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Firm Performance and Industrial Accumulation: The Role of Industrial Parks

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Abstract

This research examines the impact of industrial agglomeration on the productivity of SMEs in Vietnam, using FE regression for panel data and the PSM method. The study utilizes data from the General Statistics Office of Vietnam (2016–2020) and the OECD's TiVA database. The findings highlight the positive effects of industrial parks on firm performance, particularly for medium-sized enterprises, export-oriented firms, and those integrated into global value chains. SMEs with strong international linkages benefit from improved access to modern production technologies, with FDI capital firms exhibiting the highest productivity gains. Furthermore, the performance of industrial parks exhibits significant geographical variation, with the Southern region demonstrating superior efficiency due to the concentration of large industrial clusters and advanced facilities. High-tech zones have emerged as key drivers of regional productivity, fostering industrialization and technological innovation. Policymakers should prioritize the expansion and modernization of industrial zones, promote trade liberalization, and support SMEs through targeted incentives while strengthening FDI linkages to drive sustainable industrial development.

Keywords: Firm Performance, TFP, Industrial Accumulation, Industrial Parks
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1. Introduction

Industry clusters are the main drivers and valuable sources for faster innovation and the dissemination of essential tacit knowledge, serving as a means for regional competition. In the 21st century, research on industrial concentration, cluster linkages, and industrial cluster policies has become a prominent trend. Many scholars have suggested that one increasingly popular policy tool in developing countries in the 21st century is the establishment of special economic zones (SEZs). Some nations are upgrading their SEZs into large industrial clusters and commercial hubs with generous incentives to maximize their potential (Aggarwal, 2011; Aggarwal, 2006). In Vietnam, SEZs are mainly approached in the form of industrial clusters. Industrial clusters are geographically concentrated groups of similar or related companies that collectively create competitive advantages for their members and for regional and national economies (Porter, 1998). Industrial clusters represent a form of linkage that has emerged during the process of industrial agglomeration in Vietnam. The process of agglomeration in Vietnam can be divided into three main periods: (1) before 1987, (2) 1988–2000, and (3) post-2001.

During the first phase, small enterprises producing raw materials and finished goods established operations in Vietnam, attracted by simplified customs procedures, available infrastructure, and living conditions. In the later stages, participating companies were drawn by physical infrastructure and intellectual property systems. Industrial agglomeration in Vietnam began in the mid-1990s, driven by key attractions such as labor, market size, and personal linkages within foreign direct investment (FDI). Vietnam's unique characteristics initially attracted small and medium-sized enterprises (SMEs) and eventually large corporations (Truong, 2008). Although the concept of industrial clusters is relatively new in Vietnam, some sectors have long been established, and industrial clusters have spontaneously formed within the country. Electronics firms are concentrated primarily in the southern region, particularly in Ho Chi Minh City and Dong Nai province. Over the years, these zones have contributed to solving space constraints for enterprises, boosting industrial production, attracting foreign investment, creating a favourable investment environment, and generating employment for workers.

An increasing number of countries are focusing on industrial clusters as engines of industrialization. On one hand, industrial clusters facilitate economies of scale for businesses within the region, helping to reduce the cost of acquiring resources (Porter, 1998). On the other hand, they can enhance business productivity through the labor market pooling effect and the knowledge and technology spillover effect (Marshall, 1920). However, the relationship between industrial clusters and company performance remains unclear. Vietnam's SMEs constitute 97% of the total registered businesses, contributing approximately 60% to GDP and accounting for 36% of employment (GSO, 2023). Given the focus on SMEs, this study provides significant evidence regarding the relationship between cluster development in promoting deeper engagement in international trade and enhancing the firm performance of Vietnamese SMEs. Specifically, the research aims to achieve the following specific objectives: (i) Exploring the relationship between industrial agglomeration and firms' total factor productivity (TFP); (ii) Examining the productivity impact of firm concentration across different types of agglomeration; (iii) Offering policymakers policy recommendations to enhance the competitive capabilities of businesses.

