Provincial competitiveness and foreign direct investment: Evidence from a PCA-based institutional index in Viet Nam

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Abstract

Foreign direct investment (FDI) has become an important source of growth for many developing economies, including Viet Nam. However, FDI inflows remain uneven across Vietnamese provinces. This study examines whether differences in provincial competitiveness help explain these disparities during the period 2013-2023. Using panel data for all 63 provinces, the study constructs a composite competitiveness indicator from the ten PCI sub-indices through Principal Component Analysis (PCA). The empirical analysis applies the System Generalized Method of Moments (System GMM) to account for dynamic effects and potential endogeneity concerns. The findings suggest that provinces with stronger institutional conditions tend to be associated with higher levels of FDI inflows. In particular, governance quality, logistics activity, industrial production activity, and ICT development are positively associated with foreign investment inflows, while the COVID-19 period is associated with lower investment activity. Rather than examining PCI dimensions separately, this study employs a composite institutional indicator within a dynamic panel framework, thereby providing a broader assessment of how governance and structural conditions are associated with provincial FDI attraction in Viet Nam.

1. Introduction

Foreign direct investment (FDI) has become one of the most important drivers of economic growth and structural transformation in many developing and transition economies. Through the transfer of capital, technology, and managerial know-how, foreign investment contributes to productivity improvement and supports deeper participation in global production networks. As a result, attracting FDI has become a central policy priority for governments seeking to accelerate economic development and strengthen international competitiveness.

In recent years, however, global investment flows have shown considerable volatility. Rising geopolitical tensions, the restructuring of global supply chains, and increasing economic uncertainty have affected the movement of international capital. The World Investment Report 2025 indicates that global FDI flows declined by about 11 percent in 2024, reaching approximately USD 1.5 trillion (United Nations Conference on Trade

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and Development [UNCTAD], 2025). Despite this downward trend, developing economies have remained relatively resilient and continue to receive a large share of global investment. Regions such as Africa and Southeast Asia have maintained stable inflows of foreign capital and Viet Nam has gradually emerged as one of the most attractive investment destinations in the region. According to statistics from the Ministry of Planning and Investment, newly registered FDI in Viet Nam exceeded USD 38 billion in 2025, while cumulative registered capital reached more than USD 529 billion. The foreign-invested sector currently accounts for roughly one quarter of total social investment, contributes over half of industrial production, and generates close to seventy percent of Vietnam's export value (Ministry of Planning and Investment [MPI], 2026). These figures illustrate the increasingly important role played by FDI in Vietnam's economic development during the past decade.

Although Viet Nam has been successful in attracting foreign investment at the national level, the distribution of FDI across provinces remains highly uneven. Major economic hubs such as Ho Chi Minh City and Hai Phong consistently receive a large proportion of investment projects, whereas many other provinces attract relatively limited inflows. For instance, Ho Chi Minh City attracted more than USD 5.85 billion in registered FDI capital in 2023, accounting for nearly 16 percent of the national total, while Hai Phong ranked second with about USD 3.26 billion, or approximately 8.9 percent of total investment (MPI, 2024). In contrast, the Northern Midlands and Mountainous Region has attracted only a modest share of national FDI. This region received around 1,240 projects with total registered capital of nearly USD 29 billion, representing a relatively small proportion of national investment. Consequently, it ranked fifth among Vietnam's six economic regions in terms of foreign investment attraction, accounting for only about 3.4 percent of total projects and 6.2 percent of registered capital. Such disparities raise an important question regarding the factors that influence the spatial distribution of foreign investment. Identifying why certain provinces attract significantly more FDI than others is therefore essential for designing policies that promote regional competitiveness and more balanced economic development.

Previous research has examined a wide range of factors that influence the location decisions of foreign investors. Several studies emphasize the role of economic fundamentals, including labor quality, infrastructure development, and market size, in shaping investment attractiveness (Yukhanaev et al., 2014; Tran et al., 2021; Hoang et al., 2022). Other research highlights the importance of government-related factors such as administrative efficiency and investment promotion policies (Huynh, 2022). In addition, geographical characteristics, particularly accessibility to international markets and proximity to trade routes, have also been found to influence the distribution of foreign investment across regions (Nguyen, 2016; Nguyen et al., 2024). While these determinants are widely acknowledged in the literature, recent studies increasingly emphasize the role of institutional conditions in shaping investment decisions.

From the perspective of institutional economics, institutions establish the formal and informal rules that govern economic interactions (North, 1990). Transparent regulations, efficient administrative procedures, and consistent policy enforcement help reduce transaction costs and uncertainty for investors. Compared with structural factors such as geography or macroeconomic conditions, institutional quality can be more directly influenced by government actions and policy reforms. In Viet Nam, provincial authorities possess a certain degree of autonomy in economic governance and investment promotion. Consequently, differences in institutional quality across provinces may significantly affect their ability to attract foreign investment.

