COMPARING THE CONTRIBUTIONS OF "HARD" AND "SOFT" LOGISTICS TO MULTINATIONAL ENTERPRISES' LOCATION CHOICES
SO SÁNH ĐÓNG GÓP GIỮA THÀNH PHẦN "CỨNG" VÀ "MỀM" CỦA LOGISTICS TRONG QUYẾT ĐỊNH LỰA CHỌN ĐIỂM ĐẾN CỦA CÁC DOANH NGHIỆP ĐA QUỐC GIA

Hoang Thanh Hien*

FPT University, Danang, Vietnam

*Corresponding author: hienht57@fe.edu.vn

Abstract - This study examines how the "hard" (physical infrastructure) and "soft" (institutional, service, and organizational) components of logistics systems affect multinational enterprises' investment decisions in Vietnam. Building on the Knowledge-Capital model and using bilateral data between Vietnam and its main FDI partner countries, the empirical results show that FDI inflows respond primarily to the quality of hard logistics infrastructure, whereas the soft component of logistics does not exert a statistically significant effect. These findings suggest that, to enhance its competitiveness in attracting FDI, Vietnam should prioritize resources for the development and upgrading of physical logistics infrastructure, while simultaneously pursuing complementary institutional reforms.

Key words – Knowledge capital model; Multinational enterprises; Hard and soft logistics infrastructure; Vietnam

Tóm tắt - Nghiên cứu này phân tích mức độ mà các cấu phần "cứng" (hạ tầng vật chất) và "mềm" (thể chế, dịch vụ và tổ chức) của hệ thống logistics ảnh hưởng đến quyết định đầu tư của các doanh nghiệp đa quốc gia vào Việt Nam. Dựa trên khung mô hình Vốn tri thức (Knowledge Capital model) và sử dụng dữ liệu song phương giữa Việt Nam và các đối tác đầu tư chủ chốt, kết quả thực nghiệm cho thấy dòng vốn FDI phản ứng chủ yếu với chất lượng hạ tầng logistics "cứng", trong khi thành phần "mềm" của logistics không cho thấy tác động có ý nghĩa thống kê. Các bằng chứng này hàm ý rằng, để nâng cao khả năng cạnh tranh trong thu hút FDI, Việt Nam cần ưu tiên nguồn lực cho phát triển và nâng cấp hạ tầng logistics vật chất, đồng thời tiếp tục triển khai các cải cách thể chế hỗ trợ.

Từ khóa – Knowledge capital model; Doanh nghiệp đa quốc gia, Hạ tầng logistics "cứng" và "mềm", Việt Nam

1. Introduction

Over more than three decades of economic reform and international integration, Vietnam has consolidated its position as one of the strategic destinations for foreign direct investment (FDI) in Southeast Asia. FDI inflows not only serve as a key driver of economic growth but also constitute an important channel for technology transfer and integration into in global value chains. However, amid the post-COVID-19 restructuring of supply chains, national competitiveness is facing substantial challenges stemming from logistics costs. According to the Vietnam Logistics Report 2023, these costs currently account for 16–18% of GDP, significantly higher than the global average of 10–12% [1]. This situation creates a barrier to economic efficiency and underscores the urgent need to develop a logistics system that seamlessly connects production hubs with international gateways in order to sustain the momentum of investment attraction.

The association between logistics capacity and FDI inflows has been widely documented in empirical research. Empirical estimates indicate that a one-point increase in the Logistics Performance Index (LPI) can raise FDI inflows by an average of 7–8% [2]. In Vietnam, a notable fact is that although the country's LPI ranking declined from 39th in 2018 to 43rd [3], newly registered FDI still remained high, reaching approximately USD 36.6 billion in 2023 [4]. This observation suggests substantial room for investment growth if logistics infrastructure continues to improve, while also highlighting the need to identify location advantages within Dunning's OLI theoretical framework [5].

Nevertheless, international empirical evidence on the effects of logistics performance on FDI attraction remains inconclusive. Some studies show that the impact of the LPI may be statistically insignificant or even negative, reflecting the complexity of moderating factors such as institutional quality [6]. For Vietnam, existing studies, while affirming the role of logistics, often do not clearly distinguish the respective contributions of physical infrastructure and institutional and service-related factors [7]. In addition, the limited publication frequency of LPI data generates certain gaps in long-term time-series analysis.