The research consists of seven sections. Section 1 provides an overview of the formation of industrial parks in Vietnam and examines their significance within the broader economic and industrial development framework. Section 2 presents a literature

review on the relationship between the scale of an industry or cluster and productivity. Section 3 covers the research data. The research utilizes the dataset from small and medium-sized enterprises surveyed by the GSO from 2016 to 2020, supplemented by the OECD's TiVA database. Section 4 details the empirical analysis, including the theoretical framework and research methodology. It delineates the mathematical model utilized and employs the fixed-effects (FE) method for panel data analysis, along with propensity score matching (PSM) techniques, to ensure robust and reliable results. Section 5 discusses the research findings. Section 6 concludes the study and discusses policy implications, and finally, section 7 is the limitations of the study and future research directions.

2. Literature Review

Recent studies have shown that state industrial policies indeed have a positive impact on economic growth by addressing market failures (Lashkaripour & Lugovsky, 2023; Bartelme et al., 2021). Several specific and diverse benefits associated with industrial agglomeration have been highlighted in previous studies, including improved labor productivity (Ciccone & Hall, 1996), enhanced cooperation (Saxenian, 1994), stimulation of innovation (Bell, 2005), and reduced production costs (Jaffe et al., 1993). In addition, industrial clusters are typically developed with comprehensive infrastructure, such as roads, water supply, electricity, telecommunications, and environmental sanitation. Moreover, enterprises located within industrial clusters also benefit from technological support provided by FDI firms. These factors collectively contribute to an increase in TFP. Research by Li et al. (2021) indicates that companies located within economic zones achieve better average performance compared to those outside. Both companies within and outside these zones benefit from spillover effects, with firms that have been part of the economic zone for a longer time gaining more advantages. Furthermore, enterprises experience stronger agglomeration effects when clustered within the same industry rather than across multiple industries.

In the 21st century, studies on the role of clusters in promoting TFP became increasingly common in developing countries, particularly in China. This trend stems from the rapid growth of industrial clusters in the country, especially in the context of China's focus on modernizing its economy and optimizing production efficiency. Chang & Oxley (2009) analyzed the impact of geographic innovation on TFP in Taiwan in 2001, using 242 industries classified under the four-digit Standard Industrial Classification (SIC) system. The authors calculated TFP by estimating Translog production functions and measured geographic innovation activities using both Krugman's Gini coefficient and the Herfindahl location index. The empirical results revealed a significant positive impact of geographic innovation and R&D expenditures on TFP. Ke & Yu (2014) examined the influence of technological progress, technical efficiency, and TFP growth across 262 provincial and higher-level cities in China during 2001–2010. Their study showed that more than half of the differences in TFP growth among Chinese cities were explained by variations in agglomeration economies. Urbanization economies contributed to TFP growth through technological progress and technical efficiency. Meanwhile, local specialization enhanced technical efficiency but was not favorable for technological progress. Shen & Zou (2023) clarified that industrial clusters in China have enhanced local productivity by improving resource allocation among enterprises. These clusters not only increased average productivity but also minimized resource misallocation issues.

Amid the trend in developing countries of studying the role of industrial policies and cluster policies in economic growth, some Vietnamese scholars have researched the economic benefits of industrial clusters at the enterprise level. Manh (2023) investigated

which agglomeration factors play a key role in influencing enterprise productivity and how agglomeration causes uneven effects on different characteristics of Vietnamese firms. The study by Ni & Doan (2018) revealed that agglomeration has a negative impact on the overall performance of firms, indicating that the destructive competition effect outweighs the beneficial spillover effects in Vietnam. The impact of agglomeration on firm productivity varies across industries and types of enterprises. Gokan et al. (2019) examined the effects of agglomeration economies on the productivity of Vietnamese firms. Their research found that inter-industry transactions are only effective for private enterprises, while knowledge spillovers and labor pooling are effective for foreign-owned enterprises. Using the clustering detection method proposed by Mori & Smith (2013), the authors explored the causal relationship between industry agglomeration and productivity at the firm level. They concluded that agglomeration indeed improves firm-level productivity in Vietnam. However, such "spillover effects" only exist for foreign-invested enterprises and not for state-owned or private enterprises.