To assess the quality of local economic governance in Viet Nam, the Provincial Competitiveness Index (PCI) has been widely used as an indicator of the provincial business environment. Developed by the Vietnam Chamber of Commerce and Industry (VCCI) in cooperation with international partners, the PCI evaluates several dimensions of economic governance, including

entry costs, land access, transparency, informal charges, labor training, and policy bias (Vietnam Chamber of Commerce and Industry [VCCI], 2019). Together, these indicators reflect the extent to which provincial authorities create favorable conditions for business activities and investment. Nevertheless, the PCI consists of multiple sub-indices that capture different aspects of governance, and including them individually in econometric models may lead to multicollinearity and measurement difficulties.

To overcome this limitation, the present study constructs a composite indicator of provincial competitiveness by applying Principal Component Analysis (PCA) to the ten PCI sub-indices. This method allows the multidimensional nature of institutional quality to be summarized into a smaller number of components while reducing potential multicollinearity problems. Using panel data for all 63 provinces in Viet Nam during the period 2013- 2023, this research examines how the PCA-based competitiveness indicator is associated with provincial FDI inflows. In addition to institutional factors, the empirical model also incorporates several socio-economic control variables, such as population size, freight volume, industrial production activity, retail activity, ICT development, and the COVID-19 shock, to capture broader structural determinants of investment attraction.

From a methodological perspective, the study employs a dynamic panel approach using the System Generalized Method of Moments (System GMM) estimator. This estimation technique is suitable for accounting for dynamic effects and addressing potential endogeneity concerns while capturing the persistence of investment inflows over time. By integrating institutional and structural determinants within a dynamic econometric framework, the study provides new empirical evidence on how provincial competitiveness is associated with foreign investment attraction in Vietnam.

This study contributes to the literature in several more specific ways. First, rather than examining individual PCI components separately, it constructs an integrated measure of provincial competitiveness using Principal Component Analysis. This allows the analysis to capture the underlying institutional structure instead of focusing on isolated governance indicators, which has been a limitation in previous studies. Second, the study provides new evidence at the subnational level in Viet Nam by using a balanced panel dataset covering all provinces over a recent period. While earlier studies often focus on specific regions or shorter time spans, this paper offers a more comprehensive assessment of how institutional quality is associated with FDI across heterogeneous provincial contexts. Third, the paper adopts a dynamic panel framework using System GMM, which allows it to account for both persistence in FDI inflows and potential endogeneity between institutional quality and investment decisions. This provides an additional robustness check compared to static models commonly used in earlier research.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature on institutional quality and FDI attraction. Section 3 describes the research model and empirical methodology. Section 4 presents the data and descriptive statistics. Section 5 reports the empirical results, while Section 6 discusses the findings. Section 7 concludes the study and outlines several policy implications.

2. Literature review

Previous studies agree that institutional conditions matter for foreign investment, but they do not agree on how strong or consistent this effect actually is. In general, institutions are expected to reduce uncertainty and transaction costs, which should make a location more attractive to investors. When rules are clear, procedures are predictable, and enforcement is consistent, firms can plan better and face fewer risks. This basic argument, rooted in institutional economics (North, 1990), is often used to explain why governance quality should be linked to FDI. Empirical evidence at the international level largely supports this view, but not without variation. Some studies find a strong and positive relationship. For example, improvements in governance dimensions such as corruption con-

trol, regulatory quality, or rule of law are often associated with higher FDI inflows, especially in more advanced or stable economies (Sabir et al., 2019; Ross, 2019). In these contexts, institutional quality seems to function as a signal of reliability, helping countries compete for international capital.

However, other studies suggest that this relationship is not always straightforward. In certain cases, institutional factors appear less important than market-related considerations. Khan et al. (2024), for instance, show that investors may prioritize growth potential or market size, particularly in emerging economies where high returns can compensate for weaker institutions. This helps explain why some countries continue to attract large amounts of FDI despite governance challenges. In other words, institutions matter, but not always in the same way or to the same extent.

Another source of inconsistency in the literature comes from how institutional quality is measured. Studies that rely on individual indicators often report mixed or even conflicting results, while those using composite indices tend to find clearer relationships. The reason is that institutional quality is inherently multidimensional. Looking at a single indicator, such as transparency or administrative efficiency, may capture only part of the picture. In contrast, combining multiple dimensions into a single index can better reflect the overall governance environment. This is shown in studies such as Meressa (2022) and Bhujabal et al. (2024), where aggregated institutional measures display a more stable and significant impact on FDI.

