Southeast Asian Journal of Economics Vol.13(3), December 2025:
Received: May 9, 2024
Revision: July 1, 2024
Accepted: January 3, 2025

FDI and Labor: A Dynamic Duo for Vietnam's Provincial Exports

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Abstract

This study investigates the interconnected roles of foreign direct investment (FDI) and labor in driving provincial export performance in Vietnam. Employing the Feasible Generalized Least Squares method and secondary data covering 63 provinces from 2017 to 2022, the research reveals a nuanced relationship between FDI and labor indicators. The result indicates that FDI, skilled labor, and labor size individually boost exports. Furthermore, the impact of FDI on exports might be amplified when combined with a skilled labor force; however, the interaction between FDI and labor size may negatively impact provincial exports due to resource constraints and skill mismatches. These findings underscore the importance of strategic FDI policies and investments in human capital development to foster sustainable and competitive provincial export growth in Vietnam.

Keywords: FDI, export performance, Vietnam, labor force, labor quality, FGLS.

1. Introduction

Export is an essential part of international trade, and the earnings from export stimulate overall economic growth (Nguyen, 2016). Policymakers, especially in developing countries, must identify fundamental factors affecting export performance. These factors can be firm level characteristics, such as its production capacity, product quality, innovation, marketing strategy, pricing, and human resources (Katsikeas et al., 1996; Lipuma et al., 2013), or country characteristics, such as GDP, trade liberalization, exchange rate, foreign direct investment (FDI), institutional quality, and labor (Jongwanich, 2010; Abreo et al., 2021; Uysal & Abdulakadir, 2018; Okechukwu, 2018; Bilgin et al., 2018; Bandyopadhyay, 2020; Chowdhury & Audretsch, 2014).

The literature on export and FDI remains inconclusive on the existence of a substitution or a complementary relationship. References in the literature on trade models and FDI studies demonstrate that, depending on the circumstances, FDI and export may relate positively, as complements, as well as negatively, as substitutes (Magalhaes & Africano, 2018). Within the context of Vietnam, the country has experienced substantial economic integration, evidenced by a dramatic surge in FDI inflows. The Ministry of Planning and Investment's report shows that by the end of 2022, Vietnam's cumulative registered FDI capital had reached nearly 81 billion USD, with around 9500 projects. This is a 45-fold increase in both FDI capital and project number compared to the early 1990s. In 2020, Vietnam was for the first time in the top 20 countries receiving the most FDI inflows in the world (UNCTAD, 2021). Notably, foreign-invested enterprises have contributed significantly to Vietnam's import and export activities, accounting for approximately 73.74% of total exports and 65% of total imports in 2022 (Thanh & Thanh, 2024).

As shown in Appendix 1, export turnover exhibits significant variability among provinces and cities. For the period from 2017 to 2022, the total accumulated export turnover ranged from 89.92 million USD in Bac Kan province to nearly

253,000 million USD in Ho Chi Minh City. Notably, six localities have achieved an accumulated turnover exceeding 100 billion USD, including Ho Chi Minh City, Bac Ninh, Binh Duong, Dong Nai, Thai Nguyen, and Hai Phong. It is important to highlight that the majority of these localities with substantial export turnover also possess significant total FDI capital. For instance, provinces Ho Chi Minh City, Binh Duong, Dong Nai, Hai Phong, and Bac Ninh ranked among the top localities in terms of accumulated FDI capital by 2022, with values ranging from 25 to 55 billion USD. These observations suggest a potential positive correlation or complementary relationship between FDI and provincial exports. A more in-depth examination of this relationship could contribute valuable insights to the existing empirical literature on the interplay between FDI and trade.

In addition, data from the Ministry of Labor, Invalids, and Social Affairs also reveals a substantial expansion of employment within FDI enterprises. The workforce in this sector surged from 1.44 million in 2010 to 3.78 million by 2016, representing a 1.75-fold increase. This growth trajectory continued, with the number of employees reaching 5.09 million in 2022, marking a 1.35-fold increase compared to 2016. On average, the sector has absorbed over 360,000 new workers annually. Beyond direct employment, the FDI sector has also generated indirect job opportunities across supporting industries and businesses involved in the supply chain of FDI enterprises.

Employees within FDI enterprises also benefit from training programs, skill enhancement opportunities, exposure to advanced technologies, and the cultivation of organizational and industrial acumen. In the early stages of attracting foreign investment, labor was often concentrated in a number of labor-intensive manufacturing industries such as Textiles, Garments, and Footwear. However, currently, the proportion of labor in some high-tech manufacturing industries is increasing rapidly. The FDI sector also makes an important contribution to improving the quality of Vietnam's human resources through internal training

systems within enterprises, or linking with training facilities outside enterprises. Appendix 1 also presents the average values of the trained labor rate and labor size for the 63 provinces and cities during the research period from 2017 to 2022.

