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To cite this article: Yuanzhe Huang, Changbiao Zhong & Haowei Chen (2023) The combined effect of foreign direct investment on firm productivity, Economic Research-Ekonomiska Istraživanja, 36:2, 2139278, DOI: [10.1080/1331677X.2022.2139278](https://doi.org/10.1080/1331677X.2022.2139278)

To link to this article: <https://doi.org/10.1080/1331677X.2022.2139278>



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Published online: 01 Nov 2022.



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The combined effect of foreign direct investment on firm productivity

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ABSTRACT

This paper attempts to answer the economic implications of combining inward foreign direct investment (IFDI) and outward foreign direct investment (OFDI) by constructing a panel fixed effects model using Chinese industrial firm-level data for the period 1998–2013. Specifically, we focus on the impact of combining IFDI and OFDI on firm productivity in China. We also introduce interactive terms into the model to explore the direct and indirect mechanisms through which IFDI and OFDI affect productivity growth. The results show that IFDI and OFDI work together to contribute to productivity growth by acting directly on the level of technology, thereby increasing productivity. IFDI intensifies market concentration, which in turn positively moderates the relationship between OFDI and productivity. Furthermore, IFDI moderates the financing constraints of firms, but has a weaker effect; the easing of financing constraints facilitates the positive impact of OFDI on productivity. Absorptive capacity favours IFDI spillover, but OFDI inhibits absorptive capacity improvements. Our in-depth analysis of the mechanism of the combined impact of IFDI and OFDI on productivity reveals the objectives of using this combination, thereby providing theoretical support and policy recommendations for the implementation of this strategy.

ARTICLE HISTORY

Received 24 February 2022
Accepted 17 October 2022

KEYWORDS

Inward foreign direct investment (IFDI); outward foreign direct investment (OFDI); productivity; combined effect

JEL CODES

F21; D24

1. Introduction

The strategic shift from ‘bringing in’ to ‘going out’ and then to ‘combining bringing in and going out’ is in line with the context of China’s economic development and the differences in demand for foreign direct investment (FDI) at different stages of development. With the changes in the domestic and international economic environment and the further deepening of reform and opening up, a single approach of inward FDI (IFDI) or outward FDI (OFDI) will not be able to solve the problems of transformation and upgrading as well as upgrading the status of global value chains.

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This is also one of the starting points for the combination of ‘bringing in’ and ‘going out’ at this stage. The combination of ‘bringing in’ and ‘going out’ reflects the correlation between IFDI and OFDI in terms of scale and their changing trends. However, explaining how effective they are for economic development is also necessary. In other words, what are the drivers?

We obtain a panel of Chinese industrial firm-level data for the period 1998–2013 and focus on the impact of IFDI and OFDI together on firm productivity. In addition, the model explores the direct and indirect effects of IFDI and OFDI on firm productivity from the perspectives of technology level, financing constraints, market concentration and absorptive capacity by introducing interaction terms and by controlling for time, industry and province fixed effects to avoid the problem of omitting variables due to exogenous shocks, industry and region time-invariant factors.

The study found that IFDI and OFDI work together to contribute to productivity growth, and the mechanism study shows that both increase productivity by acting directly on the level of technology. Meanwhile, indirectly, IFDI plays a role in increasing market concentration and easing financing constraints, bringing about changes in the relationship between OFDI and productivity. In addition, while absorptive capacity is conducive to the occurrence of IFDI spillovers, OFDI inhibits the increase in absorptive capacity.

2. Literature review and hypothesis development

2.1. Literature review

Research on IFDI and OFDI has received considerable attention. Both are subject to different constraints, such as the impact of ESG on outward investment (Zumente & Bistrova, 2021). A large body of literature revolves around the respective effects of IFDI and OFDI on trade (Rao & Zhang, 2019; Shmarlouskaya et al., 2021), productivity (Driffield et al., 2009; Makiela et al., 2020), technology (Burinskas et al., 2021; Nguyen et al., 2021) and innovation (Filippetti et al., 2016; Laužikas et al., 2021) have been studied. For example, through the demonstration effect, worker mobility and competition effect channels on technology transfer (Demena & Murshed, 2018). Furthermore, a growing number of scholars are focusing on the relationship between the two, placing them in the same analytical framework (Buckley et al., 2016; Lyles et al., 2014; Narula & Dunning, 2010). However, studies on the synergistic effects of IFDI and OFDI are scarce. The extant literature focuses on the respective impacts of IFDI and OFDI on productivity. For example, Xiuwu et al. (2022) analysed the impact of IFDI and OFDI on the total factor productivity and technical efficiency index in countries along the ‘Belt and Road’. Some scholars have also begun paying attention to the joint effects of IFDI and OFDI. Luo et al. (2021) find that IFDI and OFDI contribute to economic growth when they are included in the framework of the analysis of international capital flows on economic growth. Others have also focused on environmental issues, demonstrating that two-way FDI has a significant braking effect on carbon emissions (Wang et al., 2019). Thus, the research on the joint effect of IFDI and OFDI has yielded some results. However, to the best of our knowledge, research is lacking on how the two work together to affect productivity.

