOLS method, found that FDI negatively affected the growth rate of 44 developing nations in 35 years (the period 1970–2005). He concluded that eliminating market-distorting policies, dependence on natural resources, and enhancing economic and political stability could protect nations from the negative consequences of FDI flows and promote FDI to lead to economic growth in the long run. Ndiaye and Xu (2016) considered the effect of FDI on the economic growth of West African Economic Monetary Union nations in the 1990–2012 period. The results of the analysis using OLS and FEM methods showed that FDI had a negative effect on the economic growth of these nations. The results of these studies supported the theory that developing countries are "pollution havens". Meivitawanli (2021) determines the relationship between inward FDI and economic growth in Indonesia using panel data on the provinces from 2008 to 2017. The author uses the REM, FEM, and systems GMM and finds the relationship between FDI and economic growth to be negative. The results are insignificant when the interaction term between FDI and human capital is excluded. This is against commonly held beliefs regarding FDI. The results of this research pose serious concerns for the government. It says that strategies that are not based on empirical research might be misleading and harm the economy. Elheddad, Bassim, and Ahmed (2021) confirm a similar result when examining the impact of FDI on the economic growth of Gulf Cooperation Council (GCC) countries from 2003 to 2013. Using REM and FEM, Instrumental Variable (IV), and Limited Information Maximum Likelihood (LILM) techniques, the empirical results show that FDI that goes into using or exploiting natural resources slows down economic growth in GCC economies. On the other hand, FDI that goes into making industrial goods and services has almost no effect on growth economies. Furthermore, Elheddad et al. (2021) also show that total FDI inflows inhibit economic growth in GCC economies.

However, some studies have found no evidence that FDI affects economic growth. An example is the study of Luo (2007), which used FEM and REM to analyse the 29 mainland provinces (autonomous regions or municipalities, excluding Tibet and Chongqing) between 1987 and 2001. Research results by Luo (2007) show that the direct effects FDI had on economic growth were of insignificance.

In Vietnam, a study by Hoang, Wiboonchutikula, and Tubtimtong (2010) showed that FDI positively affected the economic growth of 64 provinces in the 1995–2006 period. The result from panel data regression showed that FDI positively affected economic growth as a channel to increase fund reserves. Human capital and trade openness in Vietnam had no channels that allowed access to advanced knowledge and technology transfer from FDI inflows to accelerate Vietnam's economic growth. Like such results, Anwar and Nguyen (2010) also showed that FDI positively affected economic growth at the provincial level. Specifically, they used the GMM method on a dataset of 61 provinces in Vietnam from 1996–2005. They showed that, in general, a mutually reinforced two-way link existed between FDI flows and economic growth. However, the analysis for seven regions of Vietnam showed mixed effects of FDI. In addition, Anwar, and Nguyen (2010) also showed that the effects of FDI on economic growth in Vietnam would be more significant if more resources were invested in financial market development, education and training, and a decrease in the technology gap between domestic and foreign enterprises. Su, Nguyen, and Christophe (2019) also confirmed the positive role of FDI flows in Vietnam's economic growth. Specifically, they used data from 63 provinces of Vietnam in the 2005–2015 period by using the GMM method,

which showed that FDI flows had a positive effect on the economic growth of the provinces. Besides, Van Bon (2019), by using the GMM method to consider the effects of FDI flows and institutional quality on Vietnam's economic extension, found that FDI significantly boosted the economic growth of 43 provinces in Vietnam in the 2005–2012 period. In addition, institutional quality positively affected economic extension. However, the study found a negative relationship between FDI flows and institutional quality on economic rise. Duong (2021) analysed the economic growth of the provinces and cities in the south-east region of Viet Nam. Duong (2021) uses REM and FEM techniques to process a dataset of six provinces in the period 2015–2019 and shows that increasing the proportion of foreign direct investment will significantly boost the growth of the local economy. Recently, Oanh et al. (2022), when analysing the economic growth of the provinces of the Southern Key Economic Region of Vietnam, showed that FDI played an essential role in the region's economic growth. Specifically, they used the Bayesian regression method to process a dataset of eight provinces in the Southern Key Economic Region in the 2005–2016 period. They showed that FDI flows had a positive and strong effect on the economic rise of eight provinces in this region. Hong Hiep, Quang, and Minh (2023) use spatial econometric models to explain the impact of FDI inflows and regional spatial factors on the economic growth of 63 provinces in Vietnam over the period 2007–2018. Results show that, after controlling for the important factors of the growth model (human capital, physical capital, and institutional quality), FDI inflows have a rather limited direct and indirect impact on boosting the economic growth of localities in Vietnam.