A similar issue appears in research on competitiveness frameworks. Broader indices, such as the Global Competitiveness Index, often show that institutional quality works together with infrastructure, macroeconomic conditions, and innovation capacity to influence investment decisions (Raeskyesa & Suryandaru, 2020). This suggests that institutions should not be viewed in isolation, but rather as part of a wider system that shapes economic attractiveness.

In the context of Viet Nam, the evidence is even more mixed. The Provincial Competitiveness Index (PCI) is widely used to capture differences in local governance, yet studies using PCI data do not always reach the same conclusions. Some research finds that certain components, such as land access, administrative efficiency, or the proactivity of local authorities, have a clear positive effect on FDI (Huynh, 2022). Other studies, however, report weaker or insignificant results for variables such as transparency or informal costs (Nguyen & Luu, 2021; Nguyen et al., 2024).

These differences are not random. They often reflect variations in regional conditions. Provinces differ in terms of economic structure, development level, and integration into global value chains. In regions where industrial activity is already strong, improvements in governance may be associated with higher investment. In less developed areas, the same institutional improvements may have a smaller effect because other constraints, such as infrastructure or market access, remain important. This helps explain why PCI indicators do not produce uniform effects across all provinces.

Another limitation in the existing literature is the tendency to treat PCI components separately. While this approach can identify which specific factors matter, it may overlook the fact that investors respond to the overall environment rather than to isolated elements. As a result, focusing on individual indicators can lead to fragmented conclusions and inconsistent findings across studies. Given these issues, a more integrated approach is needed. Instead of examining each PCI component in isolation, it is more appropriate to treat institutional quality as a combined construct. This study follows that approach by using Principal Component Analysis to summarize the ten PCI sub-indices into a single competitiveness measure. By doing so, it aims to capture the common institutional dimension that underlies provincial governance.

At the same time, institutional factors alone are not sufficient to explain FDI patterns. Structural conditions such as logistics capacity, industrial production activity, and digital infrastructure also play an important role. Therefore, this study considers both institutional and economic variables within a unified framework. This allows for

a more balanced assessment of how provincial competitiveness interacts with broader development conditions in shaping foreign investment across Viet Nam.

3. Research model

3.1. Model specification

To investigate how provincial competitiveness is associated with the attraction of foreign direct investment (FDI), this study develops a dynamic panel data framework in which FDI inflows are determined by both institutional conditions and structural economic factors. Consistent with the existing literature on FDI determinants, the model incorporates a lagged dependent variable to account for the persistence of investment inflows over time. Provinces that have successfully attracted foreign investment in earlier periods are more likely to continue receiving investment in subsequent periods due to agglomeration effects, established business networks, and ongoing industrial production activity.
The baseline empirical model is specified as follows:

$$LnFDI_{it} = \beta_0 + \beta_1 LnFDI_{i,t-1} + \beta_2 PCI1_{i,t} + \beta_3 LnPopulation_{i,t} + \beta_4 LnFreightVolume_{i,t} + \beta_5 IIP_{i,t} + \beta_6 LnRetail_{i,t} + \beta_7 ICT_{i,t} + \beta_8 COVID_{it} + \varepsilon_{it} \quad (1)$$

Where:
○ $LnFDI_{it}$ represents the natural logarithm of total registered FDI capital in province i at time t.
○ $LnFDI_{i,t-1}$ is the lagged value of FDI inflows, capturing the dynamic persistence of investment attraction.
○ $PCI1_{i,t}$ is the composite provincial competitiveness indicator constructed from the ten PCI sub-indices using Principal Component Analysis (PCA).
○ $LnPopulation_{i,t}$ denotes the natural logarithm of the average population in each province.
○ $LnFreightVolume_{i,t}$ measures the logarithm of freight volume transported by province, representing logistics capacity and infrastructure development.
○ $IIP_{i,t}$ refers to the Industrial Production Index, capturing the level of industrial activity within a province.
○ $LnRetail_{i,t}$ represents the natural logarithm of retail sales of goods and services at current prices, reflecting local market size and consumption capacity.
○ $ICT_{i,t}$ denotes the Information and Communications Technology index, which measures the level of digital infrastructure development across provinces.
○ $COVID_{it}$ is a dummy variable capturing the economic impact of the COVID-19 pandemic, taking the value 0 for the period 2013- 2019 and 1 for the period 2020- 2023.
○ ε_{it} represents the error term.
By incorporating both institutional variables and key socio-economic factors, the model allows the analysis to examine how improvements in provincial competitiveness are associated with differences in foreign investment attraction across provinces.

