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Sustainable FDI and comparative advantage for product export survival: a developing countries perspective

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ABSTRACT

Establishing stable export relations is significant for developing countries to realize industrialization through exporting manufactured products. Based on the export data of 100 developing countries on the product level from 1999 to 2015, this paper empirically explores the relationship between FDI and product export survival of the host country using the survival analysis model. The estimations show that FDI is conducive to the extension of the export duration of domestic products, and this effect is more evident in products with comparative advantages. Mechanism inspections prove that FDIs extend the export duration of products by improving their quality. To overcome endogenous problems, this paper establishes instrumental variables of FDI based on population and geographical factors. The results of the two-stage least square regression support the conclusions derived from the benchmark regression. This paper provides new empirical evidence for the role of FDI in export promotion and resource allocation.

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1. Introduction

During the last several decades, global commerce and trade have transitioned progressively, and many developing nations embraced export-led industrial development policies and became more important trading partners for the developed world. These policies have been most successful in East Asian economies, particularly Japan and the Four Asian Tigers, which have experienced rapid industrialization from the early 1960s, greatly enhancing their citizens' living conditions and overall national strength (United Nations, 2021). The quick integration into the international production chain and encouragement of domestically manufactured exports has been vital strategies in the East Asian miracle model of this regional economic development practices.

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This transformation encouraged firms in developing nations to expand product exports. Multiple factors affect a firm's export growth at the micro firm level, such as reduction of production costs, improvement of product quality, and relaxation of financial constraints. Along with these factors, a firm's product export survival has drawn increased attention from researchers, demonstrating that export survival or the period of a product exported is critical in enhancing a country's export volume (Besedeš & Prusa, 2011). Besedes and Blyde (2010) established through the counterfactual method that if the product export survival of Latin American countries reaches the level of the developed countries, their export volume will increase massively. Brenton et al. (2010) found that better survival rates for current product flows are crucial for attaining quicker cumulative export growth for developing nations. Moreover, the firm's product export survival improves the technical sophistication of exports (Chen & Hui, 2015; Zhang et al., 2018). Thus, those developing countries, which have successfully extended the existing export relationships, performed better in exports

Although developing nations are not disadvantaged when initiating new product flows, their survival rates are much lower, which is a major roadblock to increasing exports. Several reasons make it hard for developing countries to maintain sustainable exports of existing products and develop new export relations.[1] Firstly, it requires significant resources to expand the extensive margin and deepen the intensive margin of existing export products and markets (Besedeš & Prusa, 2011; Manova, 2013). Therefore, firms in developing countries often suffer from strong financial constraints and cannot enter the international market independently. Secondly, there is a 'self-discovering deficiency' issue among developing economies (Hausmann & Rodrik, 2003). In developing nations, it is challenging to discover a product fit for domestic manufacturing since there are few items and the market price signal system is unsound. Thirdly, due to asymmetrical information, the international market lacks trust in the quality of goods produced by developing countries, mainly industrial products with a low international reputation (Cagé & Rouzet, 2015).

Therefore, understanding the factors contributing to export survival is essential for developing nations to sustain and expand the export volume. Different determinants of export survival have been discussed in the literature that helps a country to develop new export markets, such as prior export experience (Defever et al., 2015), export and product knowledge (Carrère & Strauss-Kahn, 2017), firms' product diversification and investment strategies (Martuscelli & Varela, 2018), and firm characteristics (Benkovskis et al., 2022). In addition, the indenture relations based on long-term and frequent cultural and geographic trade ties can help trading parties build trust and are critical for new product survival (Brenton et al., 2010). Along these, FDI is an important driver of trade that reduces financing constraints and allows businesses in developing countries to grow their production and take advantage of economies of scale, which boost their exports (Mukhtarov et al., 2019).

In this regard, foreign-owned companies played a crucial role in accelerating trade liberalization and attracting FDI worldwide. These enterprises have since embraced a strategy of active globalization to broaden their production networks and gain access to worldwide markets. Compared with the domestic firms of developing countries, foreign-owned firms have advantages in maintaining the existing trade relations and

can establish new export relations (Rhee & Belot, 1990). Firstly, foreign-owned firms have advanced production technology and standardized production process, eventually, high-quality products (Ha et al., 2020). Secondly, foreign-owned firms better understand the international market demand and can establish export relations at a lower cost. Thirdly, foreign-owned firms have a higher international reputation, which encourages the trust between trading parties and product export survival (Hu & Jefferson, 2002; Kampouris et al., 2022).

In addition to natural advantages, foreign-owned firms help domestic firms extend export survival and stabilize the newly established trade relations owing to the spillover effects. Firstly, the technology spillover effect improves the production technology and standardization of the firms and products in developing countries (Qin & Du, 2017; Wang et al., 2019). Secondly, local firms can identify the demands of the international market through foreign-owned firms and then dominate in exports to the international market by imitating them (Greenaway et al., 2004). Thirdly, international production experience and in-depth participation in the global value chain enable multinational firms to clearly understand products that the host country is suitable to produce and play the role of 'cost-discovering' payers in the host country (Harding & Javorcik, 2012), thus accelerating the expansion of product exported types by firms.

There are both direct positive effects and negative spillovers from foreign-owned firms to domestic firms regarding labor productivity and competitiveness (Konara & Wei, 2017). The negative spillover effects were dominant because the spillovers depended on the absorption capacity of the local firms, the quality of the labor force in the host country, and the nature of competition between the foreign and local firms. Moreover, the degree to which the foreign firms are technologically active in the host country, the trade policy environment, various market conditions, the country's level of development, and the degree to which they expose their technologies and capabilities to domestic firms are also important factors for this spillover.

Therefore, although numerous studies analyze the impact of FDI on the host economy, especially on the productivity and competitiveness of domestic firms, the findings are contradictory (Taghizadeh-Hesary et al., 2021; Yarovaya et al., 2021; Yu et al., 2022). Moreover, despite recognizing FDI as crucial to the continued success of exports, the direct impact of FDI on firm product export survival in developing economies is ignored. Because of the contradictory results, the significant role played by foreign-owned firms in international trade, and the government's importance towards FDI and trade policies, it is important to enlarge the research in this area. This paper is a pioneer in its attempt to study the FDI's role in improving the product export capacity of developing countries. Based on the export data of 100 developing countries on the product level from 1999 to 2015, this study assumes that FDI effectively strengthens the product export survival of the developing countries, which is acknowledged by improving the export survival of products with a comparative advantage.

The remaining parts of this paper are arranged as follows; The second section reviews the literature on FDI's impact on export capability and states forward the research hypotheses. The third section introduces the survival analysis model, empirical data, and index structure applied in this paper. The fourth section reports the estimated results and their interpretations, and the last section is the conclusion of this study.

2. Literature review and research hypotheses

Early investment and trade studies investigated the substitution or complementary relationship between product and factor flows from a macroeconomic perspective (Koopman et al., 2010). Based on the H-O theory, Mundell (1957) believed the complete flows of factors realize the equalization of the factor prices and the substitution of investment for trade. However, Markusen and Svensson (1983) assumed that the difference in production technology of the same product gives a comparative advantage among different countries and triggers the transnational flows of factors. On the empirical side, most of the recent literature concluded that FDI and trade influence each other and FDI promotes exports (Dai & Li, 2020; Ha et al., 2020; Mukhtarov et al., 2019; Naqvi et al., 2021).

With the expansion of production and communication technologies plus the relaxation of trade policies, the distributions of international production chains among countries are increasingly scattered (Kastratović 2020; Saia et al., 2015). Against this background, studies on the role of FDI in promoting the host country's exports have increased immensely. Zhang and Felmingham (2001) empirically examined the impact of FDI on exports using Chinese provincial panel export data and concluded that FDI promotes domestic firms' exports through the spillover effects. Greenaway et al. (2004) studied that in Great Britain, foreign-owned firms can easily obtain the demand information from the international market, as foreign-owned firms are part of the network of multinational firms. Jongwanich (2010) believed that with International Product Fragmentation, developing countries could reduce foreign investment restrictions and improve the business environment to attract FDI has become an important factor in export development. Anwar and Nguyen (2011) demonstrated the impact of FDI on the export decision-making of local Vietnamese firms through horizontal and vertical spillover channels; FDI improves the survival rate of local firms choosing exports through these channels (Bashir, 2022; Hussain et al., 2021). Li and Liu (2018) analyzed the export spillover effect of the foreign investment agglomeration resulting from EPZ's (Export Processing Zones) policies, using the data on the Chinese firm-product level. Specifically, they pointed out that local firms soon export products exported by firms in EPZ's and import the equipment imported by firms in EPZ's. In recent years, more scholars have begun to pay attention to the impact of FDI on the export promotion of the host countries. Harding and Javorcik (2012) empirically recognized the impact of FDI on the quality upgrading of exported products, based on the 4-digit SITC data of 105 developing countries from 1984 to 2000, and concluded that FDI improves the unit value of exports. Swenson and Chen (2014) examined China's city-product level export data and found that FDI improves the product quality of the local private firm through newly established export links. Javorcik et al. (2018) studied that foreign-owned firms improved the technical sophistication of new products produced by local firms in Turkey through backward linkages. Similarly, Abegaz and Lahiri (2020) discovered that the presence of foreign-owned firms in Ethiopia increased the export entrance and chances of survival of domestic enterprises by creating intra-industry positive externalities (Mirza et al., 2020a, 2020b). Li et al. (2021) observed that FDI has a key importance in pushing export upgrading and that both inbound and outbound FDI have a more beneficial impact on the sophistication of manufacturing exports in China (Bashir,

2022; Bashir et al., 2022; Ma et al., 2022). Sabra (2021) discovered that FDI had a positive and complementary effect on exports in the MENA region, suggesting that sophisticated FDI serves the domestic market in re-exporting to the global market. In a recent study, Pan and Chong (2022) reported that FDI impacts commerce among Belt and Road nations favorably, which has improved since the B&R Initiative was announced and boosted technological goods and services exports.