No studies have been done on the mechanisms and channels through which IFDI and OFDI act on economic development.

This paper has three contributions. First, it elaborates on the joint influence of IFDI and OFDI on productivity from theoretical and empirical dimensions. We advance the research and application of FDI theory by incorporating the conditions for the realisation of foreign and reverse spillover effects into a unified analytical framework.

Second, our research focuses on the joint mechanism of IFDI and OFDI on productivity including the direct role of technology level, and the indirect roles of financing constraints, market concentration, and absorption capacity.

Third, in contrast to the existing literature based on macro-level analysis, our research takes the perspective of micro-enterprises. This can help us accurately grasp the implementation mechanism and effect of the joint influence of IFDI and OFDI.

2.2. Hypothesis development

IFDI affects the productivity of host country firms mainly through spillover effects; on the other hand, while it will not always exist for the reason of imitation barriers and competition (Aitken & Harrison, 1999; Feinberg & Gupta, 2009).

By being embedded in the demand and supply network of the host country, a firm can access all kinds of knowledge from suppliers, consumers, partners, and institutions which MNCs know better. This helps the firm in absorbing and digesting different knowledge, which eventually feeds back to their parent. The multiple sources of knowledge and technological opportunities available to domestic firms worldwide through this route facilitate the introduction of new or improved products, processes, and organizational innovations, thereby increasing productivity (Castellani et al., 2017). Along with the competition from the international market, this encourages MNCs to invest more in research and development (R&D) to improve their competitive advantage.

IFDI in emerging economies creates favourable conditions for local firms to invest abroad. Domestic firms can gain access to their partner foreign firms' products, markets, and supplier networks in the latter's host country. Meanwhile, through competition and cooperation with foreign firms locally, local firms may recognise their own shortcomings and disadvantages, and it is difficult to obtain relevant knowledge and resources from the spillover effects. This can motivate local firms to invest in increasing their competitiveness, for which OFDI is undoubtedly an important alternative. Simultaneously, observing the business practices of foreign companies and cooperating with foreign investors can help firms recognise MNCs' business models and concepts, especially when operating in the MNCs' home country. MNCs who engage in IFDI often have rich international experience and strong networks. This helps domestic firms in integrating better into the global network.

H1: IFDI in conjunction with OFDI contributes to productivity growth.

OFDI provides local firms with an experience on how to do business in foreign markets as well as learning by doing. This helps them to be better embedded in the host market and gain resources such as knowledge from cooperation with partners,

especially by taking advantage of local human capital and other superior resources. This improves the R&D capabilities of subsidiaries and parent companies. Domestic firms operating in a different institutional environment can take full advantage of the innovation systems that exist in the host market as well as the financing environment around the world, among others (Konara & Shirodkar, 2018). Compared with local firms that do not invest abroad, MNCs are willing to learn from foreign firms in the home country and cooperate with them to improve technology. This will help improve productivity through technology development from both the international and domestic markets. In addition, domestic enterprises can learn how to run their businesses more efficiently from management practices of foreign enterprises, while achieving scale effects through cooperation with foreign enterprises. Efficiency improvements will also make it easier for domestic firms to operate overseas, especially when operating in the MNCs' home countries, and utilize resources better.

H2: IFDI and OFDI work together to promote firms' technological level, and technological improvements promote productivity growth.

By operating in the host country directly, instead of merely exporting goods and services, foreign firms from China have made it easier to access credit from local banks (Zeng & Zhang, 2015). This has contributed to the host country's financial deregulation and promoted the opening of its financial market. The capital flow between the parent company and its subsidiaries, and the cooperation between subsidiaries and host country enterprises also help optimise the corporate financing environment and reduce financing costs. Bun (2021) finds that subject to relatively light financing constraints, there was a reduction in the financial constraints faced by firms working with foreign investors in Cambodia and Myanmar. Whereas loose financing constraints help to increase firm investment (Lyandres, 2007), firms are likely to have more foreign subsidiaries when they have more cash flow and liquidity (Sasidharan & Padmaja, 2018). Both continuous investments in the same market and investment in multiple markets provide resources, such as knowledge, to the firm from developed economies and emerging economies. The former helps a British firm in digesting, absorbing, and transferring resources more effectively by embedding them in the host country network (Kafouros et al., 2012). Meanwhile, the latter provides a Taiwanese firm with diversified knowledge (Lai et al., 2010) to compensate for its own shortcomings in technology and knowledge, among others. In addition, the uncertainties that exist in the OFDI process are comfortably dealt with by the relaxed financing constraints. Further, firms can make strategic adjustments by reinvesting or making exit choices to make their cross-border operations more in line with their desired objectives.

H3: IFDI helps loosen financing constraints, while OFDI promotes productivity gains in the presence of financing constraints.

Another reason why foreign capital spillovers are difficult to generate is the presence of negative competition effects (Aitken & Harrison, 1999): MNCs squeeze the market space of domestic firms and crowd out the latter's market share. That is, when the negative competition effect is greater than the positive agglomeration effect, productivity gains of domestic firms are inhibited in the Chinese market (Lu et al., 2017).