3.2. Variable description

The dependent variable in this study is the natural logarithm of total registered FDI capital at the provincial level. This variable reflects the magnitude of foreign investment received by each province and is commonly employed in empirical analyses of FDI determinants.
The main explanatory variable is provincial competitiveness. It is represented by a composite indicator derived from the ten PCI sub-indices through Principal Component Analysis (PCA). These sub-indices capture different aspects of the local business environment, including entry costs, land access, transparency, informal charges, policy bias, the proactivity of local authorities, business support policies, labor quality, and the strength of legal institutions.
In addition to the institutional variable, several control variables are incorporated into the model to account for other factors that may influence foreign investors' location decisions. Population size is included as a proxy for labor availability and potential market demand. Freight volume reflects the capacity of transportation and logistics infrastructure. The Industrial Production Index (IIP) repre-

sents the level of industrial production activity within each province. Retail sales of goods and services are used to approximate the size of local consumption markets. Furthermore, the ICT index is introduced to capture differences in digital infrastructure development across provinces. Finally, a dummy variable for the COVID-19 period is included to account for the potential disruption caused by the pandemic to investment flows.

3.3. Estimation method

The empirical model is estimated using the System Generalized Method of Moments (System GMM) estimator introduced by Arellano and Bover (1995) and later extended by Blundell and Bond (1998). This estimation technique is widely used in dynamic panel analyses where the model includes lagged dependent variables and potential endogeneity among explanatory variables.

System GMM offers several advantages for the present study. It allows the model to control for unobserved province-specific characteristics that may affect investment attractiveness while remaining constant over time. In addition, the estimator helps address endogeneity concerns that may arise from the interaction between institutional conditions and FDI inflows. The dynamic specification also captures the persistence of investment flows by incorporating lagged values of the dependent variable as instruments.

In the empirical specification, the lagged dependent variable and the institutional competitiveness indicator (PC1) are treated as endogenous variables due to potential reverse causality with FDI inflows. The remaining control variables are treated as predetermined or exogenous depending on their potential simultaneity with investment activity. Lagged values of the endogenous variables are used as internal instruments. To avoid instrument proliferation, the instrument matrix is collapsed and the lag depth is restricted. These adjustments help improve the reliability and stability of the estimation results.

4. Data and Descriptive statistics

4.1. Data sources

This study relies on a balanced panel dataset covering all 63 provinces in Viet Nam for the period from 2013 to 2023. The dataset combines information from several official sources in order to capture both institutional conditions and socio-economic characteristics that may influence foreign direct investment at the provincial level.

Data on the Provincial Competitiveness Index (PCI) and its ten component indicators are obtained from the annual PCI reports published by the VCCI. These reports assess the quality of provincial economic governance and the business environment based on extensive surveys conducted with domestic and foreign enterprises operating in Viet Nam.

Information on foreign direct investment is collected from the General Statistics Office of Vietnam (GSO) as well as the Foreign Investment Agency under the Ministry of Planning and Investment. In this study, FDI inflows are measured using the total registered FDI capital recorded at the provincial level.

Socio-economic variables are mainly derived from statistical publications of the General Statistics Office. Provincial population data are taken from demographic reports, while freight volume statistics reflect the amount of goods transported within each province. The Industrial Production Index (IIP) is used to indicate the level of industrial production activity. Retail sales of goods and services capture the scale of local consumption markets. In addition, the level of digital infrastructure is measured using the Information and Communications Technology (ICT) index obtained from the Vietnam ICT Index reports.

To account for the economic disruption associated with the COVID-19 pandemic, a dummy variable is included in the dataset. This variable takes the value of 0 for the pre-pandemic period (2013- 2019) and 1 for the pandemic period (2020- 2023).

By combining institutional indicators with key

socio-economic variables, the dataset provides a comprehensive foundation for examining the determinants of FDI attraction across Vietnamese provinces.

4.2. Variable measurement

Table 1 summarizes the variables used in the empirical analysis and their definitions.
The key explanatory variable in this study is provincial competitiveness, measured using the composite PCI indicator derived from Principal Component Analysis (PCA). This approach allows the multidimensional structure of the PCI to be summarized into a smaller set of components that capture the underlying institutional characteristics of provincial governance.
The control variables are selected based on previous empirical studies on FDI determinants and reflect structural factors that may influence foreign investors' location decisions. These variables capture aspects such as labor availability, infrastructure development, industrial production activity, market size, and digital connectivity.
FDI is measured as total registered foreign direct investment capital at the provincial level, expressed in billion USD. All logarithmic variables are transformed using ln(x). The dataset does not contain any zero FDI observations. The negative minimum value of LnFDI reflects very small positive FDI observations in the original data rather than negative investment values. Population refers to total provincial population, freight volume represents total freight transported, and retail denotes total retail sales of goods and services. All of these variables are transformed using the natural logarithm, ln(x).