In summary, the above studies, especially the studies in Vietnam, all showed a positive effect of FDI flows on economic growth at the provincial level (Anwar & Nguyen, 2010; Duong, 2021; Hoang et al., 2010; Hong Hiep et al., 2023; Oanh et al., 2022; Van Bon, 2019). Notably, only Van Bon's study (2006) considered the role of institutional quality in regulating economic growth and FDI effects at the provincial level. To contribute to the literature on the link between FDI flows, institutional quality, and economic growth, we considered the interaction between FDI flows and institutional quality to find out the effects of FDI and institutional quality on the economic increase in 63 provinces of Vietnam in the 2005–2020 period. Appendix A presents a summary of selected studies on the effects of FDI and institutional quality on economic growth.

Methodology

Model and dataset
The purpose of this article is to investigate the effect of FDI flows on the economic increase in 63 provinces of Vietnam in the 2005–2020 period. The choice of the period is based on data availability. First, we estimate the effects of FDI flows and institutional quality on provincial economic growth through the following equation:

$$DRGP_{it} = \alpha_0 + \beta_1 FDI_{it} + \beta_2 IQ + \lambda' X_{it} + \varepsilon_{it} \tag{1}$$

Besides, we also consider the interaction between FDI flows and institutional quality (FDIxIQ) on the economic increase through equation (2):

$$DRGP_{it} = \alpha_0 + \beta_1 FDI_{it} + \beta_2 IQ + \beta_3 FDIxIQ + \lambda' X_{it} + \varepsilon_{it} \tag{2}$$

where i represents the provinces of Vietnam (i = 1,...,63) and t is the year (t = 2005,...,2020). The dependent variable is the economic growth of each province (DRGP). This variable is measured as the gross regional domestic product of each province divided by the average population of the province.

The interest-independent variables include (i) foreign direct investment (FDI), measured as net capital inflows into each province over provincial GDP, and (ii) provincial institutional quality (IQ), measured by the Provincial Competitiveness Index (PCI). PCI measures and evaluates the quality of economic governance, the ease and friendliness of the business environment, and the administrative reform efforts of the provincial governments in Vietnam.

In addition to the foreign direct investment (FDI) variable, we also add control variables to ensure that the estimated result is not biased by omitted variables, including education (EDU), unemployment (UNE), urbanization (UBR), public investment (PI), public expenditure (PE), technological capacity (TC), private investment (PINV), and population (POP). Accordingly, EDU is the percentage of the trained employed population at 15 years of age and older by kinds of economic activity; this variable was found in the previous studies (Hoang et al., 2010; Hong Hiep et al., 2023; Hosseinzadeh, 2022; Luo, 2007; Meivitawanli, 2021; Oanh et al., 2022; Odhiambo, 2022; Van Bon, 2019). UNE is the unemployment rate, which is an indicator expressing the rate between the number of unemployed persons and the labour force (%). URB is the urbanization rate, which is the percentage of actual permanent residents in urban type-recognized administrative units in the total population. PI is the public investment (% of GDP) that was used in the studies by Hoang et al. (2010), Duong (2021), Oanh et al. (2022), and Hong Hiep et al. (2023). PI is the public expenditure (% of GDP); the appearance of this variable in the research model is consistent with the previous statements (Anwar & Nguyen, 2010; Duong et al., 2022; Luo, 2007; Ndiaye & Xu, 2016; Nguyen

& Duong, 2021; Oanh et al., 2022; Sirag et al., 2018; Su et al., 2019). Independent variable Technological capacity (TC) emphasizes the capacity to enable local governments effectively to achieve the desired results with ICTs. We applied the total score of the municipal e-government assessment to measure the technological capacity at the local level. PINV is private investment (% of GDP); this variable is included in the research model based on previous studies (Duong, 2021; Hong Hiep et al., 2023; Su et al., 2019). Finally, POP is the average population, which is the mean population for a year; this variable was found in the studies of Sirag et al. (2018), Meivitawanli (2021), Luo (2007), Duong (2021) and Oanh et al. (2022).