With the findings of the above literature, it is evident that FDI effectively reduces the fixed cost and uncertainty for the local firm's entrance into the international market through the 'export spillover' effect. It is also conducive to establishing new and stable export trade relationships for the host country. On the other hand, through technology spillover effects, the production technology, quality, and sophistication of the local firms are improved, so their products can better meet the needs of international consumers, which ultimately prolong the export survival of the local firms (Besedes & Yan, 2018; Huynh et al., 2021). Based on the analysis mentioned above, the following hypothesis is proposed:

Hypothesis 1: *There is a positive correlation between the FDI stock and the export survival of a country's products. FDI can enhance the survival rate of the host country's products existing on the export market.*

In the recent past, numerous studies demonstrated the overall productivity differences between countries from the perspective of resource misallocation in the economy. Generally, the studies calculate the variance of returns on production factors between firms with given factor endowments and inter-firm productivity distribution. Several researchers show that resource misallocation is severe in developing economies (Banerjee & Duflo, 2005; Bartelsman et al., 2010; Hsieh & Klenow, 2009), which reduces overall productivity. Market admittance regulations, asymmetrical information, financial constraints, and industry monopoly are fundamental factors causing resource misallocation in developing countries (Bai & Liesch, 2022; Karim et al. 2022; Mirza et al. 2022; Restuccia & Rogerson, 2013). Eslava et al. (2013) empirically found that trade openness improves the productivity of incumbent firms in Colombia and makes low-productive firms more likely to withdraw from the market, thus reducing resource misallocation and enhancing overall productivity. Epifani and Gancia (2011) stressed that attention should be paid to the possible resource allocation distortion caused by the asymmetry of industrial trade openness. Lu and Yu (2015) conducted a DID method-based causal identification analysis of the resource allocation effect of China's trade openness. They found that industries with more open trade have lesser dispersion of internal costs and a lower degree of resource misallocation. Fossati et al. (2021) identified that any inefficiencies and barriers impacting global trade are significant causes of resource misallocation, affecting enterprise productivity in developing nations. Jiang et al. (2018) studied the impact of FDI on domestic resource misallocation in the host countries and found that openness toward FDI significantly reduces the proportion of zombie firms. Berthou et al. (2019) demonstrated that expansions in multilateral trade liberalizations promote total firm productivity in the industrial sector by redirecting trade flow towards productive businesses. Similarly, the findings of Chen et al. (2021) demonstrated that FDI from China considerably increases the total productivity of the allocation of resources within firms in the host countries.

From another dimension, this paper studies the role of FDI in helping the host country discover its comparative advantage by improving resource misallocation, thus refining the export survival of products with comparative advantage[2]. In the competitive international market, products deviating from the comparative advantage will be eliminated because of the high relative cost, and the export survival is shorter than those with comparative advantage (Jaud et al. 2018; Ji et al. 2021a, b). As mentioned earlier, the resource misallocation within the industries of the developing economies causes their export structure to deviate from its comparative advantage, reducing the overall productivity at the country level (Krifa-Schneider et al. 2022). The resource misallocation among industries may result in an excessive allocation of production factors to those industries lacking comparative advantage in the country,[3] which affects the production capacity of industries that have a comparative advantage (Pulido, 2018). Based on the above literature, the following hypothesis is proposed:

Hypothesis 2: *FDI can improve the resource allocation efficiency of the domestic export market; that is, FDI can improve the export survival of products with comparative advantage.*

3. Model and data

3.1. Model

According to the above literature reviewed and stated hypotheses, this paper empirically focuses on the FDI impact on the export survival of developing countries. In alignment with Besedeš and Prusa (2006), and Jaud et al. (2018), the Cox proportional risk model is used in this study. Cox regression is a semiparametric technique investigating the link between predictor factors and survival time. The purpose of Cox proportional risk modeling is to analyze the joint influence of numerous variables on survival simultaneously, and its main benefit over other methods is that it can predict when a failure will occur. In other words, it enables us to investigate the effect that certain variables have on the rate at which a particular event (such as the exit of a product from export) occurs at a specific instant in time (Ihwah, 2015). Hence, the Cox regression model technique estimates the hazard ratio or risk function in addition to the estimated regression coefficients. Another benefit of this model is that it is easy to implement for analyzing survival data and does not depend on the assumption of survival distribution functions, which can lead to estimation issues. Consequently, the regression coefficient and the risk function can be used to estimate the actual survival rate. The statistical form of this model is expressed as follows:

$$h\left(t|X_{ckt_0}, \eta_k = j \ or \ \right) = h_j(t)\, exp\left[\beta_1 distance_{ckt_0} + \beta_2 FDI_{ct_0} * distance_{ckt_0}\right] + \beta_3 FDI_{ct_0} + Controls_{ckt_0}\gamma_1 + \delta_c + \delta_{t_0} + \varepsilon_{ckt_0}\Big] \quad (1)$$

Here, the interpreted variable *h(t)* is a risk function, which means the conditional intensity function assumes that survival terminates at time t. Among the explanatory variables $distance_{ckt_0}$ represents the distance that the host country's export products deviate from the comparative advantage, that is, the difference between the factor intensity determined by technology in the export industry and the factor endowment

structure of the host country. FDI_{ct_0} refers to the FDI stock of the host country at the beginning of the export survival. $FDI_{ct_0} * distance_{ckt_0}$ is the interaction term of the core mentioned above explanatory variables. $Controls_{ckt0}$ refers to country-product level control variables[4] and ε_{ckt_0} is a random disturbance term. Referring to the usual processing methods (Huynh et al. 2010; Jaud et al. 2018), the observation value of the beginning year of the export survival is used as the control variable. Besides, the fixed effect is considered in the model. We mainly control the country-fixed effect (δ_c) and the time-fixed effect (δ_{t_0}). For omitted or unobservable industrial observations, the hierarchical Cox model with a 6-digit HS product (k) as the classification standard is used to control them .

3.2. Index construction and data sources

The export survival is calculated at the country(c) 6-digit HS products (k) level. Specifically, this model uses the country-product level data in the CEPII-BACI database, and the number of years that a country continuously exports a specific product is taken as the export survival of the country for a particular product. Re-export is regarded as a new export survival. To eliminate the left censor problem, we deleted the export survival in the data with the first observation year as 2000.

We used the ratio of FDI stock to GDP of the host country in that year as the index to measure FDI of the host country, referred to as 'FDI stock'. For all observational countries (2000–2015), the data on FDI stock comes from the UNCTAD database, and the data on GDP is from PWT 9.1 database, which is the current GDP data of the production method based on PPP.

For the export products' deviation from the comparative advantage, we refer to the method of Cadot et al. (2011) and Jaud et al. (2018) to calculate the deviation degree between the factor intensities determined by the production technology of the products and the factors endowment structure of the exporting country. The products imported and exported by the country can be determined by the factor's endowment structure of the country (Deardorff, 1979). The specific index framework equation is as follows:

$$distance_{ckt_0} = \sqrt{std(\kappa_{ct_0} - \hat{\kappa}_{kt_0})^2 + std\left(h_{ct_0} - \hat{h}_{kt_0}\right)^2} \tag{2}$$

Where κ_{ct_0} and h_{ct_0} are the physical and human capital abundance while $\hat{\kappa}_{kt_0}$ and $\hat{h}_{kt_0}$ are the physical and human capital intensities of product K in the initial year of export survival of country C.

We standardized the difference between the two types of factor intensities and national factor endowment following Jaud et al. (2018). The data on the social factor endowment structure comes from the PWT 9.1 database. κ_{ct_0} is the ratio of capital stock to the total population of the country in the current year and h_{ct_0} is the national human capital index based on the return on education.[5] The weighted average value of national factor intensity for exporting products is calculated, and the weight is the Revealed Comparative Advantage (RCA) of the country exporting products. This method is consistent with the idea of (Hausmann et al. 2007). The calculation

equation of physical capital intensity ($\hat{\kappa}_{kt_0}$) and human capital intensity ($\hat{h}_{kt_0}$) are as follows:

$$\hat{\kappa}_{kt_0} = \sum_c \omega_{ckt_0} \ \kappa_{ct_0} \tag{3}$$

$$\hat{h}_{ckt_0} = \sum_c \omega_{ckt_0} \ h_{ct_0} \tag{4}$$

Where ω_{ckt_0} is the RCA of export product K of country C in the initial year of export survival:

$$\omega_{ckt_0} = \frac{X_{ckt_0}/X_{ct_0}}{\sum_c X_{ckt_0}/X_{ct_0}} \tag{5}$$

Here, X represents the export volume, the numerator represents the proportion of product K exported in the total exports of country C in the initial year of export survival, and the denominator represents the sum of K products exported in the initial year of export survival. This calculation method is the same as that of (Hausmann et al. 2007) and is slightly different from the classical RCA index (Balassa, 1965).