Existing research primarily concentrates on the direct influence of FDI on trade, particularly exports. However, it is essential to acknowledge that FDI can also interact synergistically with other factors, such as labor, to enhance export performance. To the best of the author's knowledge, the literature has yet to comprehensively elucidate this synergistic effect.

The primary objective of this study is to empirically examine the direct and synergistic impacts of FDI and labor on exports within Vietnamese provinces. Employing panel data spanning the years 2017 to 2022, this research aims to contribute to a deeper understanding of the complex relationship between these variables.

The rest of the paper is organized as follows. Section 2 reviews the literature on the relationship between FDI, labor, and export. Section 3 describes the methodology and data employed in this study. Estimation results and discussion can be found in Section 4. The conclusion and implications are in Section 5.

2. Literature Review and Hypotheses

2.1 Literature on the Relationship Between FDI and Export

Most research on the relationship between FDI and export has looked at how changes in FDI correlate to changes in export and vice versa. In other words, they have questioned whether export and FDI are substitutes (negative correlation) or complementary (positive correlation).

The complementarity between export and FDI is frequently observed in trade models that incorporate vertical FDI. Such models posit that multinational enterprises divide their production processes across different countries to exploit

comparative advantage and minimize costs. These models are particularly effective in explaining FDI flows from developed to developing economies (Magalhaes & Africano, 2018). Kojima (1985) conceptualizes FDI as a conduit for transferring capital, technology, and managerial expertise from the investing to the host nation. He categorizes FDI into two primary types. Trade-oriented FDI stimulates import demand and export supply at prevailing terms of trade, resulting in mutual welfare gains for both countries. This form of FDI typically targets sectors where the source country possesses a comparative disadvantage, thereby fostering trade and beneficial industrial transformation. Conversely, anti-trade-oriented FDI exhibits opposite effects, hindering trade and inducing detrimental industrial restructuring in both nations.

The substitution between FDI and export is primarily evident in theoretical models that posit horizontal FDI. Such models presume that multinational enterprises replicate their domestic production processes in foreign markets, producing identical goods or services (Magalhaes & Africano, 2018). The theory of substitution between FDI and trade suggests that these two economic activities can be alternatives to each other under certain circumstances. In other words, firms may choose to invest directly in a foreign market rather than exporting to it, or vice versa. When faced with choices about how to serve a foreign market, firms weigh the costs and benefits of exporting versus FDI. Factors influencing the substitution decision include trade barriers, market size and growth, production costs, and technological and knowledge transfer (Moosa, 2002).

In Vietnam, research conducted by Nguyen and Xing (2008) indicated that FDI is one of the main factors promoting and facilitating the expansion of Vietnam's exports to international markets, in which a 1% increase in FDI inflows would lead Vietnam's exports to increase by 0.13%. In the same context of Vietnam, Do et al. (2022) study the impact of both domestic and foreign capital on exports in the short and long term, in the period from 1985 to 2020. Results from testing the Granger

causality relationship showed that an FDI positively affects export growth in both the short and long term, while the domestic investment has only a positive impact in the long run. In international publications (Hsiao, 2006; Kutan, 2007; Njong & Raymond, 2011; Uysal & Abdulakadir, 2018; Okechukwu, 2018), FDI was also shown to have an impact on exports. Uysal and Abdulakadir (2018) identified the positive impact of foreign capital flows on exports in addition to factors such as labor force, industrialization, and exchange rates. This result is obtained after applying the Hausman test on annual data (1990–2004) of the seven East African countries. In general, FDI can act as a catalyst for boosting a country's export performance. This also refers to the complementary effect theory, suggesting a mutually beneficial relationship between FDI and foreign trade (Voica et al., 2021).

Hypothesis 1: FDI has a positive impact on export performance.

2.2 Literature on the Relationship Between Labor and Export

Neoclassical Trade Theory emphasizes the role of comparative advantage in determining a country's export pattern. Labor plays a crucial role in determining a country's comparative advantage, as it contributes to production efficiency and competitiveness. The Heckscher-Ohlin Theorem posits that countries export goods that are intensive in their abundant factor of production. Labor-abundant countries are expected to export labor-intensive goods, while capital-abundant countries export capital-intensive goods (Mankiw, 2021).