To address these issues, this study evaluates the impact of bilateral logistics capacity on FDI inflows into Vietnam over the period 2007–2024. The paper's academic contributions are threefold. First, rather than adopting a unilateral approach, the study constructs a bilateral logistics index to capture the connectivity of international supply chains. Second, the composite index is decomposed into two components: hard logistics and soft logistics, thereby enabling a comparison of the relative contributions of physical infrastructure versus service-related institutional factors, an approach that has been less explored in prior Vietnam-based research. Finally, the empirical findings provide important evidence on the

"misalignment" in the effects of these two groups of factors, thereby suggesting specific policy priorities to optimize Vietnam's FDI attraction strategy.

2. Literature review

The relationship between logistics performance and foreign direct investment (FDI) inflows is primarily explained within Dunning's Ownership–Location–Internalization (OLI) framework [5, 8]. In this framework, logistics represents a location advantage because it helps reduce transaction costs, mitigate supply-chain disruption risks, and improve connectivity to global value chains [6, 9]. Transaction cost theory [10] and internalization theory [11] further complement the OLI framework by emphasizing that efficient logistics lowers coordination costs and contractual risks, thereby enabling multinational enterprises (MNEs) to internalize cross-border production activities. Meanwhile, Krugman's core–periphery theory [12] extends the analysis to the spatial dimension, arguing that lower transport and logistics costs promote the concentration of production and FDI in economic cores with well-developed infrastructure. Together, these foundations indicate that logistics functions both as a micro-level cost factor and as a macro-level condition shaping global investment flows.

Cross-country empirical studies generally confirm a positive relationship between logistics performance and FDI, yet the magnitude and even the sign of the effect are not uniform across countries. In the Asia–Pacific region, Wannisinghe et al. [9] find that the Logistics Performance Index (LPI), the Global Competitiveness Index (GCI), and interest rates are major determinants of FDI. However, the higher LPI increases FDI only in India, South Korea, Lebanon, and Oman, while exerting a negative effect in China, Kuwait, and the Philippines. This result implies that logistics is a necessary but not sufficient condition; its impact depends on institutional quality and macroeconomic conditions. In Africa, Rathnayake et al. [13] report similar findings: the LPI promotes FDI in Gambia, Lesotho, and Rwanda, but restrains FDI in Mauritius. At the global level, Luttermann et al. [2] estimate that each one-point increase in the LPI can raise FDI inflows by approximately 7–8%. Other regional analyses, such as Çelebi [14] and Saidi et al. [15], also confirm the intermediary role of logistics in the nexus between trade, FDI, and economic growth.

Another strand of research highlights the role of domestic transport infrastructure in shaping location advantages. Halaszovich and Kinra [6] show that road and rail infrastructure has a stronger impact on FDI than cross-national infrastructure, because it directly reduces the "economic distance" cost and enhances participation in global value chains. Kalansuriya et al. [16], focusing on OECD countries, likewise indicate that a 1% increase in investment in road or rail infrastructure can lead to an approximately 0.3% increase in FDI inflows, underscoring the pivotal role of hard infrastructure in attracting investment. Nevertheless, "soft infrastructure" factors - such as the efficiency of customs procedures, legal transparency, and the reliability of logistics services - also exert considerable influence, particularly for industries that are highly sensitive to delivery times [7].

Heterogeneity in the logistics–FDI relationship reflects the moderating role of institutions and the macroeconomic environment. Soh et al. [17] argue that logistics exerts positive effects only when institutional quality has not exceeded a certain threshold; beyond that threshold, the effect may weaken or even reverse as compliance costs increase. Other factors such as interest rates, national competitiveness, and macroeconomic stability are also important moderators [9, 13]. In addition, the logistics–FDI relationship is described as bidirectional: high-quality logistics attracts FDI, while FDI brings capital, technology (green innovation), and total factor productivity (TFP) gains that help upgrade the logistics sector itself [18].

Several representative studies on Vietnam indicate that logistics performance positively affects FDI attraction. Huynh [7] demonstrates that improvements in the LPI significantly influence FDI inflows into Vietnam over the period 2010–2018, especially when combined with factors such as market size, labor quality, and bilateral trade agreements. This finding reflects Vietnam's role as a hub in regional value chains, where efficient logistics reduces costs, accelerates goods circulation, and strengthens foreign investors' confidence.

From the above literature, three limitations emerge that this study seeks to address. First, existing analyses have largely not examined FDI inflows specifically from Vietnam's key trade partners, and thus have not fully captured bilateral pull factors. Second, most studies have not incorporated the post-pandemic adjustment of global value chains; by contrast, this study exploits the latest LPI dataset available up to 2023. Third, a systematic approach that clearly separates "hard" logistics (physical infrastructure) from "soft" logistics (customs procedures, the degree of transparency, and the stability of the legal framework) remains relatively underdeveloped.