In efforts to better clarify the benefits of participating in industrial parks during the process of industrial agglomeration, recent studies have increasingly focused on using firm-level or industry-firm-level data to analyze this relationship in greater detail, yielding clearer results. Notably, firm performance has become a critical research focus in understanding this connection. Firm performance has been examined from various perspectives, such as growth, profitability, financial aspects, innovation, productivity, and efficiency (Mahy et al., 2018). This emphasis highlights the impact of industrial park participation on a firm's competitiveness by enhancing its efficiency and productivity. A recent research direction focuses on using indicators like labor productivity or TFP as proxies for firm productivity (Gueye et al., 2020; Hummels et al., 2001; Montalbano et al., 2018; Urata, 2021). By leveraging firm-level data, many studies have uncovered how participation in industrial clusters can improve firm performance.

Thus, it can be observed that, despite numerous studies on this topic, very few have focused on the cases of developing countries. This study will be one of the pioneering efforts to provide empirical evidence on the impact of industrial clusters on the productivity growth of enterprises in Vietnam. Additionally, there are still very few studies that investigate the relationship between agglomeration and productivity at the firm level. The most recent studies in Vietnam, such as those by Howard et al. (2016) and Gokan et al. (2019), primarily focus on the determinants of industrial agglomeration at the industry level. This research aims to fill this gap by examining the impact of industrial policies on productivity growth at the firm level.

3. Data

The research utilizes a dataset on SMEs in Vietnam, collected from the GSO through an annual enterprise survey aimed at evaluating the overall business performance of Vietnamese enterprises across 37 industries. Businesses are classified in conformity with the current boundaries set forth by Vietnamese law. There is a tripartite classification of small, medium, and micro enterprises that fall under the umbrella of SMEs. To put it another way, micro enterprises are characterized by a workforce ceiling of 10 employees, small enterprises are demarcated by a maximum staffing capacity of 100 individuals, and medium enterprises are delineated by an employee limit of 200. Furthermore, the dataset encompasses the year 2020, the first year Vietnam experienced the impact of the Covid-19 pandemic. Consequently, the dataset or firm indicators have not been significantly influenced by uncontrollable factors such as diseases, quarantine measures, and other policy changes.

In this study, we use this dataset over the research period from 2016 to 2020. It is an unbalanced panel consisting of 481,547 observations, with 42,617 enterprises having data for four years and 48,483 enterprises having complete observations for all five years, indicating the stability of the dataset. The remaining observations come from enterprises with data for 1 to 3 years, which are fewer in number. This is mainly due to the challenges faced by SMEs, which have a high rate of market entry and exit. All observations include sufficient information to calculate the TFP index. See Table 1 for more details.

Over the past several years, there have been numerous studies that have used data from surveys conducted by the GSO as their input data. Many authors have relied on data from both local statistical offices and the GSO to investigate issues related to TFP in various sectors such as agriculture (Dang et al., 2022), industry (Lai et al., 2013), food and beverage manufacturing (Cao & Hoang, 2020), or within specific regional contexts as explored in studies by Ha (2021). In addition to domestic research, some foreign authors have also utilized survey data from the General Statistics Office for their studies, such as Howard et al. (2015), Ha & Kiyota (2014), and Nguyen et al. (2019). Therefore, it can be concluded that the survey data from the GSO is highly reliable and accurate as input data for research purposes.

In conjunction with the GSO dataset, the study further employs the OECD's TiVA database, providing a range of indicators to describe participation in the Global Value Chains at the industry level. The computation of value-added trade indices is based on the Global Input-Output (ICIO) tables compiled according to the concepts of the 2008 System of National Accounts (2008 SNA).