To further identify the average effect of FDI on export survival and the heterogeneous effect of FDI on products with different comparative advantages, we control the national factor endowment, industrial factor intensity, and their cross-multiplication items in the model by referring to Rajan and Zingales (1998), Nunn (2007), and Jaud et al. (2018). Specifically, we selected the following control variables:

A country's physical and human capital abundances are expressed by per capita physical capital stock and human capital index based on return on education, respectively, and the data is from PWT 9.1 database.[6] The financial development level of a country is expressed by the share of credit granted by the commercial banks to the private sector of GDP, and the data comes from the Financial Development and Structure Dataset of the World Bank, which is based on (Beck et al. 2000).

The calculation of multiplicative interaction terms of industry physical capital intensity and industry human capital intensity refers to Romalis (2004)[7], using the Manufacturing Industry Database provided by NBER. Furthermore, the industry's external financing dependence index under the ISICI Rev.2 standard comes directly from (Raddatz, 2006).

At last, we added the share of product export of the total country export in the model to control the core degree of the product in that country's export layout. Whether to export again indicates that the export survival is the first time the country has exported the product since 1999, in which the first export is 0, and the non-first export is 1. All the data used for the above indexes are from PWT 9.1 database.

3.3. Statistical description

Finally, after considering all variables, our data includes 457665 observations for export survivals of 100 countries. The statistical descriptions of each variable are as follows (Table 1):

Table 1. Data description.

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
The distance that the host country's export products deviate from the comparative advantage (Distance)	457665	1.135	0.705	0.000141	6.476
FDI Stock of the Host Country (FDI)	457665	0.523	1.586	0.00564	18.14
Physical Capital Abundance (CK)	457665	3.632	5.748	0.0549	43.86
Human Capital Abundance (HC)	457665	2.218	0.607	1.069	3.740
Financial Development Level (Fin)	457665	32.79	33.84	0.550	288.1
Industrial Physical Intensity (ck_intens)	457665	0.289	0.0686	0.0596	0.480
Industrial Human Capital Intensity (hc_intens)	457665	0.0518	0.0267	0.00549	0.130
Industry's External Financing Dependence Index (fin_intens)	457665	0.246	0.341	−1.530	1.470
Core degree of the Product (Pexport)	457665	0.00412	0.104	4.28e-08	27.56
Whether the first time to Export (Duraorder)	457665	0.535	0.499	0	1
Overall Trade Openness (Open)	457665	0.483	0.379	0.0421	5.245
GDP per Capita (GDP)	457665	1.120	1.899	0.0475	15.12

Source: authors' estimations.

Before the estimations, let us have a preliminary analysis of the survival function of product exports of the countries with different FDI stocks.[8] In Figure 1, we divide countries into two categories based on whether the FDI stock is higher than the 50% quantile. Figure 1 shows that the survival function of exports of countries with FDI stock greater than or equal to 50% quantile is relatively high, which shows that FDI improves the survival rate of product exports and preliminarily verifies Hypothesis 1.

To show the heterogeneous impact of FDI on products with different distances to comparative advantage, we consider two representative countries: Estonia and India. The proportion of Estonian FDI stock to GDP in 2000–2015 is higher than the 80% quantile of each country's FDI index in that year, while for India, it is lower than 20%. As shown in the figure, for countries with high FDI stock (i.e. Estonia), the survival function of products with comparative advantage is above one of those without comparative advantage. That indicates that the export survival of products with comparative advantage is longer. While the countries with low FDI stock (i.e. India), in the short

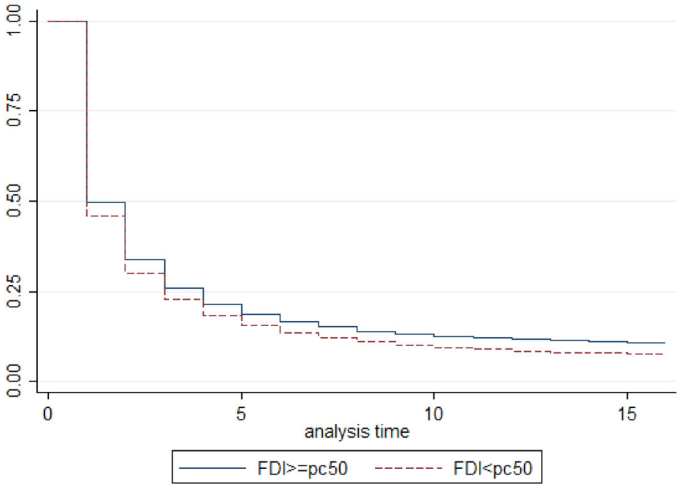

Figure 1. Export survival functions of countries with different FDI stock.
Source: Authors.

export survival, are entangled together. This preliminarily proves Hypothesis 2, that FDI improves the export survival of products with comparative advantage.

4. Empirical results

4.1. Basic estimates

The stratified Cox model based on HS 6-digit product stratification is used for estimation through Equation (1). The explained variable is the export risk function at the country-product level. All estimates control the fixed effect of the country and the fixed effect of the year plus cluster the standard deviation at the country-year level. The empirical results are shown in Table 2.

Column (1) considers the influence of the distance to comparative advantage and FDI stock on product export risk. According to estimations, the distance coefficient is positive. It means that the larger the distance to comparative advantage, the higher the survival rate (i.e. the risk) that the country stops exporting the products in the next period. The constructed index fittingly reflects whether a product conforms to the comparative

Table 2. Basic results.

	Dependent Variable: h(t)				
	(1)	(2)	(3)	(4)	(5)
Distance	0.040***	0.037***	0.034***	0.033***	0.036***
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
fdi*distance		0.005***	0.006***	0.005***	0.005***
		(0.001)	(0.002)	(0.002)	(0.002)
ck*ck_intens			−0.035***	−0.034***	−0.034***
			(0.004)	(0.005)	(0.005)
hc*hc_intens			−1.223***	−1.069***	−1.067***
			(0.127)	(0.134)	(0.134)
fin*fin_intens				−0.001***	−0.001***
				(0.000)	(0.000)
gdp*distance					−0.002
					(0.003)
Fdi	−0.008***	−0.013***	−0.009***	−0.009***	−0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Ck			−0.007	−0.008	−0.007
			(0.006)	(0.006)	(0.006)
Hc			0.514***	0.461***	0.465***
			(0.067)	(0.070)	(0.069)
Fin				0.0003	0.0003
				(0.0003)	(0.0003)
Gdp	−0.046***	−0.045***	−0.011	−0.001	0.002
	(0.013)	(0.013)	(0.019)	(0.020)	(0.022)
Pexport	−0.304***	−0.305***	−0.303***	−0.307***	−0.306***
	(0.069)	(0.069)	(0.068)	(0.073)	(0.073)
Open	−0.119***	−0.119***	−0.121***	−0.121***	−0.120***
	(0.029)	(0.029)	(0.029)	(0.032)	(0.032)
Duraorder	−0.047***	−0.047***	−0.047***	−0.048***	−0.048***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	511,569	511,569	511,569	457,665	457,665
country FE	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES

Source: authors' estimations.
Note: Standard errors at the country*year level are in parentheses. ***, **, and *indicate significance at the 1%, 5%, and 10% level. Estimations also allow for different baseline hazards across products by defining product k at the HS6 level as a strata variable.

advantage of the exporting country or not. This finding is supported by Nicita et al. (2013), who showed that the degree to which an exported good aligns with a country's comparative advantage is a strong predictor of the survival and durability of that good's exports from a Least Developed Country. The negative coefficient of FDI stock indicates that the higher the proportion of FDI stock of GDP, the smaller the product export risk is, thus proving Hypothesis 1. This finding, along with the conclusion o Anwar and Nguyen (2011) and Abegaz and Lahiri (2020), lends credence to the idea that foreign direct investment (FDI) boosts the survival rate of local businesses engaged in product exports in developing countries and that FDI-backed foreign enterprises may amplify this impact via technological, competitive, and productivity spillovers.