Empirical evidence has shown that labor quality is one of the factors that can affect the export performance of a sector or country. Labor quality refers to the skills, education, productivity, and efficiency of the workers who produce the goods and services that are exported. Higher labor quality can enhance the competitiveness, diversity, and innovation of the export products and services, and increase their value-added and market share (Bandyopadhyay, 2020). Some studies have found that labor quality has a positive effect on the export performance of high-tech and skill-intensive sectors, but a negative effect on the export performance of low-tech

and labor-intensive sectors. In high-tech and skill-intensive sectors, a highly skilled workforce is crucial for developing and producing complex products, leading to a positive effect on export performance; however, in low-tech and labor-intensive sectors, competitiveness often relies on lower labor costs. A significant increase in labor quality might lead to higher production costs, potentially harming export competitiveness in some cases (Zhang et al., 2023). Other studies have found that labor quality has a positive effect on the export performance of both developed and developing countries, but the effect is stronger for the latter (Brambilla & Porto, 2016). This might be due to their focus on transitioning to higher-value exports, where a skilled workforce plays a crucial role.

Rodrik (2022) suggests that a larger labor force can provide a readily available workforce for export-oriented industries. This can lead to increased production capacity and potentially higher export volumes. However, Alfaro et al. (2006) highlight the concern of skill mismatch, where a large workforce without the necessary skills for export-oriented industries might not translate to increased exports. It could even lead to inefficiencies and hinder productivity. Even with a large labor force, exports might be limited by insufficient resources like raw materials, technology, or infrastructure (Helpman, 1988). The skill level and experience of the workforce play a crucial role. A large force with a high proportion of skilled workers is likely to have a more positive impact on exports than a large force with limited skills (Lucas, 1988).

Hypothesis 2: Labor quality has a positive impact on export performance.

Hypothesis 3: Labor size has a positive impact on export performance.

2.3 Literature on the Interplay Between Labor, FDI, and Export

Research suggests that FDI can contribute to skill development and technology transfer, thereby enhancing labor quality. Foreign firms often invest in training and development programs for their employees (Javorcik, 2004). High-

quality labor attracts FDI, as foreign investors seek skilled workforces (Falk, 2012). The conventional wisdom is that developing countries should prioritize human capital development to attract foreign investment. However, Bhaumik and Dimova (2013) suggest that in countries with uncertain educational quality, multinational companies may prefer to invest in job-specific training rather than relying on formal education. Based on data from the textiles and garments industry, Bhaumik and Dimova (2013) found that training is more effective in improving firm efficiency compared to formal education in developing countries.

Slaughter (2004) argued that FDI can influence labor markets in developing countries in terms of both labor demand and the supply side. On the demand side, inward FDI stimulates demand for more-skilled workers in host countries through several channels, including the transfer of advanced technology to host-country affiliates, the dissemination of knowledge through market-mediated and spillover effects to host-country firms, and investments in physical capital related to new technologies. On the supply side, the impact of inward FDI on human capital development in developing countries is less straightforward. Multinational enterprises (MNEs) can facilitate investments in human capital through both short-term and long-term strategies. Short-term activities involve direct interactions with local labor markets through on-the-job training, partnerships with educational institutions, and similar initiatives. Long-term strategies contribute to the broader macroeconomic environment by influencing fiscal policies that drive education investments. MNEs can positively impact the macroeconomic environment by increasing worker productivity, providing stable foreign capital, and contributing to tax revenues. This ultimately enhances the ability of host countries to fund education initiatives.

In terms of labor force, Karlsson et al. (2007) analyzed the impact of FDI on job creation in China's manufacturing sector between 1998 and 2004. They found that FDI positively influenced employment growth, particularly in foreign-owned

firms with strong export market access. Additionally, they observed indirect positive effects on job creation in domestically owned firms, likely due to spillover benefits from FDI. Lipsey et al. (2013) found a strong correlation between the shift from domestic to foreign ownership and a subsequent increase in employment growth rates. This suggests that foreign firms are more likely to expand their workforce compared to domestic firms. Nguyen (2022) examined Asian developing economies from 2002 to 2020 and found that FDI inflows had a negative effect on unemployment, or in other words, created more jobs, and this was even amplified by digitalization.

Therefore, it is reasonable to infer a synergistic effect between FDI and labor quality and FDI and labor size on export performance.

Hypothesis 4: The combined effect of Foreign Direct Investment (FDI) and labor quality positively influences a province's export performance.

Hypothesis 5: The combined effect of Foreign Direct Investment (FDI) and labor size positively influences a province's export performance.

3. Description of Models, Variables, and Data

3.1 Model Settings

To examine the impact of FDI, labor, and their interactions on provincial export performance, the study estimates the following research model in log-linear form:

$$ln(1 + EXP_{it}) = \alpha_0 + \beta_m lnFDI_{it} + \beta_n lnLabor_{it} + \beta_s lnFDI_{it} * lnLabor_{it} + \beta_k lnCONT_{it} + \varepsilon_{it} \quad (1)$$

where i = 1, 2, 3, …, 63 provinces, t = 2017, 2018, …, 2022 (6 years), and EXP_{it} refers to the total export value of province i at time t. The logarithmic transformation of a dependent variable presents a challenge when trade values are zero, as the log of zero is undefined. To address this issue, many studies have employed a common technique: adding one to the import value. This adjustment enables the log of the

zero values to take a zero value (Eaton & Tamura, 1995; Martin & Pham, 2008). Thus, the dependent variable is transformed to $ln(1+EXP_{it})$.