Domestic enterprises struggle to compete locally with MNCs because of the lack of competitive advantages, such as technology, production, and networks; that is, firms find it difficult to improve competitiveness locally because of resource and institutional constraints, among others. Consequently, domestic firms risk losing market share; in turn, this can force them to invest abroad to improve their competitiveness. Through green field developments and mergers and acquisitions (M&A) in different markets, it brings various resources as well as opportunities for learning and cooperation to enterprises, which are freed from institutional and resource constraints as opposed to just competing at home. Moreover, competing in the global market helps to fully stimulate their own dynamics, also facilitates domestic firms in competing with MNCs in the domestic market and in further optimising their resource allocation efficiency.

H4: IFDI increases market concentration, while OFDI promotes productivity growth through foreign competition.

Studies show that the spillover effect of IFDI is closely related to the technological opportunities available to domestic enterprises (Kafourous & Buckley, 2008) and that the existence of a technological gap gives firms a strong incentive to learn advanced knowledge, technology, and management levels from foreign firms (Hitt et al., 2005), resulting in spillover effects (Findlay, 1978).

Some scholars observe that an important reason for the insignificant spillover effect of foreign capital is the insufficient absorptive capacity of domestic firms in developing economy also (Desmet et al., 2008). Along with imitation barriers, this makes it difficult for domestic firms to digest and absorb foreign firms' technology. Improving absorptive capacity depends on enhancing the company's technology and its ability to learn; however, the lack of access to sufficient knowledge and other resources in the country is clearly not conducive to improving absorptive capacity. Studies have typically focused on the generation of FDI spillovers in the context of absorptive capacity; to the best of our knowledge, few studies have examined the impact of firms' internationalisation activities on absorptive capacity. One such study from Girma et al. (2008), shows that export-oriented host country firms have stronger absorptive capacity than market-oriented host country firms; consequently, the former is more likely to absorb spillover effects. Through internationalisation, firms can engage more deeply and comprehensively with the industries in which they operate. Through systematic learning of each link in the industrial chain, firms become more aware of their own gaps, and compensate for their disadvantages through cooperation and exchange, thereby increasing their absorption capacity.

H5: OFDI contributes to absorptive capacity, while IFDI promotes productivity improvement under the effect of absorptive capacity.

3. Methodology

3.1. Sample and data description

This study uses Chinese firm-level data to analyse the joint effects of IFDI and OFDI because of the following reasons. The data are obtained by matching various

databases based on firm name and year from 1998 to 2013, including the China Industrial Enterprise Database (hereafter, ‘Industry Enterprise Database’), the Directory of Overseas Investment Enterprises (Institutions) (hereafter, ‘Investment Directory’) and the Enterprise Patent Database (hereafter, ‘Patent Database’). These three databases are the most widely used firm-level data, covering important information such as financial indicators, foreign investment and patent applications and grants. The matching of the databases allows us to obtain important indicators to measure productivity, foreign investment, foreign investment and other variables, potentially helping this study examine the impact of IFDI and OFDI together on productivity. The Industrial Enterprises Database contains information on paid-in capital, capital from different sources (including state-owned and foreign capital) and various financial information which is useful for measuring IFDI and portraying variables such as productivity and profits. The Investment Directory records information on each OFDI and is used to measure the overall level of OFDI. The Patent Database covers information on the number of patents applied for and granted by enterprises. We use the number of patents to portray the level of technology.

Owing to the problems with some of the indicators in the database of industrial firms, the information provided by some firms may be insufficiently accurate and anomalies arise in the sample observations. Incorrect estimation may occur if they are not deleted. Our deletions are as follows. 1) We exclude samples where total industrial output value, fixed assets, current assets and paid-in capital are missing or less than 0; if it is less than 0, the data are invalid. 2) We exclude samples where the number of employees is less than 8. If the number of employees is too small, it does not correspond to firms with an industrial output of more than 5 million. 3) We exclude samples where total assets are less than current assets or total fixed assets. 4) We delete firms where the age of the firm is less than 0.

3.2. Model settings

This paper builds on the international R&D spillover model (Xiuwu et al. 2022), introduces a cross-sectional term between IFDI and OFDI to examine the joint effect of IFDI and OFDI and constructs a mediation model to further analyse the joint effect of IFDI and OFDI on productivity mechanism (Baron & Kenny, 1986). We construct the following model based on the hypothesis development.