4.3. Descriptive statistics

Table 2 reports the descriptive statistics of the variables used in the analysis, providing an overview of their distribution across Vietnamese provinces during the study period.

Table 1. Variable description

Variable	Description	Unit	Expected sign	Source
LnFDI	Natural logarithm of total registered FDI capital by province	Billion USD (log-transformed)	+	GSO, Foreign Investment Agency
PC1	Composite provincial competitiveness indicator constructed using PCA from ten PCI sub-indices	Index	+	PCI reports (VCCI)
LnPopulation	Natural logarithm of provincial population	Persons (log-transformed)	+	GSO
LnFreightVolume	Natural logarithm of freight volume transported by province	Thousand tons (log-transformed)	+	GSO transportation statistics
IIP	Industrial Production Index by province	Index (%)	+	GSO
LnRetail	Natural logarithm of retail sales of goods and services	billion VND (log-transformed)	+	GSO
ICT	ICT Index measuring digital infrastructure development	Index	+	Vietnam ICT Index reports
COVID19	Dummy variable for pandemic period (1 = 2020- 2023; 0 otherwise)	Dummy variable	−	Author's construction

Source: Authors' compilation

The descriptive statistics reveal considerable variation in foreign direct investment across Vietnamese provinces. The mean value of LnFDI is 4.50, while the variable ranges from -5.28 to 9.76, indicating substantial disparities in provincial FDI attraction.

Several control variables also display notable variation across provinces. Freight volume, retail activity, and industrial production activity vary substantially, reflecting differences in economic scale and production conditions among provinces. Similarly, the ICT index ranges from 0.41 to 0.87, suggesting uneven levels of digital infrastructure across regions. Overall, these statistics indicate a high degree of heterogeneity in both institutional competitiveness and socio-economic conditions among Vietnamese provinces.

To further examine the relationships among the variables, the correlation matrix is presented in Appendix II (Table A4). The results show that most explanatory variables are moderately correlated with FDI inflows, particularly freight volume, retail activity, and population size. The relatively high correlation between PC1 and the COVID-19 dummy may partly reflect common time-related shocks during the pandemic period rather than conceptual overlap between provincial competitiveness and the pandemic variable itself. Although several pairwise correlations are relatively high, particularly between LnPopulation and LnRetail, additional VIF tests indicate that multicollinearity is not severe. As reported in Appendix II (Table A5), all VIF values remain below the commonly accepted threshold of 10, suggesting that multicollinearity is unlikely to substantially distort the estimation results.

5. Empirical results

5.1. Principal component analysis results

Before conducting the regression analysis, Principal Component Analysis (PCA) is applied to the ten PCI sub-indices to construct a composite indicator of provincial competitiveness.

The Kaiser-Meyer-Olkin (KMO) test reports an overall value of 0.8429, indicating that the dataset is highly suitable for factor analysis (Appendix I, Table A1). In addition, Bartlett's test of sphericity is statistically significant ($\chi^2 = 2915.300$, $p < 0.01$), rejecting the null hypothesis that the variables are not correlated (Appendix I, Table A2). These results confirm that PCA can be appropriately applied to the PCI indicators.

The PCA results indicate that three components have eigenvalues greater than one and together explain 67.83% of the total variance. Among them, PC1 accounts for the largest share of the variance (42%), capturing the core institutional characteristics reflected in the PCI indicators. Although multiple components have eigenvalues greater than one, only the first principal component (PC1) is retained for the empirical analysis. PC1 explains the largest proportion of total

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LnFDI	693	4.50	3.17	-5.28	9.76
PC1	693	0.00	2.05	-6.15	5.96
LnPopulation	693	6.99	0.67	5.24	8.55
LnFreightVolume	693	9.82	1.35	5.19	12.92
LnRetail	693	11.44	0.82	9.37	13.48
IIP	693	117.66	14.73	74.50	187.20
ICT	693	0.66	0.09	0.41	0.87
COVID19	693	0.36	0.48	0	1

Source: Authors' calculation from VCCI, GSO and ICT Index data

Table 3. Eigenvalues and explained variance

Component	Eigenvalue	Proportion	Cumulative
PC1	4.200	0.420	0.420
PC2	1.521	0.152	0.572
PC3	1.062	0.106	0.678

Source: Authors' calculation

variance and captures the common institutional dimension underlying the PCI sub-indices. PC2 and PC3 mainly reflect narrower and less stable dimensions that are more difficult to interpret consistently across provinces and years. The objective of the study is not to reproduce the full PCI structure but to capture the primary institutional dimension most closely associated with FDI attraction. The rotated factor loadings show that PC1 loads strongly on variables related to land access, time costs, informal charges, policy bias, proactivity, and law enforcement, suggesting that this component reflects the overall quality of provincial governance and administrative efficiency (Appendix I, Table A3). Since PC1 captures the most relevant institutional factors affecting business activities, it is selected as the primary competitiveness indicator for the regression analysis.