FDI_{it} indicates the cumulative registered FDI capital of province i at time t. $Labor_{it}$ is the vector of labor size, with labor quality (proxied by the percentage of trained labor) of province i at time t. FDI_{it}*$Labor_{it}$ is the vector of interaction terms between FDI and labor size and FDI and labor quality. $CONT_{it}$ is the vector of control variables, including institutional quality (proxied by Provincial Competitiveness Index – PCI) and the volume of goods transported by road (GoR). α_0 is the intercept term. β_m, β_n, β_s, and β_k are the influence coefficients. ε_{it} is the error term.

By analyzing this model, we can gain insights into the overall effect of FDI and labor on provincial export performance and how the combined effect of FDI and labor (through the interaction term) shapes export outcomes.

Table 1. Variables used in the model

Variables	**Inclusion Form**	**Description**	**Data Source**
EXP	ln(1+EXP)	Provincial Export Turnover (million USD): the total value of goods and services that a province exports to international markets during a year	Vietnam Import-Export Annual Report, by Ministry of Industry and Trade
FDI	lnFDI	Cumulative Registered FDI (million USD): the total amount of FDI that a province has attracted over a long period of time (1988–present)	Statistical Yearbook, by the General Statistics Office
TL	lnTL	Percentage of Trained Labor with diplomas or certificates (%): the number of trained laborers with diplomas or certificates divided by the total labor force	Statistical Yearbook, by the General Statistics Office
LS	lnLS	The size of the workforce (thousand workers): all people aged 15 years and over who are employed (working) or unemployed	Statistical Yearbook, by the General Statistics Office
PCI	lnPCI	Provincial Competitiveness Index (0–100): The PCI is comprised of 10 sub-indices, each representing a critical aspect of a favorable business environment	Provincial Competitiveness Index Annual Report, by the Vietnam Chamber of Commerce and Industry
GoR	lnGoR	The volume of goods transported by road (thousand tons)	Statistical Yearbook, by the General Statistics Office

Source: Authors' compilation

3.2 Variable Setting and Description

The present study uses secondary data for 63 provinces and cities over the 6-year period (2017–2022), corresponding to 378 observations. Table 2 shows the mean value, standard deviation, and minimum and maximum values of the variables used in the study.

The dependent variable is export performance taken from the Vietnam Import-Export Annual Report (2017–2022) published annually by the Ministry of Industry and Trade, with an average value of 4,526.255 million USD, ranging from the lowest level of 0 (Bac Kan Province, 2017) to the highest level of 47,545.54 million USD (Ho Chi Minh City, 2022).

The cumulative registered FDI capital data was extracted from the Statistical Yearbook published annually by the General Statistics Office. The mean value of FDI is 5,962.463 million USD, with a minimum of 1.5 million USD (Lai Chau Province, 2018–2022) and a maximum of 56,247.9 million USD (Ho Chi Minh City, 2022). The standard deviation of 10140.33 million USD is fairly high. This indicates that FDI capital varies considerably across regions in Vietnam. It is noteworthy that both the export and the FDI value of 2022 are the highest in Ho Chi Minh City.

Labor quality, proxied by the percentage of trained workers over 15 years old, is also collected from the GSO Statistical Yearbook. The percentage of trained labor (%) has a mean value of 21%, and its value ranges from 8.2% (Bac Lieu Province, 2018) to 50.3% (Ha Noi Province, 2022). The percentage of trained labor with diplomas or certificates (%) is measured by the number of trained laborers with diplomas or certificates divided by the total labor force. In this context, trained laborers with diplomas or certificates are individuals aged 15 or older who are employed or unemployed and have completed a vocational training program in the national education system and have been awarded a diploma or certificate, such as a basic, intermediate, college, university, master's, doctoral, or doctor of science degree. This category also includes skilled workers without diplomas or certificates

who have been trained on the job, so they have the necessary skills and experience and have performed their work for three years or more.

Labor force comprises all people aged 15 years and over who are employed (working) or unemployed. Its data is extracted from the GSO Statistical Yearbook. The workforce size has a mean value of 855,000 workers, and its value ranges from 144.6 (Bac Kan Province, 2021) to 4,826 (Ho Chi Minh City, 2019).