Data are obtained from the General Statistics Office (GSO) and the Ministry of Planning and Investment (MPI). The Vietnam Chamber of Commerce and Industry (VCCI) is responsible for producing IQ data. We summarize the variables in Table 1.

Table 1. Variable description and sources.

Variable	Description	Source
DRDP	Provincial economic rise rate	GSO
FDI	Foreign direct investment	MPI
IQ	Provincial competitiveness index (PCI) as proxy of provincial economic institutions	VCCI
EDU	Education level of the provincial labor force	GSO
UNE	Provincial unemployment rate	GSO
URB	Provincial urbanization rate	GSO
PI	Provincial public investment	GSO
PE	Provincial government capital spending	GSO
TC	Technological capacity of the province	GSO
PINV	Provincial private investment	GSO
POP	Total population of the province	GSO

Estimation strategy

In this research, we apply BLR to investigate the effect of FDI flows and their impact on the extension of the economy while controlling for other potential factors determining the growth of 63 provinces in Vietnam. BLR is a Bayesian approach to linear regression analysis. When examining the effects of factors on economic growth, authors such as Nguyen and Duong (2021) and Oanh et al. (2022) have used BLR. In contrast to traditional (frequentist) methods, the Bayesian approach itself is very flexible (Gelman & Rubin, 1992; Oanh et al., 2022). Essentially, doing complex adaptive trials with a traditional approach is impossible, whereas Bayesian methods are quite natural and straightforward. The flexibility of modelling is also a huge advantage for flexible designs. Bayesian tests, on the other hand, make use of prior knowledge to calculate experiment results. The biggest advantage of Bayesian approaches is that they use the prior knowledge each experimenter brings to the table. Using all the information at your disposal, whether current or prior, should lead to the quickest possible experiment progress (Van De Schoot & Depaoli, 2014). Finally, Bayesian analyses do not assume large samples, as is the case with traditional estimation; therefore, typically smaller data sets can be analysed without losing power while retaining precision (Bui & Thach, 2023; McNeish, 2016; Thach, 2023).

As its name suggests, the BLR is based on Bayes' theorem (Bayes, 1763), which has the following form:

$$\Pr(\theta \mid y) = \frac{\Pr(y \mid \theta)\Pr(\theta)}{\Pr(y)} \tag{3}$$

where θ describes the set of uncharted parameters and y describes the data. Pr(θ|y) represents the posterior distribution, the probability of parameter set θ for data y. Pr(y|θ) is a likelihood function, representing the probability of data y for the uncharted parameter set θ. Pr(θ) is the a priori distribution of parameter set θ, which may be inferred from theory, expert opinion, or other external resources. Finally, Pr(y) is the marginal distribution of data y and may be removed from the equation because it does not depend on θ. Equation (3) may also be written as:

$$\Pr(\theta \mid y) \propto \Pr(y \mid \theta)\Pr(\theta) \tag{4}$$

Therefore, to implement BLR, it is necessary to have an a priori distribution, a likelihood function, and a posterior distribution. Oanh et al. (2022) suggest that we presume a normally distributed prior with a zero mean for all coefficients. This prior distribution implies that the coefficients from the BLR result are more likely to have values

close to zero than non-zero values. Besides, the normally distributed prior shows an unbiased result of Bayesian analysis for our hypothesis in a negative or positive direction (Oanh et al., 2022). Secondly, for the corresponding likelihood functions of the parameters, we assume normal distributions with parameters from our econometric model. Finally, we employ Markov Chain Monte Carlo (MCMC) combined with Gibbs samplers to generate the corresponding posterior distributions of the parameters. For the simulation, we run three Markov series, for each of which we apply 12,500 drawings from the posterior distribution. As usual, 20% of the first drawing is removed, and thereby the sample size is 10,000 for each Markov chain.

Findings and Discussion

Descriptive Statistics
Table 2 reports descriptive statistics for related variables. Table 2 shows that the average economic growth (DRDP) of Vietnam's 63 provinces was 2,224 from 2005 to 2020, with a standard deviation of 0.066. The average FDI of the provinces during this period was 0.737, with a standard deviation of 0.121. The average IQ of the provinces is 0.586, and the standard deviation is 0.064. In addition, Table 2 also presents descriptive statistics for other control variables presented in Section 3.1.