5.2. SGMM estimation results

Table 4 presents the estimation results of Equation (1) using SGMM, with LnFDI as the dependent variable. Column (1) reports the baseline model examining the association between provincial competitiveness and FDI inflows across Vietnamese provinces.

The estimated coefficient of the composite competitiveness indicator (PC1) is 0.2072 and statistically significant at the 5% level. This result suggests that stronger provincial competitiveness is associated with higher FDI inflows. Since PC1 is constructed from the ten PCI sub-indices, the finding indicates that governance-related factors such as land access, administrative procedures, informal charges, proactivity of local authorities, and legal enforcement may be linked to differences in provincial investment attractiveness.

The coefficient of the lagged dependent variable, LnFDI(t-1), is positive and statistically significant at the 1% level. The estimated coefficient of 0.2027 suggests that FDI inflows exhibit persistence over time. Provinces that received relatively high levels of foreign investment in previous years are more likely to continue attracting investment in subsequent periods. This pattern may reflect the cumulative nature of investment activity, whereby existing infrastructure, production networks, and business linkages are associated with continued investment inflows.

Regarding the control variables, population size shows a positive effect at the 10% significance level, suggesting that provinces with larger populations may offer broader labor availability and market potential.

Freight volume exhibits a positive and statistically significant coefficient at the 1% level. This finding suggests that provinces with stronger transportation and logistics activity tend to receive higher FDI inflows. More developed logistics systems may help reduce transportation costs and improve connectivity with domestic and international markets.

Similarly, the Industrial Production Index (IIP) shows a positive and statistically significant association with FDI inflows at the 5% level. Provinces with higher levels of industrial production activity tend to be associated with higher FDI inflows.

The ICT index also displays a positive and statistically significant coefficient. This result suggests that better digital infrastructure and ICT development are associated with higher FDI inflows. Improved digital connectivity may help firms manage production and coordination activities more efficiently.

By contrast, the coefficient of LnRetail is

Table 4. SGMM estimation results

Variable	Coefficient	Std. Error	z-value	p-value
LnFDI (t–1)	0.2027	0.0403	5.03	0.000
PC1	0.2072	0.0990	2.09	0.036
LnPopulation	3.2532	1.8083	1.80	0.072
LnFreightVolume	0.9306	0.3568	2.61	0.009
LnRetail	-1.3092	0.9320	-1.40	0.160
IIP	0.0112	0.0056	2.00	0.046
ICT	2.0459	0.6487	3.15	0.002
COVID19	-0.8090	0.2100	-3.85	0.000
Observations	693			
Number of groups	63			
Number of instruments	28			
Lag structure	lag(2 .)			
Instrument matrix	Collapsed			

Notes: The model is estimated using two-step System GMM with Windmeijer-corrected robust standard errors. Lagged values of endogenous variables are used as internal instruments. The notation lag(2 .) indicates that lagged values starting from the second lag onward are used as instruments in the GMM estimation. The instrument matrix is collapsed and lag depth is restricted to avoid instrument proliferation.

Source: Authors' estimation

statistically insignificant, implying that local consumption market size may not be a primary factor associated with FDI location decisions in Viet Nam.

Finally, the COVID-19 dummy variable has a negative and statistically significant coefficient. This finding suggests that the pandemic period from 2020 to 2023 was associated with lower FDI inflows. Mobility restrictions, supply chain disruptions, and delays in project implementation may partly explain this pattern.

Model diagnostic tests

Several diagnostic tests are conducted to evaluate the validity of the System GMM estimation. The results are summarized in Table 5.

The AR(1) test is statistically significant ($p = 0.000$), which indicates the presence of first-order serial correlation in the differenced residuals. This outcome is expected in dynamic panel models estimated using the GMM framework. In contrast, the AR(2) test is not statistically significant ($p = 0.226$), suggesting that second-order serial correlation is absent. This result supports the validity of the moment conditions used in the estimation. The Hansen test of overidentifying restrictions yields a p-value of 0.300, while the Sargan test produces a p-value of 0.161. Both statistics suggest that the chosen instrument set is appropriate and that the model does not show clear evidence of problems related to instrument validity. Taken together, these diagnostic results support the adequacy of the System GMM specification for examining the relationship between provincial competitiveness and FDI inflows.

6. Discussion

The empirical findings provide several insights into the determinants of foreign direct investment across Vietnamese provinces.