3. Methodology

3.1. Research model

The theoretical foundation of this study is based on the Knowledge-Capital (KC) model developed by Markusen and Maskus [19]. This model provides a comprehensive analytical framework for explaining multinational enterprises' (MNEs') international investment decisions through the interaction between two FDI motives: horizontal and vertical FDI. Horizontal FDI typically arises between countries with similar economic size to expand market access, whereas vertical FDI is associated with differences in production costs and development levels, allowing firms to fragment value chains to optimize costs and efficiency.

Building on this foundation, the study develops a regression model that combines the core elements of KC theory with a gravity-model structure, an approach widely used in studies of international trade and investment. This approach allows logistics to be examined as an important transmission channel: it affects trade costs related to

horizontal FDI motives and influences supply-chain efficiency and production costs associated with vertical FDI. The general empirical model is specified as follows:

$$FDI_{ijt} = \beta_0 + \beta_1 logistics_{ijt} + \beta_2 SIMI_{ijt}$$
$$+\beta_3 DSK_{ijt} + \beta_4 X_{ijt} + \alpha_i + \gamma_t + \varepsilon_{ijt} \qquad (1)$$

where, the dependent variable FDI_{ijt}, denotes FDI flows from partner countries (i) to Vietnam (j) in year t. The main explanatory variable, $logistics_{ijt}$, represents bilateral logistics performance and is expected to have a positive effect on FDI. The model incorporates two variables representing the KC hypotheses: $SIMI_{ijt}$ measures similarity in economic size to test the horizontal FDI motive, and DSK_{ijt} measures differences in human capital to test the vertical FDI motive[1]. The vector X_{ijt} includes standard control variables commonly used in empirical FDI research, such as geographical distance, trade openness, and institutional quality. The model also includes partner-country fixed effects (α_i) to control for time-invariant characteristics of each investing partner, and time fixed effects (γ_t) to control for common global shocks.

3.2. Data and variables

The study employs an unbalanced panel dataset comprising 31 countries that are Vietnam's major investment partners, including both developed and developing economies. This group accounts for a dominant share of total FDI and includes: India, Poland, Belgium, Brunei, Canada, Taiwan, Denmark, Germany, the Netherlands, South Korea, the United States, Hong Kong, Indonesia, Macau, Malaysia, Russia, Norway, New Zealand, Japan, France, the Philippines, Cyprus, Singapore, Thailand, Turkey, Sweden, Switzerland, China, Australia, the United Kingdom, and Italy. The study period spans 2007–2024, chosen to align with the World Bank's reporting rounds of the Logistics Performance Index (LPI). To ensure the accuracy and objectivity of the original data, the study uses only years with officially published data and does not apply interpolation methods for missing years. Accordingly, the unbalanced panel is constructed based on the World Bank's actual reporting years. The main objective is to examine the effect of bilateral logistics capacity on the scale of FDI inflows into Vietnam by analyzing barriers at both ends of the supply chain.

The core explanatory variable is bilateral logistics performance (BLPI). This variable is constructed based on the theoretical view that international supply-chain performance depends simultaneously on the logistics capacity of both the capital-exporting country and the host country. To reflect this interaction as well as the effects of bottlenecks along the supply chain, BLPI is calculated as the geometric mean of the overall LPI scores for Vietnam

and partner country i at time t:

$$BLPI_{ijt} = \sqrt{LPI_{it}LPI_{jt}} \qquad (2)$$

where, LPI_{it} is the LPI score of partner country i at time t, LPI_{jt} is Vietnam's LPI score at the same time. Using the geometric mean allows the index to more clearly capture bottleneck effects in supply chains, because very low logistics performance on either side substantially reduces the overall efficiency of the bilateral connection, consistent with the operational logic of global value chains.

To further analyze transmission channels and assess robustness, BLPI is decomposed into two structural components: hard logistics and soft logistics. Hard logistics (HBLPI) represents the quality of tangible physical infrastructure, measured by the infrastructure component score in the LPI. Soft logistics (SBLPI) reflects the effectiveness of processes, institutions, and supporting services. This variable is constructed using two methods: (i) taking the arithmetic mean of the remaining five LPI components, or (ii) applying principal component analysis (PCA) to extract a composite factor. Similar to the overall index, both HBLPI and SBLPI are computed as geometric means between Vietnam and the partner country to test the distinct roles of infrastructure and institutions in shaping FDI inflows [6, 7].