$$\begin{aligned} TFP_{i,j,t} = & \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 IFDI_{j,t} \times OFDI_{i,t} \\ & + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \end{aligned} \quad (1)$$

$$\begin{aligned} Tech_{i,j,t} = & \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 IFDI_{j,t} \times OFDI_{i,t} \\ & + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \end{aligned} \quad (2)$$

$$\begin{aligned} TFP_{i,j,t} = & \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 IFDI_{j,t} \times OFDI_{i,t} \\ & + \alpha_4 Tech_{i,j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \end{aligned} \quad (3)$$

$$Finance_{i,j,t} = \alpha_0 + \alpha_1 IFDI_{j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (4)$$

$$TFP_{i,j,t} = \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 OFDI_{i,t} \times Finance_{i,j,t} + \alpha_4 Finance_{i,j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (5)$$

$$HHI_{j,t} = \alpha_0 + \alpha_1 IFDI_{j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (6)$$

$$TFP_{i,j,t} = \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 OFDI_{i,t} \times HHI_{j,t} + \alpha_4 HHI_{j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (7)$$

$$absorb_{i,j,t} = \alpha_0 + \alpha_1 OFDI_{i,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (8)$$

$$TFP_{i,j,t} = \alpha_0 + \alpha_1 IFDI_{j,t} + \alpha_2 OFDI_{i,t} + \alpha_3 IFDI_{j,t} \times absorb_{i,j,t} + \alpha_4 absorb_{i,j,t} + X_{i,t} + \gamma_i + \eta_j + \lambda_r + \delta_t + \varepsilon_{i,j,t} \quad (9)$$

Equation (1) focuses on the combined impact of IFDI and OFDI on firm productivity by cross term. Equations (2) and (3) examine the direct channel of IFDI and OFDI on productivity. Equation (2) tests whether firms have improved their technology level through IFDI and OFDI by the cross term of IFDI and OFDI and examine the effect of technology level on productivity in Equation (3). Equations (4) and (5) examine the effect of IFDI on firms' financing constraints and argue for the relationship between OFDI and productivity in the presence of financing constraints. The entry of foreign firms is more likely to be supported by bank credit, contributing to the relaxation of financing constraints. Equations (4) and (5) are constructed to test the validity of H3. The entry of foreign capital increases the concentration and competition level of the market, and domestic firms are forced to improve their competitiveness and productivity through OFDI due to their own resources and technology level. Equations (6) and (7) examine the impact of IFDI on market competition and thus, argue for the relationship between OFDI and productivity in the presence of market concentration to test whether H4 is valid. OFDI promotes the further embedding of firms in international markets, compensates for their disadvantages through exchanges and cooperation and achieves an increase in absorptive capacity. Equations (8) and (9) examine the effect of OFDI on the absorptive capacity of firms and thus, argue for the relationship between IFDI and productivity in the context of absorptive capacity. i , j , r , and t represent firm, industry, province, and year, respectively. j represents the two-digit industry code.

Considering the possible mutual causal relationship between productivity and IFDI or OFDI, which may result in endogeneity problems, both are treated with a one-period lag. This does not completely rule out the absence of endogeneity issues, which we further examine later using the propensity score matching-DID (PSM-DID) and DID methods. In addition, we use time, industry and province fixed effects to avoid the problem of omitted variables due to exogenous shocks, industry and regional time-invariant factors.

3.3. Variable explanation

3.3.1. Explained variable

TFP stands for productivity, using fixed effects to measure total factor productivity; industrial output value is deflated by the ex-factory price index of industrial products; and fixed assets are deflated by the fixed asset investment price index.

3.3.2. Core explanatory variable

The main explanatory variables are IFDI, OFDI, technology level, financing constraints, market concentration, and absorptive capacity. Among them, $IFDI_{j,t} = \frac{\sum_i Output_{i,j,t}}{Output_{j,t}}$. IFDI represents the level of foreign investment in the industry, and is the ratio of the sum of the industrial output value of foreign-owned firms in the industry to the total output value. Output is the industrial output value. OFDI is expressed as the stock of the number of outward foreign direct investments made by firms. The technical level (tech) is represented by the ratio of the paid-in capital to the number of employees of the firm (Shi & Wu, 2017). The financing constraint (finance) is represented by the ratio of interest expenses to fixed assets. The degree of market concentration (HHI) is represented by the Herfindahl Hirschman index. The absorption capacity (absorb) is expressed as the ratio of the firm's productivity to the highest productivity in the industry (Girma, 2005).

3.3.3. Control variables

X is a set of control variables that affect the innovation performance of firms, including firm size, capital intensity, profit, degree of export, firm age, and ownership structure. Size is represented by the logarithm of industrial sales value. Larger firms can bring economies of scale and more intangible assets, which are related to firm productivity (Vujanović et al., 2021). Capital intensity (cap) is expressed as the ratio of fixed assets to the number of employees. Capital-intensive firms are more likely to undertake R&D or introduce new technologies to reap productivity benefits from international operations (Zhou, 2021). Profit is expressed as the ratio of operating profit to business sales. R&D and production expansion are dependent on the profits generated by the company itself. The size of a company's exports and the age of the company both reflect its knowledge of the market and affect its ability to operate in practice, with more experienced companies likely to enjoy better performance (Acemoglu et al., 2007). Therefore, two variables, degree of export and firm age, are introduced in this paper. Export is expressed as the ratio of export delivery value to sales. The age of the business is expressed as the year of observation minus the year of opening, with the year of opening recorded as 1. Ownership is represented by 0 for state-owned enterprises and enterprises with state-owned components, and 1 for other firms. Foreign-owned, non-state enterprises are more likely to adopt the latest technology and innovate faster (Tandrayen-Ragoobur, 2022). γ_i , η_j , λ_r , and δ_t represent the firm, industry, region and time fixed effects to control for the influence of missing variables on estimation.