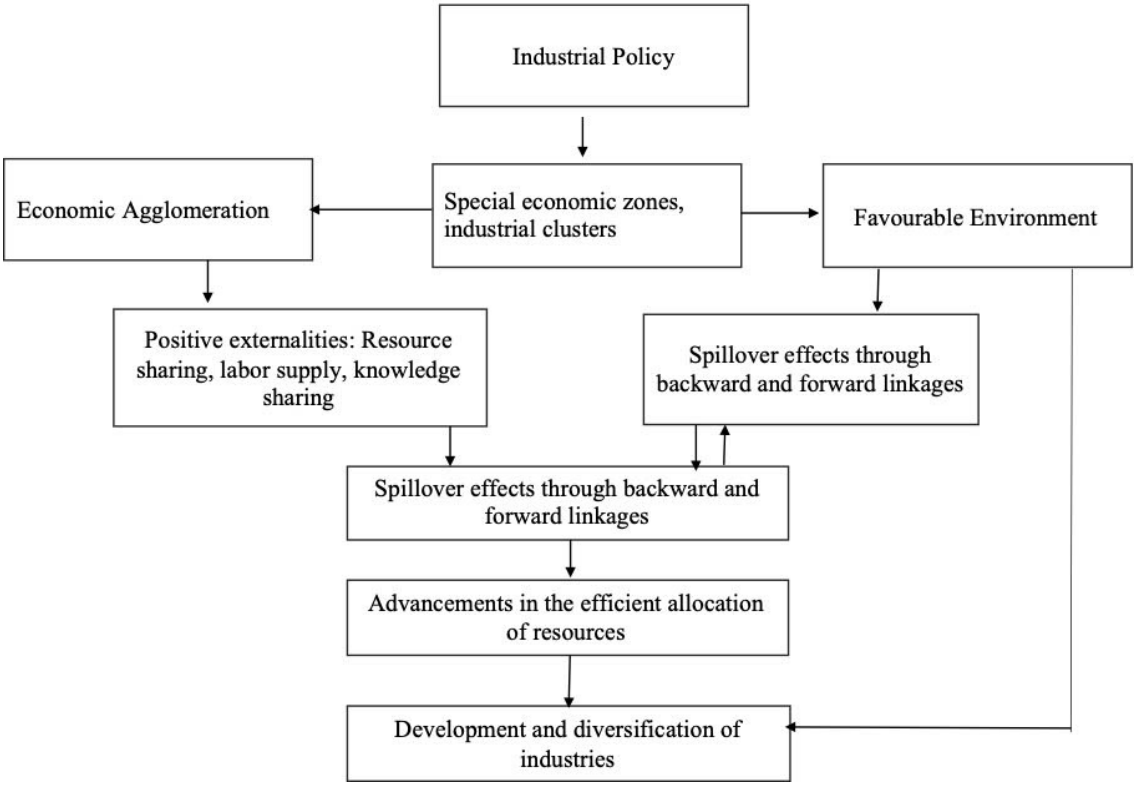
4. Empirical Analysis

4.1. Theoretical Framework

Marshall (1890) argued that the growth of an industry or cluster could generate positive spillover effects for related industries or businesses within the same geographic region. When a group of companies in a specific industry clusters together, they can share knowledge, infrastructure, and a skilled workforce. In turn, this can lead to an increase in TFP for all businesses within the cluster. Beyond external economic benefits, Marshall also recognized the advantages of internal economies of scale. These refer to the efficiencies and cost savings that individual firms within an industry experience as they expand in size. Such benefits may arise from factors like improved management practices, better access to financial resources, and stronger negotiating power with suppliers.

Based on Marshall's theory, it is evident that when companies streamline their production activities across geographic locations to leverage horizontal and vertical value chains through offshore outsourcing, the presence of an agglomeration economy within industrial clusters serves as a crucial driver for attracting both domestic and foreign investment. Successfully securing initial investments enables these clusters to generate momentum, propelling the economy toward sustainable growth, driven by localization economies, specialization, and knowledge spillovers. This process not only enhances the productivity of enterprises and regions but also contributes to trade growth.