In column (2), the interaction term of FDI stock and product distance to comparative advantage is added to test the effect of FDI on resource misallocation. The results support Hypothesis 2 as the interaction term coefficient is significantly positive at 1%. It indicates that the increase in FDI will increase the risk of industries having a more considerable distance to comparative advantage than industries with a small distance. It means that FDI promotes allocating resources to industries with a comparative advantage. The coefficient of FDI is still significantly negative at 1%, which proves that FDI reduces the risk of the host country's product exports. These empirics are in line with the studies of Nicita et al. (2013), Lectard and Rougier (2018), Mukhtarov et al. (2019), and Berthou et al. (2019) and imply that the volume of a country's FDI stock impacts the implication distance to comparative advantage for exported products and their survival. Ignoring comparative advantage in favor of enticing FDI could be harmful due to a decline in industrial value-added. Thus, the detrimental effect of trade policy on business export may be exacerbated by the FDI plan that ignores comparative advantage.

Column (3) controls the impact of the national factor endowments on the export survival of industries with different factor intensities. Specifically, the interaction terms between national physical capital abundance and ISIC Rev. 2 4-digit industry physical capital intensity, between national human capital abundance and ISIC Rev. 2 4-digit industry human capital intensity and national capital abundances, are added.[9] The results show that the interaction terms between the mentioned control variables are all significantly negative at 1%, which is consistent with the prediction of factor endowment theory. This means that physical and human capital abundance decreases product export survival risks and can magnify the impacts of FDI on export entrance and export upgrading of firms in the host country (Jaud et al. 2018).

To eliminate the influence of the external financial dependence on the export survival, the interaction term between financial development and external financial dependence is added in column (4). The results displayed that the coefficient of the interaction term is significantly negative at 1%, indicating that finance has a heterogeneous effect on product export survival. This result means that those firms with easy access to external financing in these developing countries will effectively reduce the exit probability of their product exported from the market. The estimations of core explanatory variables are still robust.

In column (5), we further control the heterogeneous effect of economic development on the export survival of products with different comparative advantages.

Specifically, we add the interaction term between GDP per capita and the product distance to comparative advantage. The results express that the interaction term coefficient is insignificant, while the influence of core explanatory variables in this paper is still statistically robust.

4.2. Robustness check

We examine different subsamples to test the robustness of the empirical results, which are shown in Table 3. Some Eastern and South-Eastern Asian countries have implemented the 'export-oriented industrialization' strategy and may have large FDI stocks. Column (1) demonstrates the results after excluding the countries mentioned above. The coefficient between FDI and distance to comparative advantage is significantly positive at 5%, and the absolute value of the coefficients remains stable, which proves that the conclusions drawn in the benchmark results are not caused by the widely concerned 'Eastern Asian miracle'. In column (2), Latin American countries are deleted. Historically these countries have implemented an import substitution strategy but rapidly opened their markets in the 1990s, which had a stern impact on

Table 3. Robustness check.

	Dependent Variable: h(t)				
	(1) Asian tiger	(2) Latin	(3) Resource	(4) Extreme	(5) New distance
Distance	0.035***	0.034***	0.028***	0.034***	0.021***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)
fdi*distance	0.004**	0.006***	0.005**	0.008***	0.004***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
ck*ck_intens	−0.033***	−0.035***	−0.041***	−0.034***	−0.035***
	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)
hc*hc_intens	−1.030***	−0.893***	−1.136***	−1.068***	−1.106***
	(0.134)	(0.145)	(0.117)	(0.134)	(0.134)
fin*fin_intens	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
gdp*distance	−0.001	−0.000	0.008***	−0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Fdi	−0.007***	−0.009***	−0.008***	−0.013***	−0.009***
	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)
Ck	−0.010	−0.010	−0.007**	−0.008	−0.006
	(0.006)	(0.006)	(0.003)	(0.006)	(0.006)
Hc	0.482***	0.492***	0.432***	0.466***	0.482***
	(0.071)	(0.078)	(0.042)	(0.069)	(0.068)
Fin	0.000	0.001	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gdp	0.007	0.004	−0.019*	0.003	−0.005
	(0.023)	(0.023)	(0.012)	(0.022)	(0.022)
Pexport	−0.305***	−0.279***	−0.276***	−0.307***	−0.306***
	(0.072)	(0.070)	(0.036)	(0.073)	(0.074)
Open	−0.155***	−0.131***	−0.109***	−0.123***	−0.118***
	(0.033)	(0.033)	(0.020)	(0.032)	(0.031)
Duraorder	−0.052***	−0.057***	−0.047***	−0.048***	−0.048***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Observations	444,985	372,884	402,624	457,665	457,485
Country	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES

Note: Standard errors at the country*year level are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level. Estimations also allow for different baseline hazards across products by defining product k at the HS6 level as a strata variable.
Source: Authors.

the local manufacturing industry. As an outcome, FDI plays a vital role in these countries. After excluding these countries, although the number of samples decreased significantly, the coefficients of each variable remained robust, and the interaction coefficient between FDI and product distance to comparative advantage increased, which confirmed the primary analysis. In column (3), countries highly dependent on extractive industry exports are excluded[10] , and the empirical results are still robust. The interaction between FDI and product distance to comparative advantage is significantly positive at 5%, while the coefficient of FDI is in line with the original estimate. In column (4), the extreme values of FDI winsorized[11]affected by extreme observations are included in the sample. According to estimated results, the coefficients excluding the influence of extreme values are consistent with the benchmark estimated results, which further verifies the robustness of this paper.

The last column uses an alternate measure for product distance to comparative advantage. The specific equation is as follows:

$$distance_{ck_0} = |std(\kappa_{ct_0} - \hat{\kappa}_{kt_0})| + |std(h_{ct_0} - \hat{h}_{kt_0})| \tag{6}$$

The empirical results show that the product distance to the comparative advantage index using Equation (6) does not change the benchmark results of the original model. FDI is significantly negative at 1%, while the interaction term of FDI and product distance to comparative advantage is significantly positive at 1%.[12]

4.3. Intermediary mechanism test

The previous empirical outcomes proved the role of FDI in improving the product export capacity of the host countries. However, the literature suggests that FDI improves the export capacity by upgrading export products that need further verification. Under the category of niche products, developing countries often produce products with low technology intensity to meet the needs of low-income consumers with low-quality requirements on the international market. Therefore, this paper takes the quality of export products as the proxy variable of export upgrading to test the mechanism.

In line with Khandelwal and Roitman (2013), we estimate the following equation with the OLS method, and its residual is the quality of export products;

$$log(x_{ikjt}) + \sigma log(p_{ikjt}) = \varphi_k + \varphi_{ct} + \epsilon_{ikjt} \tag{7}$$

In this equation, x_{ikjt} represents the quantity of product K exported by country I to country J in year t and p_{ikjt} represents the price of the product, and σ represents the price elasticity, which is set as 5. The right side of the equation controls the fixed effect to eliminate the influence of product level heterogeneity and unobservable factors in the specific year of the export-destined country on demanded quantity and product price. We standardize the product quality information obtained by the mentioned method,[13] then weigh it at the export country-product level. To obtain the overall quality of product K exported by country I in year t, we use it as

the explained variable to regress FDI and the product distance to comparative advantage.

The results of panel fixed effect regression are shown in Table 4. The negative coefficient in column (1) shows that the higher distance to comparative advantage lowers the product quality. The results represent the non-significant impact of FDI on the quality of the host country's export products, which may be due to the heterogeneity of FDI. This empirical evidence confirms that firms in developing countries can compete by reducing the distance to comparative advantage in a certain product to increase product quality rather than reducing manufacturing costs, therefore can increase the export of quality goods and vice versa. In column (2), we added interaction terms, FDI and distance, to the comparative advantage of products. The estimated interaction term is significantly negative, while the coefficient of the FDI is positive (although not significant). It is clear that FDI improves the quality of export

Table 4. Mechanism test.

	Deviation: quality		Deviation.: h(t)	
	(1) FE	(2) FE	(3) Cox	(4) Cox
Quality				−0.001***
				(0.000)
Distance	−0.002***	−0.001*	0.035***	0.035***
	(0.001)	(0.001)	(0.005)	(0.005)
fdi*distance		−0.001**	0.005**	0.005**
		(0.000)	(0.002)	(0.002)
ck*ck_intens	0.008***	0.008***	−0.045***	−0.044***
	(0.002)	(0.002)	(0.007)	(0.007)
hc*hc_intens	0.552***	0.551***	−1.215***	−1.250***
	(0.110)	(0.110)	(0.163)	(0.166)
fin*fin_intens	0.0002**	0.0002**	−0.001***	−0.001***
	(0.0001)	(0.0001)	(0.000)	(0.000)
gdp*distance		−0.0001	−0.002	−0.003
		(0.0002)	(0.003)	(0.003)
Fdi	−0.0003	0.0004	−0.007**	−0.006**
	(0.0004)	(0.0005)	(0.003)	(0.003)
Ck	−0.001	−0.001	−0.007	−0.007
	(0.001)	(0.001)	(0.007)	(0.007)
Hc	−0.059***	−0.059***	0.535***	0.536***
	(0.008)	(0.008)	(0.080)	(0.080)
Fin	−0.000	−0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Gdp	0.001*	0.002*	0.012	0.013
	(0.001)	(0.001)	(0.023)	(0.023)
Pexport	0.026***	0.026***	−0.088**	−0.078**
	(0.002)	(0.002)	(0.038)	(0.035)
Open	0.006**	0.006**	−0.149***	−0.161***
	(0.003)	(0.003)	(0.037)	(0.037)
Constant	0.540***	0.538***		
	(0.011)	(0.011)		
Duraorder			−0.049***	−0.048***
			(0.005)	(0.005)
Observations	769,485	769,485	288,274	280,231
R-squared	0.079	0.081		
Country			YES	YES
Year	YES	YES	YES	YES
country-product	YES	YES	NO	NO

Note: In columns (1) and (2), Standard errors are in parentheses. In columns (3) and (4), Standard errors at the country*year level are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.
Source: Authors.

products with a comparative advantage and has little promotional effect on products without a comparative advantage. This can lead to a decline in the quality of export products, deviating from the national factor endowment.[14] This result suggests that FDI pushes the firms to acquire a comparative advantage in a product that helps developing nations improve the quality of the goods they export.