Table 1. Baseline results.

	(1)	(2)	(3)	(4)
size	0.622*** (187.75)	0.626*** (188.29)	0.625*** (186.50)	0.629*** (187.15)
cap	0.00000526*** (20.53)	0.00000522*** (20.50)	0.00000525*** (20.54)	0.00000521*** (20.51)
profit	0.0616*** (8.26)	0.0634*** (8.54)	0.0614*** (8.25)	0.0632*** (8.53)
export	-0.0667*** (-7.54)	-0.0659*** (-7.50)	-0.0683*** (-7.72)	-0.0675*** (-7.67)
age	-0.00862*** (-19.66)	-0.00831*** (-18.92)	-0.00837*** (-19.02)	-0.00806*** (-18.31)
ownership	0.155*** (5.42)	0.158*** (5.54)	0.156*** (5.46)	0.159*** (5.59)
IFDI	-0.0503* (-1.72)	-0.00754 (-0.24)	-0.0767*** (-2.60)	-0.0330 (-1.06)
OFDI	-0.0145*** (-6.68)	-0.0126*** (-5.81)	-0.0421*** (-8.16)	-0.0395*** (-7.66)
IFDI*OFDI			0.0473*** (5.90)	0.0460*** (5.75)
Firm fixed effects	YES	YES	YES	YES
Time fixed effects	NO	YES	NO	YES
Industry fixed effects	NO	YES	NO	YES
Province fixed effects	NO	YES	NO	YES
Constant	-0.139***	-0.0662	-0.165***	-0.0921
Obs	20543	20543	20543	20543

Note: t-statistics are in parentheses, * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: authors own calculations and estimations.

4. Results and discussion

4.1. Baseline regression

The article focuses on the joint role of IFDI and OFDI. It is more concerned with the impact of the IFDI and OFDI cross-terms, where the cross-terms remain constant by controlling for different fixed effects. In Models (3)–(4) in Table 1, the cross term between IFDI and OFDI is significantly positive, in line with H1. This means that even though the spillover and reverse spillover effects are not significant, firms still profit from the combined effect of both. We emphasise that the negative roles of IFDI and OFDI individually does not affect the outcome of the joint role of IFDI and OFDI; this may be due to a complementarity between the two in terms of, say, knowledge acquisition, among others. This is where the combination of IFDI and OFDI is important and where China's efforts to deepen its reforms further should be directed. The studies by Li and Wang (2021) and Xiuwu et al. (2022) examine the impact of both IFDI and OFDI on country and industry productivity. However, the respective impact of IFDI and OFDI on productivity cannot assess the role of FDI, which is why the earlier literature argues that the impact of IFDI on productivity is uncertain. The findings of this paper suggest that IFDI and OFDI together have a positive effect on firm productivity, further deepening the understanding of how OFDI affects firm business activities and performance, contributing to a deeper understanding of the importance of an open economy for firm development and providing theoretical support, reform impetus and direction for other emerging economies and developing countries to continue opening up to the outside world.

In addition, we examine the effects of the control variables, including firm size, capital intensity, profits, degree of exporting, firm age, and ownership structure. Models (1)–(4) in Table 1 show that the results for the respective effects of the above control variables on productivity remain largely consistent across all models, indicating the robustness of the models to some extent. The effects of firm size, profit and capital intensity are significantly positive. Non-state enterprises have a more significant contribution to productivity than do state-owned enterprises. The effect of firm age on productivity is significantly negative. The study shows that IFDI does contribute to the increase in exports, but the effect of OFDI is insignificant. When the cross term between IFDI and OFDI is added, the effect of OFDI is negative while the cross term is positive, meaning that the increase in exports is derived from the effect of IFDI. Thus, the combined effect of both is unlikely to affect productivity through exports. The results in Table 1 suggest that exports inhibit productivity growth, possibly because FDI exploits China's labour factor endowment as an advantage in export trade, while Chinese domestic firms rely on labour-intensive industries and fall into a comparative advantage trap.

4.2. Mechanism test

Although the effect of IFDI and OFDI together on productivity has been proven above, we do not yet know the specific effect channel. Table 2 examines the mechanism of both on productivity, with all models incorporating control variables for time, industry, and region. Models (1) and (2) show that IFDI and OFDI act together to promote the technology level, which in turn promotes productivity. H2 notes that IFDI and OFDI increase productivity by acting directly at the technological level. Models (3) and (4) show that the weaker role of IFDI on financing constraints can be explained by the fact that firms have a relatively single source of financing, especially private firms; this weakens the role of foreign investment in influencing financing constraints. However, OFDI contributes to productivity growth under relaxed financing constraints. Although it is difficult to state the validity of H3, the direction of action is consistent with expectations, indicating the possibility of this mechanism of action to some extent. Models (5) and (6), show that IFDI exacerbates market concentration and that OFDI contributes to productivity in the presence of market concentration; thus, H4 holds. Importantly, note that competition from foreign capital does not contribute to productivity gains for all domestic firms but that this is possible through the mechanism of influencing the role of OFDI. Models (7) and (8) clearly show that OFDI is not conducive to absorptive capacity, although it contributes to productivity growth in the presence of absorptive capacity and outward investment. Thus, H5 is not supported. One possible reason for this is that in the OFDI process, domestic firms face the liability of being foreign and struggle to embed themselves better in the host country's market networks and institutions; this inhibits effective knowledge seeking, integration, and transfer (Castellani et al., 2013). Meanwhile, the increased competitiveness of domestic firms through overseas markets also puts pressure on foreign enterprises to adopt more advanced technologies, as well as on other domestic firms to increase productivity through the spillover effects.