Institutional quality is a control variable, measured by the provincial competitiveness index (PCI). Its data is gathered from the Provincial Competitiveness Index annual report (2017–2022) issued by the Vietnam Chamber of Commerce and Industry. The Provincial Competitiveness Index is an important tool used in Vietnam to assess the business environment in each province. It is comprised of ten sub-indeces, including entry costs, access to land, transparency, time costs, informal charges, policy bias, proactivity of provincial government, business support policy, labor policy, and law and order. The average value of PCI is 64.3, with a minimum of 55.12 (Dak Nong Province, 2017) and a maximum of 75.08 (Quang Ninh Province, 2020), and the standard deviation is 3.07. Quang Ninh has been the top-ranked province in the PCI for six consecutive years, from 2018 to 2023. The reasons for Quang Ninh's high PCI score include its outstanding economic management quality and its friendly and supportive business environment.

GoR, the volume of goods transported by road, is another control variable. Its value ranges from 453.7 (Ca Mau Province, 2017) to 178,691.6 (Ha Noi Province, 2022), with the mean value of 20,485.04 thousand tons.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Export	378	4526.255	8906.816	0	47545.538
FDI	378	5962.463	10140.331	1.5	56247.9
TrainedLabor	378	21.05	8.036	8.2	50.3

LaborSize	378	854.718	741.614	144.6	4826
PCI	378	64.327	3.078	55.123	75.086
GoR	378	20485.04	27664.02	453.7	178691.6

Source: Authors' calculations

4. Empirical Results and Explanations

4.1 Unit-Root Test

Table 3 gives the Levin-Lin-Chu Panel Unit-Root test result for the variables of the study. The null hypothesis is that all the panels contain a unit root. The result shows that all variables are stationary at level (Levin et al., 2002).

Table 3. Levin-Lin-Chu panel unit-root test

Variable	**Unadjusted t**	**Adjusted t***	**p-value**	**Decision**
ln(1+Export)	-6.4914	-4.9958	0.0000	I(0)
lnFDI	-39.5019	-42.0433	0.0000	I(0)
lnTL	-11.3537	-8.8383	0.0000	I(0)
lnLF	-8.1025	-4.3920	0.0000	I(0)
lnPCI	-16.0878	-11.9528	0.0000	I(0)
lnGoR	-6.7614	-5.0879	0.0000	I(0)

Source: Authors' calculations

4.2 Multicollinearity Test

Table 4 shows the correlation matrix between the independent variables. The results show that the correlation coefficient between the independent variables does not exceed 0.8, meaning that multicollinearity is less likely to occur (Gujarati, 2003).

Table 4. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)
(1) LnFDI	1.000				
(2) lnTL	0.451	1.000			
(3) lnLF	0.617	0.217	1.000		
(4) lnPCI	0.449	0.409	0.359	1.000	
(5) lnGoR	0.651	0.662	0.633	0.373	1.000

Source: Authors' calculations

Using the VIF test in Stata to check multicollinearity, the results in Table 5 show that all VIF values are <3, indicating that multicollinearity does not occur (Baltagi, 2008). Accordingly, the independent variables are suitable for use in the regression model.

Table 5. Variance inflation factor

	VIF	1/VIF
lnGoR	2.635	.379
lnLF	2.314	.432
lnTL	2.283	.438
lnFDI	2.133	.469
lnPCI	1.392	.719
Mean VIF	2.311	.

Source: Authors' calculations

4.3 The Reliability Test of Pooled OLS, FEM, and REM Models

The study used static panel data analysis methods, including the Ordinary Least Squares (OLS), Fixed-Effects (FEM), and Random-Effects (REM), and FGLS (Feasible Generalized Least Squares), to explain the impact of foreign direct investment and labor on export performance.

To choose the appropriate model among the three models, pooled OLS, FEM, and REM, the author used the F-test and Hausman test; the results are shown in Table 6. The F-test has the value P-value = 0.000<0.05; therefore, at the 5% statistical significance level, the hypothesis H0 is not accepted, so the estimate from the FEM model is more appropriate. Next, the author ran two models, FEM and REM, then used the Hausman test to select the optimal model. The result Prob>chi2 = 0.0000<0.05 shows that with a statistical significance level of 5%, H0 is rejected, so the FEM model is selected (Torres-Reyna, 2007).

To ensure that the estimated results from the FEM model were reliable, the author checked for possible defects in the model. First, the Modified Wald test was used to check the phenomenon of heteroscedasticity for the FEM model.

The value Prob>chi2 = 0.0000<0.05 shows that at the 5% significance level, H0 is not accepted, concluding that the model experiences heteroscedasticity (Baum, 2001). Second, the Wooldridge test was used to test for autocorrelation. Prob value>F = 0.0000<0.05 shows that at the 5% significance level, H0 is rejected, meaning the model has autocorrelation (Wooldridge, 2010).