Table 2. Descriptive statistics of variables (2005–2020).

Variable	Obs	Mean	Std. dev.	Min	Max
DRDP	1,008	2.224	0.066	1.828	2.417
FDI	1,008	0.737	0.121	-0.711	0.949
IQ	1,008	0.586	0.064	0.358	0.776
EDU	1,008	0.922	0.092	0.386	1.000
UNE	1,008	0.031	0.127	0.001	3.650
URB	1,008	0.265	0.166	0.000	0.873
PI	1,008	0.181	0.180	0.001	1.807
PE	1,008	0.348	0.237	0.000	1.669
TC	1,008	22.172	2.662	17.135	31.553
PINV	1,008	0.035	0.025	0.000	0.193
POP	1,008	13.972	0.577	12.572	16.450

Correlation analysis
Table 3 summarizes the results of the correlations among the variables included in the analysis. The result shows a negative and low correlation between the DRGP variable and the FDI variable (r = -0.19). In contrast, there is a positive and low correlation between the DRGP variable and IQ (r = 0.31). Table 3 also shows that EDU, UNE, URB, PE, TC, and PINV variables positively correlate with DGRP, while PI and POP variables negatively correlate with DGRP.

Table 3. Correlation matrix.

	DRDP	FDI	IQ	EDU	UNE	URB	PI	PE	TC	PINV	POP
DRDP	1										
FDI	-0.19	1									
IQ	0.31	-0.02	1								
EDU	0.29	0.11	0.28	1							
UNE	0.01	-0.02	0.05	0.00	1						
URB	0.20	0.07	0.34	0.12	0.11	1					
PI	-0.13	-0.01	-0.26	-0.18	-0.04	-0.05	1				
PE	0.15	-0.15	-0.23	-0.05	-0.07	-0.25	0.48	1			
TC	0.01	0.29	0.38	0.15	0.01	0.52	-0.18	-0.41	1		
PINV	0.10	-0.08	-0.17	-0.07	-0.04	-0.15	0.18	0.32	-0.25	1	
POP	-0.49	0.28	0.29	0.19	0.03	0.28	-0.35	-0.55	0.47	-0.31	1

Bayesian linear regression analysis

Table 4 presents the estimation result for equation (1) using the BLR method. Table 4 shows that the mean parameter of FDI is -0.0183, and the probability of the negative effect of the FDI parameter on economic growth (DRDP) is 94.82%. Hence, FDI flows have a strong and negative effect on the economic growth of the localities in Vietnam. Our result aligns with previous studies (Elheddad et al., 2021; Herzer, 2012; Meivitawanli, 2021; Ndiaye & Xu, 2016) and supports the "Race to the Bottom" hypothesis. However, our results contradict the view and much of the empirical evidence on the role and impact of FDI on economic growth (Duong et al., 2022; Sirag et al., 2018). Our results suggest that FDI flows into resource-rich economies may be a factor in the resource curse. Specifically, FDI flows into extractive industries can harm local economies. Elheddad et al. (2021) argue that changes in local market structures due to investment inflows can increase rent-seeking activities and worsen the institutions of the local economy (a variation of the "resource curse"). Besides, Tran et al. (2023) argue that companies from developed countries invest in developing countries to take advantage of lower costs and less stringent environmental standards, leading to pollution being transferred from developed countries to developing countries. These will have the consequence of reducing economic growth in FDI-receiving countries. These results give evidence of the crowding-out effect of FDI flows. In 2006, Vietnam's government gave comprehensive authority to localities in licensing and managing foreign investment activities. Besides the positive aspects, this policy also has limitations. Specifically, this empowerment policy allows localities to compete to attract FDI by offering numerous incentives, which often exceed the existing framework and the capacity for appraising and licensing FDI projects. In addition, localities also lack mechanisms to control FDI projects related to environmental issues. Although FDI enterprises contribute more than 70% of export turnover (Ministry of Planning and Investment, 2018), these enterprises tend to shift capital flows into industries that consume energy and natural resources, have a large labour force, and are not environmentally friendly, such as metallurgy, ship repair, textiles, footwear, mining, and the extraction of minerals not associated with deep processing. About 67% of FDI firms in Vietnam belong to the low value-added manufacturing industry, 80% of which own medium technology, 14% of which use low technology, high energy consumption, and high emissions (Ministry of Planning and Investment, 2018). In addition, Vietnam proactively reduces concern about environmental issues by easing environmental protection standards and implementing flexible policies to compete with other nations in the process of attracting FDI capital. These policies have promoted the pollution haven hypothesis in a more favourable manner, exacerbated pollution and environmental degradation problems in investment-receiving countries, and ultimately depressed local economic growth in Vietnam.