A central result of this study is the positive relationship between provincial competitiveness and FDI inflows. This finding suggests that stronger

Table 5. Diagnostic tests of the System GMM model

Test	Statistic	p-value	Interpretation
AR(1)	–5.23	0.000	Expected
AR(2)	–1.21	0.226	No second-order autocorrelation
Hansen test	10.66	0.300	Instruments valid
Sargan test	13.03	0.161	Instruments acceptable

Source: Authors' estimation

institutional conditions may be associated with differences in investment patterns across provinces. In the Vietnamese context, where provinces differ in administrative capacity and governance quality, better performance in areas such as land access, administrative procedures, and legal enforcement may be associated with lower uncertainty for foreign investors. Lower uncertainty, in turn, may help support a more favorable environment for project implementation, which is an important consideration for firms making long-term investment decisions.

This result is consistent with Sabir et al. (2019) and Bhujabal et al. (2024), who highlight the importance of institutional quality in attracting FDI. However, it contrasts with Khan et al. (2024), who argue that institutional factors may be less influential in environments where market opportunities dominate. The evidence from this study suggests that, at the subnational level, governance quality remains relevant to understanding differences in FDI across provinces, even in an export-oriented economy like Viet Nam. This implies that local institutional differences may still be associated with provincial investment outcomes, despite broader national-level policies aimed at attracting foreign investment.

The results also highlight the importance of logistics and transportation activity. Provinces with higher freight volumes tend to be associated with higher FDI inflows, suggesting that transport connectivity and logistics performance may influence investment location decisions. One possible explanation is that more efficient transportation systems help reduce production and distribution costs, especially for firms participating in export-oriented manufacturing and global value chains. In Viet Nam, where a large share of FDI is linked to processing and manufacturing activities, logistics efficiency may help firms maintain smoother supply chain coordination. This finding is broadly consistent with Tran et al. (2021) and Huynh and Huynh (2022). The relatively strong coefficient observed in this study may also reflect the growing importance of supply chain reliability in recent years.

Industrial production activity is also positively associated with FDI inflows. The coefficient of IIP suggests that provinces with higher levels of industrial production activity tend to receive higher levels of foreign investment. Since IIP reflects industrial production activity rather than the absolute scale of industrial capacity or the broader industrial ecosystem, the result should be interpreted as indicating an association between more active manufacturing performance and stronger FDI inflows. This interpretation is generally consistent with Contractor et al. (2021).

The ICT index also shows a positive relationship with FDI inflows. This finding suggests that digital infrastructure and information technology development may be associated with stronger provincial investment attractiveness. Better digital connectivity can support communication, coordination, and production management activities, which are increasingly important in modern manufacturing systems. The result is consistent with Raeskyesa and Suryandaru (2020), who emphasize the growing role of technological readiness in attracting international investment.

By contrast, the effect of population size is relatively modest. Although provinces with larger populations may provide broader labor availability, the results suggest that labor quantity alone may not be the main factor associated with FDI attraction. Other conditions, such as infrastructure

quality, industrial activity, and institutional conditions, may play a more important role. Similarly, the coefficient of LnRetail is statistically insignificant, implying that local consumption market size may not be strongly associated with provincial FDI inflows in Viet Nam. This finding differs from studies emphasizing market-seeking investment behavior and instead may support the argument that a large share of FDI in Viet Nam remains export-oriented and efficiency-seeking. The negative coefficient of the COVID-19 variable suggests that the pandemic period was associated with lower FDI inflows across provinces. Restrictions on mobility, supply chain disruptions, and delays in project implementation likely contributed to weaker investment activity during 2020- 2023. This finding is consistent with Bon et al. (2022). At the same time, the positive coefficient of lagged FDI indicates that investment persistence remained significant despite temporary external shocks.

Overall, the findings suggest that provincial FDI attraction is associated with both institutional and structural conditions. Institutional quality may help reduce uncertainty and improve the business environment, while logistics activity, manufacturing dynamics, and digital infrastructure may provide conditions that support production and investment operations. Rather than operating independently, these factors appear to interact in shaping provincial investment attractiveness.

7. Conclusion and Policy implications

This study examines the relationship between provincial competitiveness and foreign direct investment across Vietnamese provinces during the period 2013- 2023. A composite indicator of provincial governance quality is constructed from the ten PCI sub-indices using Principal Component Analysis, while the empirical analysis applies the System Generalized Method of Moments to account for dynamic effects and potential endogeneity concerns.

The findings suggest that provincial competitiveness is associated with differences in FDI inflows across provinces. More specifically, provinces with better governance conditions, stronger logistics activity, higher levels of industrial production activity, and better digital infrastructure tend to be associated with stronger investment performance. Rather than implying a purely causal relationship, the results indicate that institutional and structural conditions jointly contribute to shaping the overall investment environment.