Table 1. *Summary statistics*

Variables	Mean	Std.dev	Min	Max
BLPI: Bilateral LPI in equation (2)	3.38	0.23	2.62	3.82
SFDI: logarithm of accumulated FDI	7.46	1.95	3.21	11.18
FDIF: annual FDI inflow (mil.USD)	701.4	1636.1	0.00	14969.2
SIMI: economic size similarity	0.31	0.15	0.02	0.50
DSK: human-capital differences	2.25	0.95	0.02	3.80
OPEN: Openness to trade	1.02	0.80	0.23	4.43
INST1: Institution quality using average calculation	0.74	0.21	0.16	0.99
INST2: Institution quality using PCA	0.12	2.22	-6.25	2.61
DIST: Distance	8916.93	16723.2	806.60	98284.6
HLPI: hard logistics (infrastructure)	3.38	0.27	2.59	3.90
SLPI1: soft logistics using average	3.32	0.20	2.62	3.70
SLPI2: soft logistics using PCA	0.11	2.04	-6.37	3.31

Source: Author's calculation

The dependent variable is measured using two indicators to capture both long-run accumulation and short-run fluctuations. The first measure is the natural logarithm of cumulative FDI stock from the partner

---

[1] $SIMI_{ijt}$ is computed as: $SIMI_{ijt} = \left\{ 1 - \left[\frac{GDP_{it}}{GDP_{it}+GDP_{jt}} \right]^2 - \left[\frac{GDP_{jt}}{GDP_{it}+GDP_{jt}} \right]^2 \right\}$ to capture the equivalence in economic size between the partner country and Vietnam. DSK_{ijt} is computed as: $\left| ln(percapita\ GDP_{it}) - ln(percapita\ GDP_{jt}) \right|$ to measure skill differences between the partner country and Vietnam.

country to Vietnam, reflecting capital accumulation over time. The second measure is annual net FDI inflows in million USD, representing new capital allocation decisions in each period. Using both dependent variables enables a consistency check of estimation results under different FDI flow dynamics.

To control for other macro-level factors and mitigate omitted-variable bias, the model includes additional standard controls. Trade openness (OPEN) captures the degree of international economic integration of the partner country. Institutional quality (INST) is constructed from the Worldwide Governance Indicators (WGI) dataset and is computed using a method analogous to that used for the soft logistics variable. Data on investment and macroeconomic indicators are collected from the World Bank, UNCTAD, and the CEPII GeoDist database, with monetary variables deflated to the 2015 base year using the GDP deflator to ensure real comparability.

3.3. Estimation methods

The study employs two complementary estimation techniques: a fixed-effects model with Driscoll–Kraay standard errors (FE–DK) and the Poisson Pseudo Maximum Likelihood (PPML) estimator. Combining these methods reflects the characteristics of bilateral FDI data and enables the study to address econometric issues commonly encountered in analyzing investment flows. The dataset includes FDI flows from multiple countries into Vietnam over 2007–2024, while the LPI is reported only for selected years. The number of time periods is relatively limited, and common shocks - such as the global financial crisis and the COVID-19 pandemic - may induce cross-sectional dependence across countries, making conventional clustered standard errors less reliable.

To address this issue, the study applies Driscoll–Kraay standard errors within a fixed-effects framework [20]. This approach provides standard errors that are robust to heteroskedasticity, serial correlation, and cross-sectional dependence when the cross-sectional dimension is large but the time dimension is relatively small, and is therefore particularly suitable for macro panel data subject to common shocks [21]. The FE–DK model exploits within-country variation over time while removing unobserved time-invariant characteristics, thereby improving the reliability of statistical inference on the effects of logistics performance on FDI.

In addition, annual bilateral FDI data often contain many zero observations and exhibit substantial heteroskedasticity. In this context, log-linear models such as OLS or conventional fixed effects can yield biased and inconsistent estimates [22]. PPML is selected because it can handle zero values directly and remains consistent under general forms of heteroskedasticity; PPML is now regarded as a benchmark estimator in studies of international trade and investment [23]. Implementing FE–DK and PPML in parallel enables cross-validation of the estimation results, thereby providing more robust evidence on the impact of logistics performance on FDI inflows into Vietnam. Finally, the study conducts a series

of robustness checks, including adding variables capturing free trade agreements, estimating separate models for developed and developing country groups, and replacing BLPI with measures of hard logistics and soft logistics.