Table 2. Channels of action of IFDI and OFDI on productivity impact.

	tech (1)	productivity (2)	finance (3)	productivity (4)	HHI (5)	productivity (6)	absorb (7)	productivity (8)
size	12.83 (1.18)	0.628*** (189.70)	0.0153** (2.59)	0.626*** (189.59)	0.0000168 (0.70)	0.630*** (188.95)	0.0362*** (58.30)	0.512*** (165.61)
cap	0.124*** (150.19)	-0.00000129*** (-3.32)	-4.64e-08 (-0.10)	0.00000522*** (20.68)	1.01e-08*** (5.39)	0.00000518*** (20.42)	0.000000152** (3.19)	0.00000471*** (22.34)
profit	20.80 (0.87)	0.0621*** (8.50)	-0.0516*** (-3.85)	0.0654*** (8.89)	0.0000508 (0.93)	0.0627*** (8.48)	0.0105*** (7.58)	0.0323*** (5.25)
export	-29.58 (-1.04)	-0.0659*** (-7.61)	-0.00862 (-0.54)	-0.0655*** (-7.50)	-0.000158** (-2.44)	-0.0678*** (-7.73)	-0.00603*** (-3.67)	-0.0509*** (-6.98)
age	0.511 (0.36)	-0.00809*** (-18.64)	0.00214** (2.73)	-0.00840*** (-19.29)	0.0000395** (12.34)	-0.00785*** (-17.82)	-0.00225*** (-27.49)	-0.00130*** (-3.49)
ownership	492.5*** (5.33)	0.133*** (4.75)	0.0225 (4.44)	0.157*** (5.55)	0.000271 (1.29)	0.161*** (5.66)	-0.0182*** (-3.43)	0.203*** (8.59)
IFDI	492.5*** (4.87)	-0.0589* (-1.91)	-0.0182 (-0.33)	-0.00543 (-0.18)	0.00170*** (7.46)	-0.0324 (-1.04)	-0.0182*** (-3.43)	-0.152*** (-2.86)
OFDI	5.694 (0.34)	-0.0398*** (-7.84)		-0.0129*** (-5.99)		-0.0400*** (-11.79)	-0.00790*** (-19.53)	0.0117*** (6.45)
IFDI*OFDI	74.64** (2.88)	0.0421*** (5.34)						
tech		0.0000525*** (21.90)						
finance				0.0343*** (7.89)				
OFDI*finance				-0.00197* (-1.79)				
HHI						-1.502 (-1.40)		
OFDI*HHI						2.932*** (10.59)		2.934*** (80.65)
absorb								0.560*** (7.40)
IFDI*absorb								
fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-708.5 20543	-0.0548 20543	-0.120 20523	-0.0714 20506	0.118*** 20543	0.0803 20543	0.0416 20543	-0.143 20543

Note: 1) t-statistics are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01; and 2) firm, time, industry, and province fixed effects are included. Source: authors own calculations and estimations.

This drives further productivity within the industry and lowers the relative productivity of the firms undertaking OFDI.

The above results are similar to or different from existing findings. For example, Lyandres (2007) finds that foreign investment reduces financing constraints with Myanmar and Cambodia. By contrast, the results of this paper suggest that foreign investment does not affect financing constraints. A possible reason is that the level of development of China's financial market is lower than that of the commodity market, which is one of the important elements of China's deepening opening up to the outside world. How to improve the financial market through the development and further opening of financial markets is a proposition that needs to be considered for China's development. In addition, Zhang et al. (2014) argue that foreign intangible assets are an important factor that hinders the occurrence of spillover effects, which is in line with this paper's research. The reason why Chinese enterprises have difficulties in improving their absorption capacity in the process of outbound investment is the existence of factors such as outsider disadvantages. This requires the government to better provide assistance and services to enterprises going abroad. Such efforts include providing information on the market system and culture of the host country to overcome the outsider disadvantage, as well as providing ideas on how enterprises can optimise their OFDI to better utilise global resources.

4.3. Endogeneity

We focus on the joint role of IFDI and OFDI and thus, need to examine the issue of endogeneity under both dimensions. To address this, we use the (PSM-DID) and DID methods to test for OFDI and IFDI, respectively. The results are shown in Table 3. For OFDI, we first use the PSM method to match firms that have not made outward investments. Moreover, the results may differ according to the matching methods. Here, we use nearest neighbour matching (Models (1) and (2)). We did not list the result of calliper nearest neighbour matching and Mahalanobis matching. The result is the same using different matching measures. DID was used DID for regression based on the matching. The IFDI and OFDI cross terms in Models (2), which are the focus of this study, are significantly positive. This supports the baseline regression results, further demonstrating that the results are plausible.