Further, export upgrading or product quality is an important component for the survival of firm export products. Thus, we test whether the quality of export products can improve export survival. Column (3) replicates the baseline regression with limited samples without including product quality. The calculation method of product quality can only be applied to products with considerable heterogeneity, resulting in a sharp decrease in sample observations. However, we found that the results in the benchmark regression are still robust, confirming that distance to comparative advantage increases the risk factor of product export survival, and FDI is an effective remedy to enhance the product survival rate. After adding product quality in column (4), the coefficient of the product quality variable is significantly negative at 1%. It indicates that improving the product quality increases the product survival rate and is beneficial to promote product export continuously. After controlling the intermediary variables, the coefficients of FDI and the interaction term between FDI and product comparative advantage are significantly negative and positive, respectively. The negative coefficient of FDI shows that it reduces the risks associated with product export survival, whereas the positive coefficient of the interaction term reveals that product without comparative advantage decreases their export survival. In summary, these results explain that FDI fortifies the host country's exports and increases product survival by improving product quality and helping the firm achieve comparative advantage, which is confirmed by the literature review part of this paper.

4.4. Endogenous problem

Considering the possible endogeneity, this paper utilizes a two-stage least square (2SLS) instrumental variable (IV) technique referring to the method of Frankel and Romer (1999hx0029; and Levchenko (2013) to identify more accurately the impact of FDI on product export survival. We apply the gravity model to regress the two-sided FDI flow[15] to the population and geographical variables, sum up the two-sided FDI fitting values obtained by the model with the host country as the benchmark, and use it as an instrumental variable of FDI[16]. The estimated results are shown in Table 5:

The estimated results of OLS regression in column (1) suggest whether the products exported in 2004 will not be exported in the next year for the FDI of the host country in the CEPII database. The control variables are the same as in benchmark regression. Besides, we control the fixed effect of the country and industry to calculate the robust standard error. The interaction term between FDI and product distance to comparative advantage is significantly positive at 5%. It indicates that the products lacking comparative advantage are more likely to exit from the export market in the next period, thus reflecting the role of FDI in resource allocation.

Column (2) shows the estimation of the first phase of 2SLS. The results show a significant correlation between the two interaction terms (the total FDI predicted

Table 5. 2SLS results.

Dependent Variables	(1) Outcome	(2) FDI distance	(3) Outcome
fdi*distance	0.012**		0.035***
	(0.006)		(0.010)
Distance	0.068***	0.149***	0.065***
	(0.003)	(0.007)	(0.003)
ck*ck_intens	−0.010*	−0.006	−0.010*
	(0.006)	(0.005)	(0.006)
hc*hc_intens	−0.215**	0.122*	−0.216**
	(0.091)	(0.065)	(0.091)
fin*fin_intens	−0.000*	0.000	−0.000*
	(0.000)	(0.000)	(0.000)
gdp*distance	−0.019***	−0.079***	−0.025***
	(0.003)	(0.011)	(0.004)
Pexport	−0.023***	0.000	−0.023***
	(0.002)	(0.001)	(0.002)
efv*distance		2,198.328***	
		(89.085)	
Constant	0.138***	−0.600***	0.328***
	(0.012)	(0.042)	(0.034)
Observations	176,629	176,629	176,629
R-squared	0.163	0.958	0.163
Country	YES	YES	YES
Industry	YES	YES	YES

Note: Standard errors at the country*year level are in parentheses. ***, **, and* indicate significance at the 1%, 5%, and 10% level.
Source: Authors.

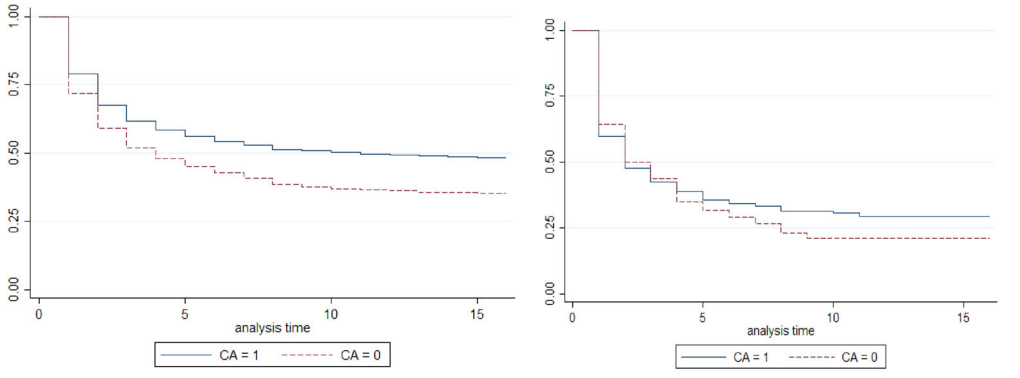

Figure 2. Export survival functions of products with/without comparative advantage in two typical countries.
Source: Authors.

value and product distance to comparative advantage and the actual FDI and product distance to comparative advantage[17]). This means that the IV used in the study is appropriate for the treatment variable of 2SLS estimation. Column (3) shows the estimated results of the second stage. Here, the interaction term coefficient is significantly positive at 1%, which is similar to the Cox proportional risk regression. It means that the FDI brought by geographical factors and the potential investment opportunities will pay more attention to the factor endowment of the host country.

Thus, based on more political risks, culture, and institutional factors, FDI is conducive to helping the host country 'discover' its comparative advantage.

5. Conclusions

For a sizeable number of developing countries, it is a more practical way to industrialize through the rapid promotion of the production scale and technology, being aware of the international market demands. This development strategy requires developing countries to improve their ability towards sustainable product exports and gradually improve their export structure. However, because of ineffective technology, the lack of understanding of the international market demand, and the existence of 'self-discovery' problems, it is difficult for such countries to establish comprehensive and stable trade relationships. Besides, a wide range of resource misallocations exists in the context of a weak market mechanism and unreasonable government intervention. Many resources may be used to produce products that do not have comparative advantages. The above problems have created considerable obstacles for developing countries to achieve healthy export development.

To this end, this study investigated the impacts of FDI, a key determinant of export growth, on product export survival in developing countries. We establish a survival analysis model based on the Cox proportional risk regression to analyze the relationship at the firm level from 1999 to 2015. The study provides some intriguing results. First, based on the spillover effect theory of FDI, the recent literature on market openness, and the improvement of resource allocation efficiency, the results proposed that FDI can promote sustainable product exports and enhance the resource allocation efficiency of the export markets. Second, the results showed that FDI could help developing countries establish more stable trade relationships and reduce risks of low product survival rate, which is more apparent for the products having a comparative advantage.

The findings of this paper take one step further in the theoretical support for the existing policies toward FDI and have important policy implications for developing countries. First, the government must implement policies encouraging economic integration, commerce, export promotion, and regional cooperation to attract high-quality export-oriented FDI. Second, the FDI not only promotes total exports and increases the types of export products but also improves the ability of the host countries to export products continuously and can promote the rational allocation of resources in the production process of the export products. Therefore, more open and effective channels of communication and investment services should be established in the policymaking process of developing nations to bring the role of FDI into a better play. Third, the policymakers should keep granting significant facilities to foreign investors, especially in the export-oriented sectors. In case financial facilities are more difficult to be granted by some developing countries because of tight financial constraints of their public budgets, the governments should focus on granting necessary non-financial facilities, such as simplifying the formalities for settling a new business, facilities for acquiring lands, easy access, and entrance to the market. Fourth, exports from strategically chosen industries with solid backward and forward links should be

encouraged by policymakers. Furthermore, exporting enterprises constitute a significant source of spillover, making it crucial to promote multinationals with export potential that use local production factors. These companies assist domestic competitors in entering the export market by sharing knowledge and resources that might lower the initial financial investment required to begin exporting globally and reduce the risks associated with product survival.

Lastly, despite providing an empirical approach to FDI and export nexus, our research has several limitations that may be addressed in future research. First, the likelihood of investments in the volatile economic sector by risk-averse investors remains an underexplored topic in the current research. Such investigation will contribute significantly to the economic literature as output volatility, and FDI are critical for emerging and underdeveloped countries. Second, more research is needed to determine how comparative advantage affects export survival across countries. It is possible that changes in the export basket, or a more general decline in the significance of comparative advantage, explain the persistence of exports through time. Third, analyzing how recent economic and financial crises impact institutional policymaking related to FDI and export is a valuable future research direction. Fourth, FDI's interaction with the business freedom index and global supply chain competitiveness under the availability of a larger panel dataset will expand the existing economic literature.