4. Estimation results

4.1. Baseline estimation results

Table 2 reports regression results from two estimation approaches: the fixed-effects model with Driscoll–Kraay standard errors (FE–DK) and the Poisson Pseudo Maximum Likelihood (PPML) model. The results indicate that the bilateral logistics performance index (BLPI) exerts a positive and statistically significant effect on FDI into Vietnam under both specifications, thereby supporting the study's central hypothesis regarding the facilitating role of logistics for FDI.

Table 2. Baseline results using DK and PPML estimations

	FE-DK (1) SFDI	PPML (2) FDIF
BLPI	0.729**	1.800***
	(0.215)	(0.669)
SIMI	7.685***	-1.098
	(1.959)	(1.756)
DSK	0.172	0.865**
	(0.274)	(0.518)
OPEN	-0.471***	-0.564*
	(0.110)	(0.315)
INST1	-2.565***	-1.435
	(0.687)	(2.548)
DIST	0.518	-1.783***
	(0.163)	(0.390)
_cons	0.000	14.785***
	(.)	(3.709)
Observations	205	205
Within R^2/Pseudo R^2	0.188	0.411
F/chi^2	75547.792	48.131
P_value	0.000	0.000

Source: Author's calculation

Note: Standard errors are reported in parentheses. *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively.

In the FE model with Driscoll–Kraay standard errors reported in column (1), the dependent variable is defined as the natural logarithm of cumulative FDI stock. The estimated coefficient on BLPI is 0.729 and is statistically significant at the 5% level. In economic terms, this result implies that a 0.1-point improvement in the bilateral logistics performance index is associated with an approximately 7.3% increase in cumulative FDI stock from the partner country to Vietnam, holding other factors constant. This finding indicates that upgrades in the logistics system play an essential role in long-run capital accumulation and is fully consistent with prior empirical evidence by Luttermann et al. [2] on the positive association between the LPI and FDI inflows.

For the PPML model in column (2), the dependent variable is annual realized FDI inflows, capturing short-run

responses in investors' capital allocation decisions. The coefficient on BLPI is 1.800 and is statistically significant at the 1% level. This estimate suggests that a 0.1-point increase in BLPI may lead to an expected increase of approximately 19.7% in annual FDI inflows. This effect is not only statistically significant but also economically substantial, consistent with Huynh [7], who considers logistics a critical infrastructure foundation that enhances the attractiveness of the investment environment. The consistency in sign and statistical significance across the two estimation methods, despite differences in data properties, indicates that the positive relationship between logistics and FDI is robust.

Beyond the key variable of interest, the KC-theory-based controls provide additional insights into investment motives. The SIMI variable, capturing similarity in economic size, exhibits a strong positive effect in the DK model, supporting the hypothesis of a horizontal FDI motive aimed at serving comparable domestic consumer markets. By contrast, in the PPML model, the DSK variable measuring labor-skill differentials has a positive and statistically significant effect. This suggests that differences in human capital between Vietnam and partner countries motivate new vertical FDI, as investors seek cost advantages or specialization capabilities within global value chains.

The estimates also record a negative effect of trade openness on investment in both models. The negative coefficient on OPEN suggests a substitution relationship between trade and investment, whereby lower trade costs may encourage firms to export rather than establish production facilities abroad. In addition, institutional quality in the partner country (INST1) has a negative effect on cumulative investment, implying that better institutional environments in source countries tend to retain domestic capital. Geographic distance (DIST) is positive (statistically insignificant) in the FE model but turns negative (consistent with theoretical expectations) and statistically significant in the PPML model. This reflects the advantage of PPML in handling gravity-type data relative to conventional FE models, which often face limitations in estimating time-invariant variables and are more susceptible to multicollinearity.

Overall, the quantitative analyses confirm that bilateral logistics performance is a key factor contributing to partner countries' decisions to expand investment in Vietnam. Although both models yield consistent results regarding the direction of the BLPI effect, PPML is considered technically superior due to its ability to effectively handle data with many zero values and the heteroskedasticity commonly present in international capital-flow data, as recommended by Silva and Tenreyro [22, 23]. Therefore, PPML is used as the primary basis for extended analyses and robustness checks in subsequent sections to enhance the credibility of the study's conclusions.

4.2. Robustness checks

To ensure the reliability and validity of the main findings reported above, the study conducts a series of robustness checks by varying model specifications. Detailed regression results are presented in Table 3,

focusing on three main approaches: altering the institutional control measure, testing heterogeneity across country groups, and decomposing the logistics index into its components. All estimates use PPML to maintain consistency with the preferred baseline framework.