Figure 1: Mechanisms of Productivity Enhancement in Industrial Parks



Source: Author's compilation based on Marshall (1890)

4.2 Empirical Strategy

The aim of the study is to investigate whether a firm belonging to an industrial park has a causal impact on its performance based on the heterogeneity between the firm and the difference types of industrial parks. To this end, this study adopts a three-step strategy. First, considering firm performance in Vietnam, we use the TFP index as a representative variable calculated based on the method mentioned by Wooldridge (2009). Second, we test the significance of the relationship between firms' location in industrial parks and the firm's TFP in the sample of Vietnam for the period 2016-2020 by adopting a regression model with added fixed effects. Then, we test a further expanded version of the above relationship, including the interaction term, to find out the heterogeneous impact. Third, panel data with regression models and fixed effects still have a problem with selection bias because firms located in industrial parks can improve productivity; however, firms with higher productivity will tend to choose to be located more in industrial parks. Therefore, we use propensity score-based matching and the Mahalanobis nearest-neighbor matching algorithm to compare firms that are located in industrial parks with control firms out of the park.

In the first step, the research calculates the value of TFP using the GMM method of Wooldridge (2009). Initially, calculations and measurements related to TFP revolved around Solow's (1957) residual calculation method as well as the Cobb-Douglas production function expressed in algorithmic form as follows:

$$Y\ (t) = f(L_{(t)}, K_{(t)}, M_{(t)}, t) \quad (1)$$

In which: Y(t) is output at time t; L(t) is labor at time t; K(t) is capital at time t; M(t) is the intermediate input at time t; the time variable t is also included to represent how the production function changes over time. Based on this production function, an increase in output Y must come from an increase in inputs or a change in production techniques.

Wooldridge (2009) used exogenous variables lagged one year or intermediate input variables lagged one year as instrumental variables. The advantage of GMM estimation is that it is easy to obtain fully robust standard errors. Additionally, GMM makes effective use of the moment conditions implied by the Olley & Pakes (1993) and Levinsohn & Petrin (2003) assumptions. Two-step estimators are inefficient for two reasons: (i) they ignore the contemporaneous correlation in the errors of the two equations; and (ii) they do not effectively account for serial correlation or uncertainty in the errors. GMM uses correlation between equations to improve efficiency, and the optimal weight matrix effectively explains serial correlation and heteroskedasticity.

In the second step, we adopt a regression model with fixed effect to investigate the relationship between industrial park location and firm productivity. We present Eq. (2) and Eq. (3) as follows:

$$TFP_{ist} = \beta_1 IP_{ist} + \beta_2 Firm\ Control_{ist} + \beta_3 Sector\ Control_{st} + \beta_4 Province\ Control_{pt} + \delta_s + \delta_t + \varepsilon_{ist} \quad (2)$$

$$TFP_{ist} = \beta_1 IPtype_{ist} + \beta_2 Firm\ Control_{ist} + \beta_3 Sector\ Control_{st} + \beta_4 Province\ Control_{pt} + \delta_s + \delta_t + \varepsilon_{ist} \quad (3)$$

The study also considers the heterogeneity impact between firms located in industrial clusters through Eq. (4) as follows:

$$TFP_{ist} = \beta_1 IP_{it} x Firm\ Type_t + \beta_2 Firm\ Control_{ist} + \beta_3 Sector\ Control_{st} + \beta_4 Province\ Control_{pt} + \delta_i + \delta_t + \varepsilon_{ist} \quad (4)$$

where: TFP_{ist} is Total Factor Productivity (TFP) of firm i in sector s at time t; we control for firm chacracteristics, sector and province index as follows: capital intensity ($\frac{K}{L}_{ist}$), labor quality ($\frac{Wage}{L}_{ist}$), sector gross output $Grossop_{st-1}$, $GVCop_{st-1}$ $(GVC\ participation\ index\ of\ sector\ s\ at\ time\ t-1)$, and Herfindahl Hirschman index at 2-digit industry level (HHI_{st}), Vietnam provincial competitiveness index (PCI_{pt}). These control variables are factors that can influence both a firm's decision to participate in an industrial park and its TFP. Capital intensity and labor quality directly impact a firm's TFP. Firms with higher capital intensity are more likely to enter industrial parks. The HHI index represents the level of industry competition, while the PCI index reflects the level of support and development policies in different provinces of Vietnam. Provinces with higher PCI scores provide a more favorable environment for businesses, particularly those operating within industrial parks.