Table 4. Impact of FDI flows and institutional quality on provincial economic growth.

Independent variables	Mean	Probability of mean	MCMC diagnostics	
			Efficiency	Rc
FDI	-0.0183	0.9482**	1.00000	1.00030
IQ	0.2908	1.0000*	1.00000	1.00000
EDU	0.2043	1.0000*	1.00000	0.99999
UNE	-0.0078	0.7852**	1.00000	1.00000
URB	0.0948	1.0000*	1.00000	1.00010
PI	-0.0942	1.0000**	1.03000	1.00015
PE	-0.0038	0.7081**	1.03000	1.00001
TC	0.0022	0.9998*	1.01000	1.00003
PINV	0.0473	0.8113*	1.00000	1.00012
POP	-0.0934	1.0000**	1.00000	1.00009
_cons	3.1270	1.0000*	1.00000	1.00006
Variance	0.0015	–	0.96100	1.00015

Notes: * Probability that the mean parameters are positive, ** Probability that the mean parameters are negative.

Like previous studies (Duong, 2021; Hong Hiep et al., 2023; Nguyen & Duong, 2021; Van Bon, 2019), we find that institutional quality (IQ) has a positive effect on economic growth. Specifically, the mean parameter of this factor is 0.2908, and the probability of this factor's positive effect on DRDP is 100%, so we conclude that IQ has a positive and strong effect on the economic growth of the provinces in Vietnam. Institutional quality, which encompasses several channels such as legal, regulatory, and public governance systems, may facilitate the enhancement of economic growth. Especially since 2007, the Vietnamese government has increased decentralization to local authorities in proactively developing the economy in the provinces. This shift has granted provincial governments greater authority and autonomy in various aspects, such as attracting FDI, licensing investment activities,

facilitating workforce training and recruitment, and accessing land resources. Consequently, the significance of local institutional quality has become increasingly pronounced in the pursuit of economic development. Local governments have a crucial role in effectively mobilizing and distributing resources to promote economic growth. In recent years, the localities of Vietnam have continuously improved the business environment. Also, local governments have improved administrative procedures' efficiency, reduced compliance burdens with conditional business licensing procedures, and reduced informal costs. In addition, local authorities have also made efforts to address land access issues, support small and medium-sized enterprises, and enhance information dissemination and guidance for enterprises.

For control variables, we find a strong and positive effect of EDU, URB, TC, and PINV on DRGP. Specifically, the mean parameter of EDU is 0.2043, and the probability of a positive impact of EDU on DRGP is 100%, so the education level of the provincial labour force has a positive and strong impact on the growth of the province. Our results agree with the conclusions from previous experimental studies (Anwar & Nguyen, 2010; Hoang et al., 2010; Hong Hiep et al., 2023; Hosseinzadeh, 2022; Luo, 2007; Odhiambo, 2022; Van Bon, 2019). The mean parameter of URB is 0.0948, and the probability of a positive impact of URB on DRGP is 100%, so the urbanization rate has a positive and strong impact on the growth of the provinces. The empirical results show that at the provincial level in Vietnam, technological innovation capability (TC) has a significant positive impact on the development level of the economy. In the same line that concludes with Su et al. (2019), Duong (2021), and Hong Hiep et al. (2023), we find the impact of positive and strong private investment (PINV) on the growth of the economy. Meanwhile, UNE, PI, PE, and POP negatively relate to DRGP. Specifically, the mean parameter of UNE is -0.0078, and the probability of a negative impact of UNE on DRGP is 78.52%, so the unemployment rate of the province has a strong and negative impact on the growth of the province. Public investment (PI) will reduce the economic growth of the provinces. This result ours was found in the work of Duong (2021) and Oanh et al. (2022). We affirmed that provincial government capital spending (PE) reduces economic growth. The findings about FDI conform with several studies in the past (Anwar & Nguyen, 2010; Duong et al., 2022; Sirag et al., 2018). Finally, we find that a higher total population of the province (POP) will have a negative impact on the economic growth of the province. This result is consistent with some studies on POP, such as Luo (2007), Sirag et al. (2018), Meivitawanli (2021), and Duong (2021).