The first approach, shown in column (1), addresses potential sensitivity to the measurement of institutional quality. In this specification, the original institutional variable is replaced with the composite index INST2 constructed using principal component analysis (PCA). The estimated coefficient on BLPI remains positive, with a value of 1.697, and is statistically significant at the 5% level. The magnitude is nearly identical to that of the baseline model, indicating that the positive relationship between bilateral logistics performance and FDI inflows is present and does not depend on alternative institutional measures.

Table 3. Robustness checks

	PPML (1) FDIF	PPML (2) FDIF	PPML (3) FDIF	PPML (4) FDIF
BLPI	1.697**	1.468**		
	(0.659)	(0.629)		
DEV*BLPI		0.110		
		(0.156)		
HBLPI			1.953**	2.020**
			(0.963)	(0.904)
SBLPI1			-0.673	
			(1.433)	
SBLPI2				-0.152
				(0.254)
SIMI	-1.400	-1.201	-0.378	-0.360
	(1.645)	(1.659)	(1.680)	(1.677)
DSK	0.691*	0.848*	0.955*	0.962*
	(0.497)	(0.536)	(0.538)	(0.538)
OPEN	-0.519	-0.533*	-0.599*	-0.597*
	(0.324)	(0.322)	(0.326)	(0.326)
INST2	-0.057			
	(0.226)			
INST1		-1.468	-1.689	-1.696
		(2.222)	(2.298)	(2.277)
DIST	-1.768***	-1.893***	-1.827***	-1.830***
	(0.394)	(0.300)	(0.407)	(0.409)
_cons	14.419***	16.795***	16.773***	14.096***
	(4.456)	(2.610)	(4.364)	(2.727)
Observations	205	205	205	205
Pseudo R²	0.409	0.417	0.426	0.427
chi2	44.866	62.640	48.363	47.994
Fp	0.000	0.000	0.000	0.000

Source: Author's calculation

*Note: Standard errors are reported in parentheses. *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively.*

The second approach tests whether the effect of logistics differs between groups of countries at different development levels. In column (2), the model adds an interaction term between BLPI and the dummy variable DEV, which equals 1 if the partner country is classified as a developed economy under the World Bank classification and 0 otherwise. The results show that while the BLPI coefficient remains statistically significant with a similar magnitude (1.468), the interaction term is very small (0.110) and statistically

insignificant. This implies that the promoting role of logistics for FDI inflows into Vietnam is homogeneous, with no meaningful difference between investors from developed and developing countries. Therefore, improving logistics capacity is expected to generate broadly shared investment-attraction benefits across all partners.

The third approach, presented in columns (3) and (4), identifies specific channels by decomposing BLPI into two groups: hard logistics (HBLPI) and soft logistics (SBLPI). The empirical results reveal a clear contrast. HBLPI has a positive and large estimated coefficient (1.953 and 2.020, respectively) and is statistically significant at the 5% level in both specifications. In contrast, proxies for soft logistics - SBLPI1 and SBLPI2 - are statistically insignificant. This finding suggests that the primary FDI-enhancing mechanism through logistics operates through the quality of physical infrastructure, such as seaports, transport networks, and warehousing facilities, rather than procedural or service-capacity factors. This conclusion is fully consistent with Halaszovich and Kinra [6], who argue that physical infrastructure plays a core role in reducing transaction costs and connecting to global supply chains.

In addition to the main variables, the control variables in the robustness specifications remain highly consistent with the baseline model. Geographic distance (DIST) and trade openness (OPEN) continue to exhibit statistically significant negative effects, while skill differentials (DSK) remain positive. Taken together, the stability of coefficient signs, significance levels, and magnitudes across multiple estimation scenarios provides convincing evidence that bilateral logistics performance - particularly the hard-infrastructure dimension - is a robust and important determinant of FDI inflows into Vietnam.

4.3. Discussion

The results confirm that bilateral logistics performance is an important determinant that exerts a positive and substantial impact on both annual net FDI inflows and cumulative FDI stock in Vietnam. This finding not only reinforces earlier empirical evidence but also extends understanding of the mechanism through which logistics affects international investment decisions in the context of deep integration into global value chains. The positive and statistically significant BLPI coefficients in both the FE–DK and PPML models indicate that improvements in logistics reduce transaction costs, shorten economic distance, and enhance supply-chain efficiency, consistent with Luttermann et al. [2] and Saidi et al. [15], as well as with the OLI framework in which location factors and logistics costs constitute key components of location advantage.