Table 6. Testing the reliability of Pooled OLS, FEM, and REM models

Test	**Hypothesis**	**Statistic**	**Results**
F-test	H0: The OLS model is more suitable than the FEM model	F(62, 310) = 48.73 Prob > F = 0.0000 < 0.05	Reject H0; FEM Model is more suitable than OLS
Hausman test	H0: The REM model is more optimal than the FEM model	Chi2(5) = 131.47 Prob > chi2 = 0.0000 < 0.05	Reject H0; the FEM model is selected
Modified Wald test	H0: The FEM model does not have heteroscedasticity.	Chibar2(63) = 1.7e+05 Prob > chibar2 = 0.0000 < 0.05	Reject H0; the model has heteroskedasticity
Wooldridge test	H0: No first order autocorrelation	F(1,62) = 34.743 Prob > F = 0.0000 < 0.05	Reject H0; the model has autocorrelation

Source: Authors' calculations

To overcome the phenomenon of heteroskedasticity and autocorrelation that still occurs in the FEM model, the FGLS regression is used. Table 7 shows the results of all four estimation methods. FGLS was chosen for further analysis.

Table 7. Estimation results from OLS, fixed effects, random effects, and FGLS models

	(1)	(2)	(3)	(4)
VARIABLES	Pooled OLS	Fixed Effects	Random Effects	FGLS
lnFDI	0.456***	-0.0108	0.179***	0.443***
	(0.000)	(0.833)	(0.000)	(0.000)
lnTL	0.493**	0.807***	1.208***	0.381***
	(0.031)	(0.000)	(0.000)	(0.001)
lnLS	1.067***	-1.252***	0.245	1.121***
	(0.000)	(0.000)	(0.253)	(0.000)
lnPCI	4.957***	2.176***	2.060***	3.991***
	(0.000)	(0.003)	(0.008)	(0.000)
lnGoR	-0.0841	0.336***	0.292***	-0.105**

	(0.305)	(0.007)	(0.006)	(0.017)
Constant	-24.61***	0.656	-10.80***	-20.34***
	(0.000)	(0.840)	(0.001)	(0.000)
Observations	378	378	378	378
Number of Province	63	63	63	63
R-squared	0.717	0.645		

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations.

4.4 Feasible Generalized Least Squares Model

FGLS regression was conducted to investigate the direct impact of FDI and labor on provincial export performance, as shown in model 1. Then, to examine the combined effect of FDI and labor on export performance, interaction terms between FDI and labor indicators, as shown in models 2 and 3, were gradually added.

Table 7. FGLS Estimation Results for Export

VARIABLES	(1)	(2)	(3)
nFDI	0.443***	0.140	0.819***
	(0.000)	(0.337)	(0.000)
lnTL	0.381***	-0.362	0.624***
	(0.001)	(0.398)	(0.000)
lnLS	1.121***	1.025***	1.724***
	(0.000)	(0.000)	(0.000)
lnPCI	3.991***	3.974***	3.519***
	(0.000)	(0.000)	(0.000)
lnGoR	-0.105**	-0.0841*	-0.110**
	(0.017)	(0.061)	(0.010)
lnFDI*lnTL		0.102**	
		(0.041)	
lnFDI*lnLS			-0.0641***
			(0.001)
Constant	-20.34***	-17.67***	-22.64***
	(0.000)	(0.000)	(0.000)
Observations	378	378	378

Note: p-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations.

The Direct Effect of FDI and Labor on Provincial Export Performance

The results shown in Column 1 indicate that FDI, Trained Labor, and Labor Size all have a positive and statistically significant impact on the export performance of provinces examined.

The coefficient associated with FDI was found to be 0.443, which is statistically significant at the 1% level. This suggests that a 1% increase in FDI might lead to a 0.443 % increase in exports, controlling for the effects of other variables. The positive relationship between FDI and trade suggests that there is a complementary effect between FDI inflows and provincial exports. FDI brings in capital, technology, and management expertise. These resources can help local businesses improve their production processes, product quality, and access to new markets, leading to increased exports. Furthermore, foreign companies often need to source supplies locally, stimulating production and exports. In essence, FDI and provincial exports reinforce each other, creating a positive cycle of economic growth. The results are in line with prominent studies that have identified the complementary effect of FDI on export performance (Voica et al., 2021; Nguyen & Xing, 2008; Özgur Uysal & Abdulakadir, 2018; Okechukwu, 2018).