Based on these findings, several policy implications can be drawn. Strengthening institutional quality at the provincial level should remain a central priority for local governments. Efforts to simplify administrative procedures, improve regulatory transparency, and reduce bureaucratic delays can significantly enhance the investment climate. In particular, reforms aimed at improving land access procedures, minimizing informal costs, and ensuring fair treatment of enterprises may help create a more predictable and investor-friendly environment.

Investment in logistics and transportation infrastructure also remains essential for improving provincial competitiveness. Expanding and upgrading transportation networks, ports, and logistics systems can reduce trade costs and strengthen supply chain connectivity. Provinces with stronger logistics capacity may be better positioned to attract export-oriented FDI, especially in manufacturing and processing industries.

In addition, policies that support industrial production activity and strengthen supporting industries may contribute to longer-term investment attraction. Developing industrial zones, improving workforce skills, and encouraging linkages between foreign firms and domestic suppliers can help strengthen the broader conditions associated with sustainable industrial growth.

Finally, accelerating digital transformation and expanding ICT infrastructure can further improve the investment environment. Investments in digital infrastructure, e-government systems, and smart public services can enhance administrative efficiency and reduce transaction costs for firms.

Despite these contributions, several limitations should be acknowledged. First, the measurement of institutional quality relies on PCI indicators, which are partly based on firm perceptions and may not fully capture all dimensions of governance. Second, the use of Principal Component

Analysis, while useful for reducing dimensionality, may mask the effects of individual institutional components. Third, although the System GMM approach addresses endogeneity concerns, the results may still be sensitive to instrument selection and model specification.

These limitations suggest several directions for future research. Further studies could explore alternative measures of institutional quality, including objective administrative or regulatory data. In addition, sector-level analysis may provide more detailed insights into how different types of FDI respond to institutional and structural factors. Finally, future research could examine the implications of recent administrative boundary adjustments in Vietnam and assess whether changes in provincial structure alter the relationship between governance and investment attraction.■

Author declaration

During the preparation of this manuscript, the authors used Grammarly to assist with grammar and language editing and Zotero to manage and format references. These tools were used solely for language polishing and reference organization. All research design, data analysis, interpretation of results, and scientific content were developed by the authors. The authors carefully reviewed the manuscript and take full responsibility for the final published content.

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Appendix I. PCA results of PCI sub-indices

Table A1. KMO test for sampling adequacy

Variable	KMO
Entry costs	0.7117
Land access	0.9154
Transparency	0.4428
Time costs	0.8326
Informal charges	0.8462
Policy bias	0.9487
Proactivity	0.8601
Business support	0.6117
Labor quality	0.5687
Legal institutions	0.9038
Overall KMO	0.8429

Source: Authors' calculation

Table A2. Bartlett's test of sphericity

Statistic	Value
Determinant of correlation matrix	0.014
Chi-square	2915.300
Degrees of freedom	45
p-value	0.000

Source: Authors' calculation

Table A3. Rotated factor loadings of PCI sub-indices (Varimax rotation)

PCI sub-index	PC1	PC2	PC3
Entry costs	-0.0683	-0.6433	0.3311
Land access	0.4058	0.0055	-0.0723
Transparency	0.0488	-0.1155	0.7247
Time costs	0.4247	-0.1387	0.1735
Informal charges	0.4361	0.0374	0.0884
Policy bias	0.3478	-0.0425	-0.0466
Proactivity	0.4184	0.1150	0.0909
Business support	-0.0429	0.6428	0.2031
Labor quality	-0.0778	0.3469	0.5194
Legal institutions	0.3921	0.0595	0.0223

Source: Authors' calculation

Appendix II – Correlation matrix

Table A4 Correlation matrix of variables

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) LnFDI	1.000							
(2) PC1	0.101	1.000						
(3) LnPopulation	0.570	0.094	1.000					
(4) LnFreightVolume	0.612	0.141	0.724	1.000				
(5) LnRetail	0.572	0.316	0.831	0.807	1.000			
(6) IIP	0.124	-0.058	0.102	0.168	0.211	1.000		
(7) ICT	0.433	0.240	0.452	0.447	0.511	-0.078	1.000	
(8) COVID19	0.002	0.714	0.045	0.149	0.213	-0.121	0.182	1.000

Source: Authors' calculation

Table A5. Variance Inflation Factor (VIF) results

Variable	VIF	1/VIF
LnRetail	4.87	0.205
LnPopulation	4.35	0.230
LnFreightVolume	3.92	0.255
PC1	2.84	0.352
COVID19	2.61	0.383
ICT	2.18	0.459
IIP	1.76	0.568
Mean VIF	3.36	

Source: Authors' calculation