When the composite logistics index is decomposed into two groups, the positive effect is driven mainly by the hard-infrastructure component. The statistically significant HBLPI coefficients indicate that the quality of physical infrastructure - such as seaports, airports, railways, and domestic transport networks - is the dominant factor influencing FDI attraction, whereas the soft-logistics indicators are not statistically significant. This aligns with Halaszovich and Kinra [6], who argue that investment in

physical infrastructure reduces economic-distance costs, and is consistent with Kalansuriya et al. [16] regarding the role of infrastructure in strengthening competitiveness in FDI attraction. The absence of a statistically clear effect for soft logistics may stem from Vietnam's development conditions during the study period. Foreign investors appear to prioritize the availability of physical infrastructure (transport connectivity and seaports) to ensure basic goods circulation. Moreover, institutional and procedural reforms (soft logistics) often entail longer lags before translating into tangible, perceived efficiency gains compared with visible infrastructure projects.

At the same time, differences in the effects of control variables suggest the concurrent presence of horizontal and vertical FDI motives. The positive and significant SIMI effect in the FE–DK model indicates that investors from economies with sizes similar to Vietnam tend to pursue long-term, market-seeking projects, reflecting horizontal FDI. Conversely, the positive and significant DSK effect in the PPML model implies that short-run, more responsive capital flows aim to exploit labor and production-cost advantages, which is characteristic of vertical FDI. This indicates that Vietnam functions both as an expanding consumer market and as a production location within global value-chain networks.

5. Conclusion and policy implications

This study provides empirical evidence on the role of bilateral logistics performance in shaping foreign direct investment (FDI) inflows into Vietnam over the period 2007–2024. By applying a fixed-effects model with Driscoll–Kraay standard errors and the Poisson Pseudo Maximum Likelihood (PPML) estimator, the analysis confirms a positive relationship with strong statistical significance between logistics capacity and international investment activity. Specifically, improvements in the logistics index exert positive effects on both annual net FDI inflows and long-run cumulative FDI stock. A central finding is the dominant role of physical infrastructure, or "hard" logistics, whereas "soft" logistics factors - such as customs procedures - do not exhibit a clear influence. This implies that, from foreign investors' perspective, the quality of transport infrastructure remains a fundamental prerequisite.

Based on the quantitative results, several important policy implications are proposed to enhance national competitiveness. First, the Government should continue to prioritize resources for strategic logistics infrastructure projects, focusing on upgrading deep-water ports, modernizing airports, and completing transport networks that connect industrial zones with export gateways. In parallel, Vietnam should proactively promote bilateral and multilateral cooperation to establish cross-border logistics corridors, including harmonizing customs standards and sharing supply-chain data. Although the statistical results do not emphasize the impact of soft logistics, administrative procedure reform and efforts to strengthen the capabilities of domestic logistics service firms should still be implemented in a coordinated manner to build a sustainable logistics ecosystem.

Despite its contributions, the study has several limitations that warrant careful consideration. First, because the LPI is not published annually, the unbalanced panel may not fully capture short-run fluctuations or policy lags. Second, the country-level analysis does not allow identification of heterogeneous logistics effects across industries or specific types of investment. Third, endogeneity arising from the bidirectional relationship between infrastructure development and investment attraction remains a methodological challenge, as FDI inflows may also act as a driver of logistics system upgrades. Given the discontinuous structure of the World Bank's LPI data across years, using lagged variables to fully address endogeneity is not feasible if the study aims to preserve sample size and the accuracy of the original data. Therefore, the estimated results should be interpreted cautiously as conditional evidence of a strong correlation, serving as a reference for policy formulation.

Future research may extend the analysis to provide a more comprehensive perspective. Using alternative logistics indicators with higher frequency - such as customs clearance time or transport costs - would help quantify short-run effects more precisely. In addition, firm-level microdata analysis is a necessary complement to identify which sectors benefit most from logistics improvements, thereby supporting targeted policy design. Methodologically, applying instrumental-variable techniques or dynamic panel models would better address endogeneity concerns. Finally, research on green logistics is a promising direction in the context of attracting FDI aligned with sustainable development.