The coefficient of Trained Labor, measured at 0.381 and statistically significant at the 1% level, indicates the estimated change in Export for a 1% increase in the percentage of Trained Labor, holding all other variables constant. This means that for every 0.381% increase in Trained Labor, the export performance is expected to increase by 1% on average. Similarly, the coefficient of Labor Size, valued at 1.121 and statistically significant at 1% level, denotes the predicted change in export performance resulting from a 1% increase in the number of laborers, while keeping all other variables constant. This implies that, on average, a 1% increase in exports is expected for every 1.121% increase in labor size. Thus, within the context of Vietnam, both labor quality and workforce size have the potential to directly promote exports. This finding aligns with previous research, such as Guerra (2023),

who highlights the positive association between export and skilled labor. Similarly, research by Schwarzer (2017) on German firms supports the notion that exporting can enhance labor productivity, particularly when firms upgrade their labor quality. Additionally, Llop (2022) quantified the employment impacts of exports, emphasizing the importance of labor in export performance.

The Combined Effect of FDI and Labor on Provincial Export Performance

The result shown in Column 2 indicates that the combination of FDI and a skilled workforce significantly boosts a province's export performance. In other words, when these two factors interact, the positive impact is amplified. FDI often involves transferring advanced technology and production methods (Blomström et al., 2001). A skilled workforce can quickly adapt to and utilize these new technologies. A well-trained labor force can maximize the benefits of FDI by increasing efficiency, reducing costs, and improving product quality (Narula & Marin, 2003). The combination of FDI resources and skilled labor can foster a more innovative environment, leading to the development of new and competitive products. By producing more sophisticated products, provinces can command higher prices in international markets, boosting export earnings. In essence, the synergy between FDI and trained labor creates a powerful engine for export growth. In previous studies, Brambilla and Porto (2016) and Bandyopadhyay (2020) also pointed out that high labor quality is a significant asset for a country's competitiveness in the global export market, as it can develop new and innovative products and services, making a country's exports more attractive to foreign buyers; it also can produce goods and services more efficiently, leading to lower production costs and more competitive export prices.

In 2023, an estimated 14.1 million workers possessed a formal degree or certificate, representing 27.0% of the total labor force in Vietnam (GSO, 2024). This signifies a 0.6 percentage point increase compared to 2022. However, significant gaps remain in the quality of the labor supply. This skilled workforce falls

short of the demands of a modern, flexible, sustainable, and integrated labor market. Notably, approximately 38 million workers lack even basic training (elementary level or higher) (GSO, 2024). This substantial figure underscores the significant challenge of enhancing the technical expertise of the Vietnamese workforce. Consequently, the development of targeted policies and comprehensive training programs constitutes an urgent requirement in the near future.

The findings in Columns 1 and 3 show that while FDI and labor size individually boost exports, their interaction can lead to negative outcomes due to several contextual factors unique to Vietnam. Vietnam's infrastructure and skilled labor may not be sufficient to support the combined influx of FDI and a large labor force, leading to inefficiencies and, ultimately, lower export competitiveness. The technology and expertise brought by FDI may require a higher skill level than the available local labor force, causing productivity issues (Dao, 2022).

5. Conclusion and Implications

The findings of this research underscore the critical role of FDI, skilled workforce, and labor size in driving provincial export performance in Vietnam. Although the synergy of FDI and a skilled workforce significantly enhances a province's export performance, the interaction between FDI and labor size might exert a negative influence on provincial exports in Vietnam due to resource constraints and skill mismatches.

Based on the research findings, we recommend that investing in education and training to create a skilled workforce is crucial for maximizing the benefits of FDI, and vice versa, as implementing policies to attract foreign investment is essential to complement the skilled labor force. Governments should focus on policies that encourage both FDI and human capital development to achieve optimal export performance, such as prioritizing education and vocational training to create a skilled workforce capable of meeting the demands of foreign investors. In essence,

while a large labor force is important, it is the quality of the labor force combined with the strategic investments from foreign companies that truly drives export growth.

In summary, this research highlights the interconnectedness of FDI and labor in driving provincial export growth in Vietnam. By implementing effective FDI policies, investing in human capital development, and promoting a conducive labor market environment, provinces can foster sustainable and competitive export performance.

Looking ahead, this research paves the way for further exploration of the dynamics between FDI, other determinants, and their interactions on export performance. By examining similar relationships in other developing economies, valuable knowledge can be gained regarding the generalizability of these findings. Understanding these broader trends will inform the development of effective policies to promote export-driven growth across a wider range of countries.

Acknowledgment

We would like to thank editor Vasileios Zikos and the anonymous reviewers for their useful comments and suggestions that have improved the paper. This revised version uses updated data series and a more robust estimation. We extend our appreciation to our friends and colleagues, who have been providing valuable advice throughout the revised manuscript. We are also grateful to Thuongmai University for providing the necessary facilities and resources, which made the study possible. This research is funded by Thuongmai University, Hanoi, Vietnam.