Table 4 also provides information about the diagnosis of MCMC. Gelman and Rubin (1992) argue that when using the MCMC technique to create posterior distributions, MCMCs must ensure stability and convergence. The efficiency sampling index (Efficiency), with a value as close to 1 as possible, determines the stability of the estimators. Also, the convergence is tested by the Rc statistic, and an Rc threshold below 1.1 is considered to indicate that MCMCs have converged. Table 4 reports that all sampling indices are close to 1, and the Rc statistic is less than 1.1, so the posterior simulations have satisfied the criteria of Bayesian regression.

Table 5. Impact of FDI flows and institutional quality on provincial economic expansion with interaction between FDI flows and institutional quality.

Independent variables	Mean	Probability of mean	MCMC diagnostics	
			Efficiency	Rc
FDI	-0.2580	0.9811**	1.00000	1.00022
IQ	0.0034	0.5067*	1.00000	1.00025
FDIxIQ	0.3855	0.9740*	1.00000	1.00023
EDU	0.2088	1.0000*	1.00000	0.99998
UNE	-0.0074	0.7749**	1.00000	1.00007
URB	0.0926	1.0000*	1.00000	1.00032
PI	-0.0940	1.0000**	0.97710	1.00003
PE	-0.0046	0.7406**	0.98010	1.00006
TC	0.0022	0.9998*	0.97780	1.00005
PINV	0.0452	0.7998*	1.00000	1.00006
POP	-0.0923	1.0000**	0.99340	0.99999
_cons	3.2867	1.0000*	0.99310	1.00011
Variance	0.0015	–	0.97090	1.00016

Notes: * Probability that the mean parameters are positive, ** Probability that the mean parameters are negative.

Also, by BLR, Table 5 presents the effect of FDI flows, institutional quality, and the interaction between FDI and institutional quality on the economic growth of 63 provinces in Vietnam. Similar to Table 4, Table 5 also shows that FDI flows have a negative effect and institutional quality positively affects economic growth. The mean parameter

of FDIxIQ is 0.3855, and the probability of this interaction's positive effect on DRGP is 100%, so the interaction between FDI flows and institutional quality affects economic growth. Our results are in contrast to the findings of Van Bon (2019). Thus, the localities of Vietnam with the same level of FDI flows can have different economic growth outcomes depending on the provincial institutional quality. Consistent with this argument, this result implies that a locality with good institutional quality can increase spillover effects from FDI flows because it directly affects business operating conditions. In addition, institutional quality is likely to affect the absorptive capacity of host localities, thereby mediating the effect of FDI flows on economic growth. Finally, the effect of the remaining control variables (EDU, URB, TC, PINV, UNE, PI, PE, and POP) on provincial economic growth is similar to the result in Table 4, which implies that the effect of the control variables on economic expansion is stable.

Besides, statistical values such as effective sampling index and Rc also show that MCMCs have fully met the requirements of Bayesian regression.

Conclusions

This paper studies the effect of FDI flows and institutional quality on the economic growth of localities in Vietnam. Based on the availability of the dataset, we used the Bayesian regression method on a sample of 63 provinces in Vietnam in the 2005–2020 period. Our main findings cover that FDI flows have a negative effect on economic growth, while institutional quality has a positive effect on economic expansion. Besides, we also find the effect of the interaction between FDI flows and institutional quality on economic expansion to be positive and strong. These findings suggest that localities with good institutional quality benefit more from FDI than those with poor institutional quality. Thus, the effect of FDI flows may be sensitive to the institutional quality of the investment-receiving province. The result shows that FDI inflows play a bigger role in stimulating economic expansion in provinces with better institutional quality than in provinces with lower institutional quality. The findings of this study provide evidence that institutional quality is a crucial factor in attracting and improving the efficiency of FDI. Specifically, localities with good institutional quality will improve their ability to absorb FDI. Therefore, we recommend that Vietnam simultaneously implement policies to promote the institution's role in attracting FDI inflows and improving the investment environment, which will help absorb and increase the efficiency of FDI and promote economic development. It is necessary to improve domestic conditions to establish equitable linkages, improving the capacity of domestic enterprises to benefit from technological know-how from foreign companies. Furthermore, the Vietnamese government should apply screening policies to ensure that FDI does not displace domestic enterprises. In addition, local governments need to have policies to shift FDI projects from brown to green, that is, not accept new FDI projects in industries that consume energy, cause the greenhouse effect, and are not environmentally friendly (brown FDI projects), but focus on attracting FDI in clean energy projects and eco-industrial park models (green FDI projects).