REFERENCES

[1]   V. Ha. Enhancing National Logistics Competitiveness: A Business Perspective, *tapchicongthuong.vn*, 2025 [Online]. Available: https://tapchicongthuong.vn/nang-cao-nang-luc-canh-tranh-logistics-quoc-gia--goc-nhin-tu-doanh-nghiep-333290.htm. [Accessed: November 30, 2025]

[2]   S. Luttermann, H. Kotzab, and T. Halaszovich, "The impact of logistics performance on exports, imports and foreign direct investment," *World Review of Intermodal Transportation Research,* vol. 9, pp. 27-46, 2020.

[3]   B. World, *"Connecting to Compete 2023: Trade Logistics in an Uncertain Global Economy*," World Bank, Washington, DC2023.

[4]   UNCTAD, "*World Investment Report 2024: Investing in Sustainable Energy for All*," United Nations Conference on Trade and Development, Geneva, Switzerland 2024.

[5]   J. H. Dunning, "Towards a New Paradigm of Development: Implications for the Determinants of International Business," *Transnational Corporations,* vol. 15, p. 56, 2006.

[6]   T. Halaszovich and A. Kinra, "The impact of distance, national transportation systems and logistics performance on FDI and international trade patterns: Results from Asian global value chains," *Transport Policy,* vol. 98, pp. 35-47, 2020-11-01 2020.

[7]   L. T. D. Huynh, "Studying relationships between logistics and foreign direct investment in Vietnam," *Journal of Economic Studies,* vol. 7, pp. 35-44, 2022.

[8]   J. H. Dunning, "Toward an Eclectic Theory of International Production: some empirical Tests," *Journal of International Business Studies,* vol. 11, pp. 9-31, 1980.

[9]   P. Wannisinghe, S. Jayakody, S. Rathnayake, D. Wijayasinghe, R. Jayathilaka, and N. Madhavika, "Determining the influence of LPI, GCI and IR on FDI: A study on the Asia and Pacific Region," *PloS one,* vol. 18, p. e0281246, 2023.

[10] O. E. Williamson, "Transaction cost economics," *Handbook of industrial organization,* vol. 1, pp. 135-182, 1989.

[11] P. J. Buckley and M. Casson, "A long-run theory of the multinational enterprise," in *The future of the multinational enterprise*, ed: Springer, 1976, pp. 32-65.

[12] P. Krugman, "Increasing Returns and Economic Geography," *Journal of Political Economy,* vol. 99, pp. 483-499, 1991.

[13] S. Rathnayake, S. Jayakody, P. Wannisinghe, D. Wijayasinghe, R. Jayathilaka, and N. Madhavika, "Macroeconomic factors affecting FDI in the African region," *PLOS ONE,* vol. 18, 2023-01-23 2023.

[14] Ü. Çelebi, "The impact of logistics performance index upon Gross Domestic Product: mediating roles of foreign direct investment and patents," *Journal of Global Strategic Management,* vol. 14, pp. 29-44, 2021.

[15] S. Saidi, V. Mani, H. Mefteh, M. Shahbaz, and P. Akhtar, "Dynamic linkages between transport, logistics, foreign direct Investment, and economic growth: Empirical evidence from developing countries," *Transportation Research Part A: Policy and Practice,* vol. 141, pp. 277-293, 2020.

[16] N. Kalansuriya*, et al.*, "Analysing the influence of logistics, corruption, FDI and GDP on global competitiveness: A cross-sectional study," *Journal of the Knowledge Economy,* vol. 15, pp. 13532-13551, 2024.

[17] K. Soh, W. Wong, and C. Tang, "The role of institutions at the nexus of logistic performance and foreign direct investment in Asia," *The asian journal of shipping and logistics,* vol. 37, pp. 165-173, 2021.

[18] W. Song and X. Han, "The bilateral effects of foreign direct investment on green innovation efficiency: Evidence from 30 Chinese provinces," *Energy,* vol. 261, p. 125332, 2022.

[19] J. R. Markusen and K. E. Maskus, "General-equilibrium approaches to the multinational firm: A review of theory and evidence," National Bureau of Economic Research2001.

[20] J. C. Driscoll and A. C. Kraay, "Consistent covariance matrix estimation with spatially dependent panel data," *Review of economics and statistics,* vol. 80, pp. 549-560, 1998.

[21] D. Hoechle, "Robust standard errors for panel regressions with cross-sectional dependence," *The stata journal,* vol. 7, pp. 281-312, 2007.

[22] J. S. Silva and S. Tenreyro, "The log of gravity," *The Review of Economics and statistics,* vol 88, no. 4, pp. 641-658, 2006.

[23] J. S. Silva and S. Tenreyro, "Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator," *Economics Letters,* vol. 112, pp. 220-222, 2011.