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Appendix

Appendix 1

Variability among Vietnamese provinces and cities (2017–2022)

STT	Province	Cumulated exports (2017-2022) (millions USD)	Cumulated FDI until 2022 (millions USD)	Mean of trained labor (%)	Mean of labor size (1,000 workers)
1	An Giang	4,710.61	317.3	13.74	187.667
2	BRVT	28,810.92	33,304.1	28.03	236.833
3	Ben Tre	7,266.07	1,585	11.86	325.167
4	Binh Duong	166,063.29	39,629.8	20.58	46.8333
5	Binh Phuoc	18,138.49	3,991	17.33	222.833
6	Binh Thuan	3,326.45	3,838.8	16.39	285.5
7	Binh Dinh	6,786.98	1,205.6	21.51	338.5
8	Bac Lieu	3,516.53	4,496	10.24	170.167
9	Bac Giang	68,113.06	9,408	21.86	138.667
10	Bac Kan	89.92	7.9	20.32	69.3333
11	Bac Ninh	231,238.07	23,317.3	29.02	314
12	Cao Bang	427.72	21.6	22.41	93
13	Ca Mau	6,510.76	153.5	12.77	254.333
14	Can Tho	9,243.85	2,266.5	21.57	268.833
15	Gia Lai	2,799.49	92.1	13.33	346
16	Ha Giang	797.46	4.1	15.3	163
17	Ha Nam	19,094.47	5,345.1	22.69	154.5
18	Ha Noi	89,724.97	38,848.8	47.23	120
19	Ha Tinh	6,947.63	12,014.2	26.28	245.667
20	Hai Duong	47,859.39	9,169.5	24.21	129.333
21	Hai Phong	102,225.32	25,302.4	33.98	23.5
22	Hoa Binh	2,603.11	720.1	19.78	183.5
23	Hau Giang	3,695.13	686.1	11.62	138.833
24	Hung Yen	23,805.03	6,649.4	24.46	284
25	Khanh Hoa	8,632.80	4,395.1	22.51	268.167
26	Kien Giang	4,048.77	4,810.1	14.39	358.167
27	Kon Tum	2,906.12	245.4	16.54	85.1667
28	Lai Chau	66.84	1.5	17.31	74.6667
29	Lao Cai	5,415.39	582.6	20.67	136.333
30	Lang Son	5,394.38	240.4	21.52	140
31	Long An	34,931.92	12,918.6	15.59	189.833
32	Lam Dong	2,594.68	514.3	18.18	313.667
33	Nam Dinh	12,627.90	3,719.8	18.75	126.667
34	Nghe An	6,382.65	2,572.6	21.8	53.1667
35	Ninh Binh	11,568.75	1,602.8	29.4	190.5

36	Ninh Thuan	389.45	1,735.1	17.65	94.3333
37	Phu Tho	29,421.03	3,133.7	26.86	315.167
38	Phu Yen	1,063.77	2,034.8	18.37	169.5
39	Quang Binh	857.30	1,116.3	23.85	167.5
40	Quang Nam	8,164.60	6,340.6	21.97	336.667
41	Quang Ngai	8,828.23	2,134.8	21.79	289.167
42	Quang Ninh	16,687.59	10,172.7	38	282.833
43	Quang Tri	1,666.53	2,524.2	25.71	100.5
44	Soc Trang	6,288.58	340.6	12.18	252.333
45	Son La	121.41	135.7	14.55	278.333
46	HCM city	252,921.85	56,247.9	36.73	133.5
47	Hue	6,364.24	4,239.1	25.23	225.667
48	Thanh Hoa	22,425.60	14,851.6	21.94	65.1667
49	Thai Binh	11,575.66	1,971.6	17.67	143.333
50	Thai Nguyen	160,108.76	10,483.9	29.58	285.667
51	Tien Giang	19,745.82	2,799.7	12.51	25.8333
52	Tra Vinh	2,103.61	3,188	11.54	203.167
53	Tuyen Quang	607.04	208.8	20.37	144.667
54	Tay Ninh	31,874.60	9,173.6	15.02	268.667
55	Vinh Long	3,769.17	1,010.2	15.82	225.833
56	Vinh Phuc	30,236.18	6,742.2	27.93	235.333
57	Yen Bai	1,397.90	456.9	19.71	158.167
58	Da Nang	10,218.24	6,146.3	44.8	223.167
59	Dien Bien	189.68	3	17.62	97.6667
60	Dong Nai	119,646.96	35,406.4	21.38	51.5
61	Dong Thap	7,771.59	231.6	13.98	297.167
62	Dak Lak	7,499.26	647.6	16.11	30.1667
63	Dak Nong	615.06	311.9	14.1	117.167