In addition, the effects for IFDI and the control variables are largely consistent with the baseline regression, indicating the reliability of the baseline regression results. The Foreign Investment Industry Guidance Catalogue (hereafter, the Industry Guidance Catalogue) is used to set the timing of policy shocks for IFDI. China's Ministry of Commerce has published this catalogue seven times. Most studies use 2002 as the time point for analysis. Here, we compare the 1997, 2002, 2004, 2007 and 2011 versions. We find that the changes to the encouraged, restricted and prohibited categories are larger in 2002 and 2007. To avoid the resultant problem of estimation bias, we use 2002 and 2007 as the time points for the analysis. As shown in Models (3) and (4), the cross term between IFDI and OFDI is significantly positive, indicating that IFDI and OFDI work together to promote productivity and are not affected by changes in the Industry Guidance Catalogue.

Table 3. Endogenous results.

	nearest neighbour		2002 (3)	2007 (4)
	(1)	(2)		
size	0.557*** (615.45)	0.557*** (615.26)	0.536*** (277.24)	0.557*** (253.53)
cap	0.00000469*** (30.75)	0.00000469*** (30.75)	0.00000587*** (18.89)	0.00000583*** (18.85)
profit	0.000554*** (14.63)	0.000554*** (14.63)	-0.0109*** (-7.09)	-0.0107*** (-6.99)
export	-0.170*** (-55.51)	-0.169*** (-55.46)	-0.116*** (-16.61)	-0.122*** (-16.21)
age	-0.000524*** (-16.00)	-0.000525*** (-16.01)	-0.000770*** (-7.57)	-0.00965*** (-23.82)
ownership	0.535*** (60.96)	0.535*** (60.97)	0.529*** (26.43)	0.308*** (10.93)
du	-0.120*** (-25.75)	-0.124*** (-28.39)	-0.0192** (-2.71)	-0.00592 (-0.78)
dt	-0.126 (-0.71)	-0.127 (-0.72)	0.283*** (7.30)	-0.0443** (-2.53)
du*dt	0.00330 (0.49)			
IFDI	-0.100*** (-3.56)	-0.102*** (-3.63)		
OFDI			-0.0198*** (-4.41)	-0.0153*** (-4.35)
IFDI*OFDI		0.0315** (2.00)	0.0195*** (4.16)	0.0146*** (3.71)
fixed effects	YES	YES	YES	YES
Constant	-0.247***	-0.247***	0.273***	0.501***
Obs	152257	152257	28142	23279

Note: 1) t-statistics are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01; 2) firm, time, industry, and province fixed effects are included.

Source: authors own calculations and estimations.

4.4. Robustness tests

The robustness of the model and reliability of the findings are verified by replacing the variables and changing the sample (Table 4). First, to verify the robustness of the results of the baseline regression, we replace the IFDI variable with the share of sales of foreign-owned firms in the industry, share of the number of foreign-owned firms in the industry, and share of employees of foreign-owned firms in the industry. Second, we replace the tech variables with patent flows and patent stocks to verify the direct effects of IFDI and OFDI. Third, we adjust the sample interval (Table 3).

Models (1)–(6) in Table 4 show that no matter what indicator is used to replace IFDI, the cross-term effect of IFDI and OFDI remains significantly positive. Meanwhile, Models (7)–(10) show that regardless of the indicators used for technology levels, IFDI does not affect the role of IFDI and OFDI through technical channels, and the results remain consistent across different technology level measures. In addition, the robustness test results show that the role of control variables does not change with changes in the indicator measurement method and sample interval. The results for the explanatory variables, cross-sectional terms, and control variables indicate that the model is robust and credible.

Table 4. Robustness test.