Notes

1. A research report published by the Inter-American Development Bank (IDB, 2007), cited many products of Latin American countries that cannot maintain sustainable exports.
2. The longer the export survival of a country's product is, the more resources are invested in that product. Jaud et al. (2018) found that financial development can improve the export survival of industries with comparative advantage.
3. A catch-up strategy of developing countries.
4. A country-product level also includes control variables at the country and firm level.
5. Refer to Human Capital in PWT 9.0
6. Refer to the calculation of κ_{ct_0} and h_{ct_0}.
7. The proportion of raw materials is considered. Besides, the industry standard in the original data is SIC 1987, which we correspond with ISIC Rev. 2 And the ISIC Rev. 2 finally adopts the mean value of corresponding indexes of SIC 1987.
8. The survival function here is a Kaplan-Meier estimate.
9. The material and human capital density indexes are absorbed by the stratification variable HS 6-digit industry.
10. In these countries, the extractive industries accounted for more than 60% on average in the export in 2000-2015, the data is from the WDI database.
11. We set the Winsorzing thresholds at 1% and 99%.
12. During analysis, we deleted the observation value of 5% of the products whose distance to comparative advantage changed more in the last year of export survival compared with the initial year.
13. $stquality_{ikjt} = {}^{quality_{ikjt} - MAXquality_{kt}}/_{MAXquality_{kt} - MINquality_{kt}}$, where $MAXquality_{kt}$ and $MINquality_{kt}$ represents the highest and lowest product quality of product k in year t respectively.
14. From the coefficients in Column (2), it is clear that the quality of products with a distance to comparative advantage greater than 1.92 (1.92 =.0007192 /.0003737, close to 90% quantile) will decline under a given FDI stock.

15. The reason that bilateral FDI flow data is selected as the explanatory variable of the gravity model is that the gravity model explains the flow data to a higher degree, such as bilateral trade volume.
16. See the appendix for detailed estimation strategy and results.
17. See the appendix for the reasons for the significant estimation coefficient.
18. Data source: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=4

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Source of data

Data source is provided into the manuscript.
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Data availability

Datasets are available at request from the corresponding author.

References

Abegaz, M., & Lahiri, S. (2020). Entry and survival in the export market: Spillovers from foreign and outward-looking domestic firms in Ethiopia. *The European Journal of Development Research*, *32*(4), 847–872. https://doi.org/10.1057/s41287-019-00242-2

Anwar, S., & Nguyen, L. P. (2011). Foreign direct investment and export spillovers: Evidence from Vietnam. *International Business Review*, *20*(2), 177–193. https://doi.org/10.1016/j.ibusrev.2010.11.002

Bai, T., & Liesch, P. (2022). Organizational goals and resource allocation to overseas foreign direct investment. *Journal of World Business*, *57*(3), 101308. https://doi.org/10.1016/j.jwb.2022.101308

Balassa, B. (1965). Trade liberalisation and "revealed" comparative advantage 1. *The Manchester School*, *33*(2), 99–123. https://doi.org/10.1111/j.1467-9957.1965.tb00050.x

Banerjee, A. V., & Duflo, E. (2005). Growth theory through the lens of development economics. *Handbook of Economic Growth*, *1*, 473–552.

Bartelsman, E., Haltiwanger, J., & Scarpetta, S. (2010). Cross-country and within-country differences in the business climate. *International Journal of Industrial Organization*, *28*(4), 368–371. https://doi.org/10.1016/j.ijindorg.2010.03.007

Bashir, M. F. (2022). Discovering the evolution of pollution haven hypothesis: A literature review and future research agenda. *Environmental Science and Pollution Research*, *29*(32), 48210–48232. https://doi.org/10.1007/s11356-022-20782-1

Bashir, M. F., Ma, B., Xia, W., Shahzad, U., & Radulescu, M. (2022). Do economic openness and institutional quality influence environmental patents? Empirical evidence from South Asia. *Environmental Engineering & Management Journal (EEMJ)*, *21*(1), 1–15.

Beck, T., Levine, R., & Loayza, N. (2000). Finance and the sources of growth. *Journal of Financial Economics*, *58*(1–2), 261–300. https://doi.org/10.1016/S0304-405X(00)00072-6

Benkovskis, K., Jarrett, P., Krill, Z., Tkacevs, O., & Yashiro, N. (2022). The survival of Latvian products and firms in export markets.
Berthou, A., Chung, J. J.-H., Manova, K., & Sandoz Dit Bragard, C. (2019). Trade, productivity and (mis) allocation. Available at SSRN 3502471.
Besedes, T., & Blyde, J. (2010, January). *What drives export survival? An analysis of export duration in Latin America*. Available at Www. Editorialexpress. Com/Cgi-Bin/Conference/Download. Cgi.
Besedeš, T., & Prusa, T. J. (2006). Product differentiation and duration of US import trade. *Journal of International Economics*, *70*(2), 339–358. https://doi.org/10.1016/j.jinteco.2005.12.005
Besedeš, T., & Prusa, T. J. (2011). The role of extensive and intensive margins and export growth. *Journal of Development Economics*, *96*(2), 371–379. https://doi.org/10.1016/j.jdeveco.2010.08.013
Besedes, T., and Yan, S. (2018). Product quality, duration, and trade growth. *FREIT Working Paper No. 1210*, *55*(8), 66–89.
Brenton, P., Saborowski, C., & Von Uexkull, E. (2010). What explains the low survival rate of developing country export flows? *The World Bank Economic Review*, *24*(3), 474–499. https://doi.org/10.1093/wber/lhq015
Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011). Export diversification: What's behind the hump? *Review of Economics and Statistics*, *93*(2), 590–605. https://doi.org/10.1162/REST_a_00078
Cagé, J., & Rouzet, D. (2015). Improving "national brands": Reputation for quality and export promotion strategies. *Journal of International Economics*, *95*(2), 274–290. https://doi.org/10.1016/j.jinteco.2014.12.013
Carrère, C., & Strauss-Kahn, V. (2017). Export survival and the dynamics of experience. *Review of World Economics*, *153*(2), 271–300. https://doi.org/10.1007/s10290-017-0277-1
Chen, L., Guo, S., Lu, J., & Gerschewski, S. (2021). Outward FDI and efficiency in within-firm resource allocation–Evidence from firm-level data of China. *Journal of Asian Economics*, *74*, 101298. https://doi.org/10.1016/j.asieco.2021.101298
Chen, X., & Hui, L. (2015). Can export duration of products advance constant upgrading of export technology sophistication? From a perspective of heterogeneity of graphic advantage of export trade (in Chinese). *Journal of Finance and Economics*, *41*(01), 74–86.
Dai, M., & Li, B. (2020). Improving firm survival: Exports or outward foreign direct investment? *Post-Communist Economies*, *32*(5), 675–696. https://doi.org/10.1080/14631377.2019.1678097
Deardorff, A. V. (1979). Weak links in the chain of comparative advantage. *Journal of International Economics*, *9*(2), 197–209. https://doi.org/10.1016/0022-1996(79)90003-5
Defever, F., Heid, B., & Larch, M. (2015). Spatial exporters. *Journal of International Economics*, *95*(1), 145–156. https://doi.org/10.1016/j.jinteco.2014.11.006
Epifani, P., & Gancia, G. (2011). Trade, markup heterogeneity and misallocations. *Journal of International Economics*, *83*(1), 1–13. https://doi.org/10.1016/j.jinteco.2010.10.005
Eslava, M., Haltiwanger, J., Kugler, A., & Kugler, M. (2013). Trade and market selection: Evidence from manufacturing plants in Colombia. *Review of Economic Dynamics*, *16*(1), 135–158. https://doi.org/10.1016/j.red.2012.10.009
Fossati, R., Rachinger, H., & Stivali, M. (2021). Extent and potential determinants of resource misallocation: A cross-sectional study for developing countries. *The World Economy*, *44*(5), 1338–1379. https://doi.org/10.1111/twec.13041
Frankel, J. A., & Romer, D. H. (1999). Does trade cause growth? *American Economic Review*, *89*(3), 379–399.
Greenaway, D., Sousa, N., & Wakelin, K. (2004). Do domestic firms learn to export from multinationals? *European Journal of Political Economy*, *20*(4), 1027–1043. https://doi.org/10.1016/j.ejpoleco.2003.12.006
Ha, V., Holmes, M. J., & Hassan, G. (2020). Does foreign investment benefit the exporting activities of Vietnamese firms? *The World Economy*, *43*(6), 1619–1646. https://doi.org/10.1111/twec.12912
Harding, T., & Javorcik, B. S. (2012). Foreign direct investment and export upgrading. *Review of Economics and Statistics*, *94*(4), 964–980. https://doi.org/10.1162/REST_a_00226

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1–25. https://doi.org/10.1007/s10887-006-9009-4