Our study also has some limitations. The central limit is that we only consider the linear relationship between FDI flows and local economic growth in Vietnam. Earlier empirical studies showed a positive relationship between FDI flows and economic expansion at the provincial level. Therefore, future studies should consider the possibility of nonlinear effects of FDI on economic growth by applying a Bayesian nonlinear regression model to clarify how negative and positive FDI shocks affect the relationship between FDI flows and economic increases in Vietnam.

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Appendix A.

Table A-1. Review of selected studies on the relationship between FDI, institutional quality, and economic growth.

Authors	Method	Samples	Main results
Luo (2007)	FEM and REM	29 mainland provinces of China (1987-2001)	FDI has no impact on economic growth
Hoang et al. (2010)	Panel data regression	64 provinces of Vietnam (1995-2006)	FDI has a positive and significant effect on economic growth
Anwar and Nguyen (2010)	GMM	61 provinces in Vietnam (1996–2005)	FDI has a positive and significant effect on economic growth
Herzer (2012)	DOLS	44 developing nations (1970–2005)	FDI has a negative and significant effect on economic growth
Mehic et al. (2013)	PCSE	7 transitional nations in Southeast Europe (1998–2007)	FDI has a positive and significant effect on economic growth
Ndiaye and Xu (2016)	OLS and FEM	West African Economy Monetary Union nations (1990-2012)	FDI has a negative and significant effect on economic growth
Sirag et al. (2018)	FMOLS and DOLS	Sudan (1990-2014)	FDI has a positive and significant effect on economic growth
Su et al. (2019)	GMM	63 provinces of Vietnam (2005-2015)	FDI has a positive and significant effect on economic growth
Van Bon (2019)	GMM	43 provinces of Vietnam (2005-2012)	FDI and institutional quality have a positive and significant effect on economic growth. The interaction between FDI flows and institutional quality on economic rise is negative.
Chaudhury et al. (2020)	Panel data regression	8 South Asian nations (1990–2014)	FDI has a positive and significant effect on economic growth
Nguyen and Duong (2021)	BLR	BRICS nations (1991-2017)	FDI has a positive and strong effect on economic growth
Elheddad et al. (2021)	REM, FEM, IV and LILM	GCC countries (2003-2013)	FDI has a negative and significant effect on economic growth
Duong (2021)	REM and FEM	6 provinces in the South-East region of Viet Nam (2015–2019)	FDI has a positive and significant effect on economic growth
Meivitawanli (2021)	REM, FEM and GMM	Provinces of Indonesia (2008–2017)	FDI has a negative and significant effect on economic growth
Oanh et el. (2022)	BLR	8 provinces in the Southern Key Economic Region (2005-2016)	FDI has a positive and significant effect on economic growth
Odhiambo (2022)	FMOLS and DOLS	27 Sub-Saharan African nations	FDI has a positive and significant effect on economic growth
Duong et al. (2022)	GMM	90 middle-income nations (1990-2020)	FDI has a positive and significant effect on economic growth
Hosseinzadeh (2022)	Spatial regression	30 provinces of Iran (2010–2018)	FDI has a positive and significant effect on economic growth
Kusairi et al. (2023)	Panel data regression	16 developing countries (2006–2019)	FDI has a positive and significant effect on economic growth
Chibalamula et al. (2023)	REM	5 African countries (1994–2019)	FDI has a positive and significant effect on economic growth
Hong Hiep et al. (2023)	Spatial regression	63 provinces in Vietnam (2007–2018)	FDI inflows have a rather limited direct and indirect impact on boosting the economic growth