	sales			number of firms			employees			foreign output			foreign output			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
size	0.626*** (188.30)	0.629*** (187.17)	0.628*** (187.99)	0.630*** (187.02)	0.634*** (185.30)	0.638*** (184.30)	2.392*** (4.12)	0.629*** (187.02)	9.248** (2.85)	0.629*** (187.02)						
cap	0.0000522*** (20.50)	0.0000521*** (20.51)	0.0000524*** (20.60)	0.0000523*** (20.60)	0.0000524*** (20.64)	0.0000523*** (20.66)	0.0000710 (1.62)	0.0000521*** (20.49)	0.000704** (2.87)	0.0000521*** (20.49)						
profit	0.0634*** (8.54)	0.0632*** (8.53)	0.0622*** (8.38)	0.0621*** (8.38)	0.0601*** (8.12)	0.0601*** (8.13)	-0.993 (-0.77)	0.0633*** (8.54)	-5.339 (-0.75)	0.0633*** (8.54)						
export	-0.0660*** (-7.50)	-0.0675*** (-7.68)	-0.0648*** (-7.36)	-0.0659*** (-7.50)	-0.0626*** (-7.13)	-0.0642*** (-7.33)	1.569 (1.03)	-0.0677*** (-7.69)	5.718 (0.67)	-0.0677*** (-7.69)						
age	-0.00830*** (-18.92)	-0.00806*** (-18.30)	-0.00830*** (-18.97)	-0.00812*** (-18.49)	-0.00796*** (-18.18)	-0.00767*** (-17.43)	-0.218** (-2.86)	-0.00804*** (-18.25)	-0.797* (-1.87)	-0.00804*** (-18.25)						
ownership	0.158*** (5.54)	0.159*** (5.59)	0.165*** (5.79)	0.166*** (5.82)	0.172*** (6.06)	0.173*** (6.11)	2.798 (0.57)	0.159*** (5.58)	1.075 (0.04)	0.159*** (5.58)						
IFDI	-0.00479 (-0.16)	-0.0305 (-0.98)	-0.230*** (-5.13)	-0.258*** (-5.71)	-0.295*** (-9.61)	-0.307*** (-9.99)	-8.924* (-1.66)	-0.0298 (-0.96)	-9.542 (-0.32)	-0.0298 (-0.96)						
OFDI	-0.0126*** (-5.81)	-0.0398*** (-7.72)	-0.0124*** (-5.72)	-0.0341*** (-7.09)	-0.0112*** (-5.19)	-0.0422*** (-8.21)	-7.458*** (-8.37)	-0.0392*** (-7.59)	14.39** (2.89)	-0.0392*** (-7.59)						
IFDI*OFDI	0.0464*** (5.82)	0.0464*** (5.82)	0.0549*** (5.06)	0.0549*** (5.06)	0.0537*** (6.64)	0.0537*** (6.64)	54.76*** (39.71)	0.0420*** (5.03)	146.4*** (19.01)	0.0420*** (5.03)						
Tech (flows)																
Tech (stocks)																
fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cons	-0.0667 20543	-0.0929 20543	-0.0458 20543	-0.0666 20543	-0.111 20543	-0.148 20543	-20.64 20543	-0.0912 20543	-113.1 20543	-0.0912 20543						
Obs	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543	20543

Note: 1) t statistics are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01; 2) firm, time, industry, and province fixed effects are included; 3) Cons means constant. Source: authors own calculations and estimations.

5. Conclusions and Implications

Using Chinese industrial firm-level data from 1998–2013, this study attempts to determine the economic implications of combining IFDI and OFDI for emerging economies. We found that 1) IFDI and OFDI together contribute to productivity growth. 2) IFDI and OFDI improve productivity by directly acting on the technological level. 3) IFDI intensifies market concentration, and market concentration positively regulates the relationship between OFDI and productivity. 4) IFDI eases the financing constraints of firms but has a weak effect, while easing the financing constraint is conducive to OFDI positively affecting productivity. 5) Absorptive capacity is conducive to the occurrence of IFDI spillover effects, but OFDI inhibits absorptive capacity improvement.

Through in-depth analysis of the mechanism through which the combination of IFDI and OFDI affects productivity, this study reveals the policy significance and purpose of the combination of IFDI and OFDI. Importantly, it provides theoretical support and policy suggestions for the implementation of this strategy. In the process of building an open economy, attention should be paid to the coordination between IFDI and OFDI. The aim should be to vigorously introduce high-quality FDI to achieve spillover effects and stimulate the progress of domestic enterprises through measures such as optimising the business environment and aligning with high-standard international rules. Furthermore, the financial system of the home country should be optimised, while gradually opening up the financial market and give full play to the role of foreign investment in financing constraints, thereby stimulating the indirect effect of financing constraints. Firms should be also encouraged to go global while focusing on guidance on various issues in international market operations, especially cultural and institutional conflicts; this can help promote the firms' integration the host country's market network.

Although the article emphasises the importance of the joint role of IFDI and OFDI and is an important addition to foreign direct investment theory, it has some shortcomings. Firstly, it does not consider the impact of changes in the external environment on the development of IFDI and OFDI and the impact on productivity. The current COVID-19 pandemic has affected the global production network and has also caused great damage to FDI, and developing economies appear to be more vulnerable to this crisis (Rajnoha & Kánová, 2022). Observing the impact of this phenomenon on the joint effect of two-way investment. Secondly, the use of China as an object of study provides a rich source of material for this paper, which is why previous literature has focused more on China. With the increase in the level of openness of countries such as Vietnam and Indonesia, their two-way investment has received attention. Thus, whether the research in this paper is applicable to these countries remains to be seen. Thirdly, this paper focuses on the static effects of two-way investment and does not analyse the dynamic effects. Pittaway et al. (2004) and Kafourous et al. (2012) emphasise the importance of network structure for the reverse spillover effect, and if the role of the network structure of FDI can be further characterised, the impact of the combined effect of IFDI and OFDI on productivity can be better understood. This is a direction that can be pursued in the future.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work is supported by Zhejiang Provincial Philosophy and Social Sciences Planning Project (22NDJC072YB); Ningbo Social Science Research Base Project of China (JD5-FZ05); 2021 Ningbo University Senior Literary and Social Sciences Incubation Programme (XPYQ21004).

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