Hausmann, R., & Rodrik, D. (2003). Economic development as self-discovery. *Journal of Development Economics*, *72*(2), 603–633. https://doi.org/10.1016/S0304-3878(03)00124-X

Hsieh, C.-T., & Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics*, *124*(4), 1403–1448. https://doi.org/10.1162/qjec.2009.124.4.1403

Hu, A. G., & Jefferson, G. H. (2002). FDI impact and spillover: Evidence from China's electronic and textile industries. *The World Economy*, *25*(8), 1063–1076. https://doi.org/10.1111/1467-9701.00481

Hussain, M., Bashir, M. F., & Shahzad, U. (2021). Do foreign direct investments help to bolster economic growth? New insights from Asian and Middle East economies. *World Journal of Entrepreneurship, Management and Sustainable Development*, *17*(1), 62–84. https://doi.org/10.1108/WJEMSD-10-2019-0085

Huynh, H. T., Nguyen, P. V., Trieu, H. D., & Tran, K. T. (2021). Productivity spillover from fdi to domestic firms across six regions in Vietnam. *Emerging Markets Finance and Trade*, *57*(1), 59–75. https://doi.org/10.1080/1540496X.2018.1562892

Huynh, K. P., Petrunia, R. J., & Voia, M. (2010). The impact of initial financial state on firm duration across entry cohorts. *The Journal of Industrial Economics*, *58*(3), 661–689. https://doi.org/10.1111/j.1467-6451.2010.00429.x

IDB. (2007). "The Emergence of New Successful Export Activities in Latin America & the Caribbean" Research Department Network Project. *Inter-American Development Bank*, *46*, 126–144.

Ihwah, A. (2015). The use of Cox regression model to analyze the factors that influence consumer purchase decision on a product. *Agriculture and Agricultural Science Procedia*, *3*, 78–83. https://doi.org/10.1016/j.aaspro.2015.01.017

Jaud, M., Kiendrebeogo, Y., & Véganzonès-Varoudakis, M.-A. (2018). Financial vulnerability and export dynamics. *The World Economy*, *41*(6), 1640–1663. https://doi.org/10.1111/twec.12596

Javorcik, B. S., Lo Turco, A., & Maggioni, D. (2018). New and improved: Does FDI boost production complexity in host countries? *The Economic Journal*, *128*(614), 2507–2537. https://doi.org/10.1111/ecoj.12530

Ji, X., Chen, X., Mirza, N., & Umar, M. (2021). Sustainable energy goals and investment premium: Evidence from renewable and conventional equity mutual funds in the Euro zone. *Resources Policy*, *74*, 102387. https://doi.org/10.1016/j.resourpol.2021.102387

Ji, X., Zhang, Y., Mirza, N., Umar, M., & Rizvi, S. K. A. (2021). The impact of carbon neutrality on the investment performance: Evidence from the equity mutual funds in BRICS. *Journal of Environmental Management*, *297*, 113228.

Jiang, L., Lu, Y., & Chen, Y. (2018). Can market mechanism help to cure zombie firm? Evidence from FDI liberation. *The Journal of World Economy*, *9*, 121–145.

Jongwanich, J. (2010). Determinants of export performance in East and Southeast Asia. *World Economy*, *33*(1), 20–41. https://doi.org/10.1111/j.1467-9701.2009.01184.x

Kampouris, I., Mertzanis, C., & Samitas, A. (2022). Foreign ownership and the financing constraints of firms operating in a multinational environment. *International Review of Financial Analysis*, *83*, 102328. https://doi.org/10.1016/j.irfa.2022.102328

Karim, S., Naeem, M. A., Mirza, N., & Paule-Vianez, J. (2022). Quantifying the hedge and safe-haven properties of bond markets for cryptocurrency indices. *The Journal of Risk Finance*, *23*(2), 191–205. https://doi.org/10.1108/JRF-09-2021-0158

Kastratović, R. (2020). The impact of foreign direct investment on host country exports: A meta-analysis. *The World Economy*, *43*(12), 3142–3183. https://doi.org/10.1111/twec.13011

Khandelwal, P., & Roitman, A. (2013). The economics of political transitions: implications for the Arab Spring. *International Monetary Fund*, *31*, 59–75.

Konara, P., & Wei, Y. (2017). Foreign direct investment as a catalyst for domestic firm development. *Transnational Corporations*, *23*(3), 1–32. https://doi.org/10.18356/a4a49e57-en

Koopman, R., Powers, W., Wang, Z., & Wei, S.-J. (2010). *Give credit where credit is due: Tracing value added in global production chains*. National Bureau of Economic Research (no.w16426). 21–45.

Krifa-Schneider, H., Matei, I., & Sattar, A. (2022). FDI, corruption and financial development around the world: A panel non-linear approach. *Economic Modelling*, *110*, 105809. https://doi.org/10.1016/j.econmod.2022.105809

Lectard, P., & Rougier, E. (2018). Can developing countries gain from defying comparative advantage? Distance to comparative advantage, export diversification and sophistication, and the dynamics of specialization. *World Development*, *102*, 90–110. https://doi.org/10.1016/j.worlddev.2017.09.012

Levchenko, A. A. (2013). International trade and institutional change. The Journal of Law. *Economics, & Organization*, *29*(5), 1145–1181. https://doi.org/10.1093/jleo/ews008

Li, C., Liu, C., & Zhao, J. (2021). The effects of inward and outward foreign direct investment on manufacturing export sophistication in China. *Applied Economics Letters*, *28*(20), 1758–1766. https://doi.org/10.1080/13504851.2020.1854429

Li, X., & Liu, A. A. (2018). Imitating to export. *China Economic Review*, *53*, 254–270.

Lu, Y., & Yu, L. (2015). Trade liberalization and markup dispersion: Evidence from China's WTO accession. *American Economic Journal: Applied Economics*, *7*(4), 221–253.

Ma, B., Wang, Y., Zhou, Z., Lai, Y., Zhou, Z., & Bashir, M. F. (2022). Can controlling family involvement promote firms to fulfill environmental responsibilities?—Evidence from China. *Managerial and Decision Economics*, *43*(2), 569–592. https://doi.org/10.1002/mde.3403

Manova, K. (2013). Credit constraints, heterogeneous firms, and international trade. *The Review of Economic Studies*, *80*(2), 711–744. https://doi.org/10.1093/restud/rds036

Markusen, J. R., & Svensson, L. E. (1983). *Trade in goods and factors with international differences in technology*. National Bureau of Economic Research Cambridge.

Martuscelli, A., & Varela, G. (2018). Survival is for the fittest: Export survival patterns in Georgia. *Economic Systems*, *42*(3), 397–413. https://doi.org/10.1016/j.ecosys.2017.10.002

Mirza, N., Hasnaoui, J. A., Naqvi, B., & Rizvi, S. K. A. (2020a). The impact of human capital efficiency on Latin American mutual funds during Covid-19 outbreak. *Swiss Journal of Economics and Statistics*, *156*(1), 1–7. https://doi.org/10.1186/s41937-020-00066-6

Mirza, N., Rahat, B., Naqvi, B., & Rizvi, S. K. A. (2020b). Impact of Covid-19 on corporate solvency and possible policy responses in the EU. *The Quarterly Review of Economics and Finance*, (1), 1–25.https://doi.org/10.1016/j.qref.2020.09.002

Mirza, N., Rizvi, S. K. A., Saba, I., Naqvi, B., & Yarovaya, L. (2022). The resilience of Islamic equity funds during COVID-19: Evidence from risk adjusted performance, investment styles and volatility timing. *International Review of Economics & Finance*, *77*, 276–295. https://doi.org/10.1016/j.iref.2021.09.019

Mukhtarov, S., Alalawneh, M. M., Ibadov, E., & Huseynli, A. (2019). The impact of foreign direct investment on exports in Jordan: An empirical analysis. *Journal of International Studies*, *12*(3), 38–47. https://doi.org/10.14254/2071-8330.2019/12-3/4

Mundell, R. A. (1957). International trade and factor mobility. *The American Economic Review*, *47*(3), 321–335.

Naqvi, B., Mirza, N., Rizvi, S. K. A., Porada-Rochoń, M., & Itani, R. (2021). Is there a green fund premium? Evidence from twenty seven emerging markets. *Global Finance Journal*, *50*, 100656. https://doi.org/10.1016/j.gfj.2021.100656

Nicita, A., Shirotori, M., & Klok, B. T. (2013). *Survival analysis of the exports of least developed countries: The role of comparative advantage* [Paper presentation]. United Nations Conference on Trade and Development.

Nunn, N. (2007). Relationship-specificity, incomplete contracts, and the pattern of trade. *The Quarterly Journal of Economics*, *122*(2), 569–600. https://doi.org/10.1162/qjec.122.2.569

Pan, S., & Chong, Z. (2022). Effects of FDI on trade among countries along the Belt and Road: A network perspective. *The Journal of International Trade & Economic Development*, 1–20. https://doi.org/10.1080/09638199.2022.2078865

Pulido, J. (2018). *Intra-and inter-industry misallocation and comparative advantage*. Mimeo.

Qin, X., & Du, D. (2017). Do external or internal technology spillovers have a stronger influence on innovation efficiency in China? *Sustainability*, *9*(9), 1574. https://doi.org/10.3390/su9091574

Raddatz, C. (2006). Liquidity needs and vulnerability to financial underdevelopment. *Journal of Financial Economics*, *80*(3), 677–722. https://doi.org/10.1016/j.jfineco.2005.03.012

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*.

Restuccia, D., & Rogerson, R. (2013). Misallocation and productivity. *Review of Economic Dynamics*, *16*(1), 1–10. https://doi.org/10.1016/j.red.2012.11.003

Rhee, Y. W., & Belot, T. (1990). *Export catalysts in low-income countries: A review of eleven success stories*. The World Bank.

Romalis, J. (2004). Factor proportions and the structure of commodity trade. *American Economic Review*, *94*(1), 67–97. https://doi.org/10.1257/000282804322970715

Sabra, M. M. (2021). Does inward FDI promote exports and GDP: Dynamic panel evidence from selected MENA countries. *Journal of Applied Economics & Business Research*, *11*(1), 12–24.

Saia, A., Andrews, D., & Albrizio, S. (2015). Productivity spillovers from the global frontier and public policy: Industry-level evidence.

Swenson, D. L., & Chen, H. (2014). Multinational exposure and the quality of new Chinese exports. *Oxford Bulletin of Economics and Statistics*, *76*(1), 41–66. https://doi.org/10.1111/j.1468-0084.2012.00726.x

Taghizadeh-Hesary, F., Rasoulinezhad, E., Yoshino, N., Sarker, T., & Mirza, N. (2021). Determinants of the Russia and Asia–Pacific energy trade. *Energy Strategy Reviews*, *38*, 100681. https://doi.org/10.1016/j.esr.2021.100681

United Nations. (2021). Department of Economic and Social Affairs Sustainable Development. Retrieved 27 August, 2022, from https://sdgs.un.org/goal.

Wang, Y., Xie, L., Zhang, Y., Wang, C., & Yu, K. (2019). Does FDI promote or inhibit the high-quality development of agriculture in China? An agricultural GTFP perspective. *Sustainability*, *11*(17), 4620. https://doi.org/10.3390/su11174620

Yarovaya, L., Mirza, N., Abaidi, J., & Hasnaoui, A. (2021). Human capital efficiency and equity funds' performance during the COVID-19 pandemic. *International Review of Economics & Finance*, *71*, 584–591. https://doi.org/10.1016/j.iref.2020.09.017

Yu, B., Li, C., Mirza, N., & Umar, M. (2022). Forecasting credit ratings of decarbonized firms: Comparative assessment of machine learning models. *Technological Forecasting and Social Change*, *174*, 121255. https://doi.org/10.1016/j.techfore.2021.121255

Zhang, F., Zhipeng, J., & Zhang, Q. (2018). Would longer export duration help improve domestic technical complexity of export – evidence from China's product export data (in Chinese). *Journal of International Trade*, (10), 58–71.

Zhang, Q., & Felmingham, B. (2001). The relationship between inward direct foreign investment and China's provincial export trade. *China Economic Review*, *12*(1), 82–99. https://doi.org/10.1016/S1043-951X(01)00044-X

Appendix

In contour to Frankel and Romer (1999), We use the gravity model, which only contains population and geographical variables to predict FDI:

$$\begin{aligned} ln\left(FDI_{ij}/GDP_i\right) = {} & a_0 + a_1 ln\, D_{ij} + a_2 ln\, pop_i + a_3 ln\, area_i + a_4 ln\, pop_j + a_5 ln\, area_j \\ & + a_6 landlock_i + a_7 landlock_j + a_8 l_{ij} + a_9 l_{ij} ln D_{ij} + a_{10} l_{ij} ln\ pop_i \\ & + a_{11} l_{ij} ln\, area_i + a_{12} l_{ij} ln\, pop_j + a_{13} l_{ij} ln\, area_j + a_{14} l_{ij} landlock_i \\ & + a_{15} l_{ij} landlock_j + e_{ij} \ldots\ldots\ldots \end{aligned} \tag{8}$$

Here, variable FDI_{ij}/GDP_i is the ratio of FDI from country j to country i to GDP of country i in 2004. D_{ij} is the distance between the two countries; pop_i and pop_j are the total populations of the two countries; $area_i$ and $area_j$ are the land area of the two countries; $landlock_i$ and $landlock_j$ are the virtual variables, indicating two countries are landlocked; l_{ij} is the virtual variable that indicates the two countries are adjacent. According to Frankel and Romer (1999), we add the multiplicative interaction term of the virtual variable of adjacency. After obtaining the estimates of the FDI logarithm of all pair countries, to get the total FDI predicted value of the host country should be summed up with the FDI of the host country as the benchmark. Referring to Frankel and Romer (1999), Equation (9) is established, and the fitted FDI/GDP is obtained, which calculated as $\widehat{FDI_C}$:

$$\widehat{FDI_C} = \sum_{j \neq i} e^{a' X_{ij}} \ldots\ldots\ldots\ldots\ldots\ldots \tag{9}$$

$\widehat{FDI_C}$ is the instrumental variable of FDI/GDP (mentioned as FDI_C).

The FDI data of core explanatory variables for each country are from the French CEPII[18] database, and geographic, and population data are also from the CEPII database. The estimated results of the gravity model are as follows:

The results are in complete line with Frank and Romer (1999). Overall, the estimated R^2 is 0.188, which shows that the geographical and demographic factors are critical for determining FDI inflow.

Table A1. Results of the gravity model of bilateral FDI.

	Variables		Interaction	
Deviation Variables: ln FDI_{ij}/GDP_i	Coeff.	Std.	Coeff.	Std.
ln D	−1.323***	0.0423	1.073*	0.574
ln pop (host)	−0.394***	0.0271	0.266	0.241
ln area(host)	−0.116***	0.0207	−0.740***	0.237
ln pop (source)	0.793***	0.0276	−0.216	0.262
ln area(source)	−0.369***	0.0219	−0.141	0.252
landlock(host)	−1.502***	0.0784	−0.157	0.577
landlock(source)	−2.431***	0.0824	−0.0741	0.581
L	3.146	2.385		
Constant	1.155**	0.456		
Observations		20,033		
R-squared		0.188		

Note: Standard errors are in parentheses. ***, **, and* indicate significance at the 1%, 5%, and 10% level.
Source: Authors.

Moreover, it is found that the total predicted value is far less than the actual value. The reason for this is related to the characteristics of FDI flow.

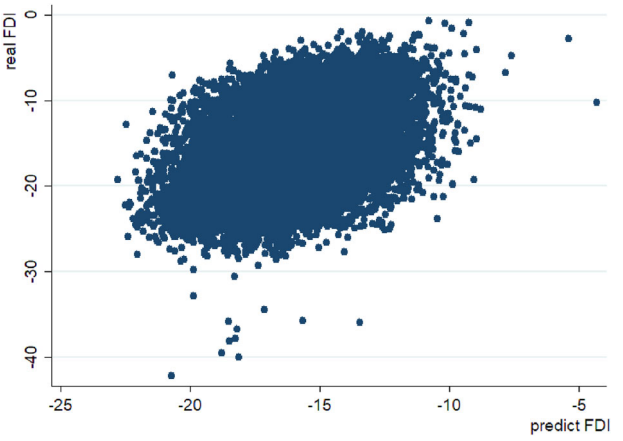

Figure A1. Real Bilateral FDI vs. predict Bilateral FDI.
Source: Authors.

Almost all host countries have actual bilateral FDI, which is significantly different from the predicted value, so there is a significant gap in the aggregation process. The logical reason behind this phenomenon is that the source countries of FDI are concentrated only in a few countries. From the overall scatter diagram (A1), the predicted value of FDI and the actual value of FDI are positively related.

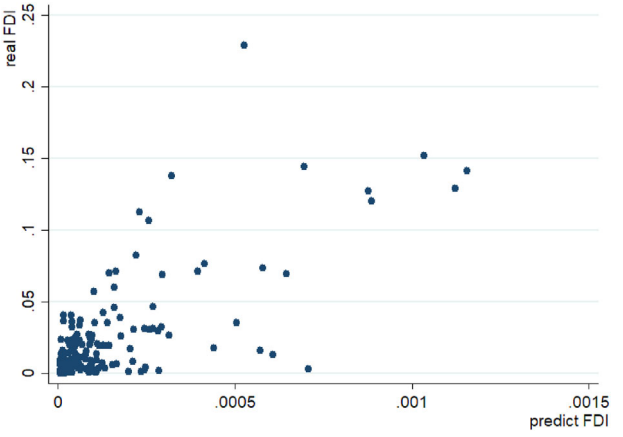

Figure A2. Aggregate real FDI vs. Aggregate predict FDI.
Source: Authors.

After getting the total FDI predicted value, Figure 2 shows the relationship between the fitted value and the actual value.

It can be seen from the figure that the predicted value is positively correlated with the actual value.