The $IPtype_{ist}$ in Eq. (3) refers to 4 types of industrial parks, including normal, manufacturing, economic, and high technology, as indicated in Vietnam Enterprise Survey. The $Firm\ Type_t$ in Eq. (4) are Med_{ist} (a dummy equals to 1 when the firm is medium-sized firm); $ExportD_{ist}$ (a dummy equals to 1 if the firm engages in exporting activities and 0 otherwise); GVC_{ist} (a dummy equals to 1 if the firm participates in the

global value chain and 0 otherwise); and FDI_{ist} (a dummy equals to 1 when firm ownership type is FDI and 0 otherwise). In addition to these explanatory variables, this research also considers other control δ_s and δ_t, which are sector and time fixed effects, respectively, to capture bias due to unobserved factors and investigate across-firm changes in productivity within an industry. This research uses δ_i for a firm fixed effect in Eq. (4) in order to focus on the heterogeneity effect. Lastly, the error term is presented by ε_{ist}. All variables are in logs except for dummies, sector, and province control variables. A full description of the variables used in the empirical analysis is provided in Table 1.

For the matching method in the third step, we are concerned about selection bias, as participation in industrial parks can enhance firms' productivity. However, firms with higher productivity are also more likely to join industrial parks. Therefore, to assess the impact of participating in industrial zones, we adopt a comparison approach by matching the treated group—firms within industrial zones—with the control group—firms outside industrial parks. It is important to ensure that the control and treatment groups are comparable in key factors such as the number of employees, type of enterprise, and funding sources, with the only difference being whether the firm is located within an industrial park or not.

To achieve this objective, we first perform matching using the PSM method. In this approach, we calculate the propensity score for each enterprise choosing to locate in industrial parks based on observable characteristics through a logistic regression model. Subsequently, we match entities with similar propensity scores and explain the TFP differences between the treatment and control groups by the accumulated benefits of participating in industrial parks.

To achieve this, a propensity-score nearest-neighbor matching algorithm is employed to construct a refined control group of SMEs that do not benefit from the incentives provided by industrial parks. Each SME is assigned a propensity score based on parameters such as labor intensity, labor quality, business size (measured by the number of full-time employees), FDI status, and additional indices such as the Global Value Chain participation index at the industry level and the Provincial Competitiveness Index (PCI) at the provincial level. These factors are included in the propensity score computation, as they are considered to influence both the decision to participate in industrial clusters and the firm's TFP. Additionally, the study incorporates exact matching based on key characteristics such as

- Time (to ensure firms are matched within the same year),
- Sector (as different sectors may have varying cluster preferences),
- Region (matching within Vietnam's three main regions—North, Central, and South—to minimize geographic disparities).

A firm from the control group and a firm from the treatment group are matched if they belong to the same year, operate in the same sector, are located in the same geographic region within Vietnam (North, Central, or South), and have similar propensity scores. Furthermore, to provide sensitivity analyses for the matching results, each firm in the treatment group is sequentially matched with:

- 1 firm with the closest propensity score,
- 5 firms with the closest propensity scores,
- 20 firms with the closest propensity scores.

Table 1: Descriptive Statistics

Variable	Descriptive	Mean	Std. Dev.	Min	Max
Industrial Parks (IP)	IP=1, enterprise located in industrial park	0.035	0.184	0	1
ownD	OwnD = 1 if the enterprise is a private enterprise, = 2 if the enterprise is state-owned, = 3 if the enterprise has foreign investment	1.054	0.300	1	3
Type	Type=1 if the enterprise is in a conventional industrial park, Type=2 if located in an export processing zone, Type=3 if located in an economic zone, Type=4 if located in a high-tech park	0.048	0.289	0	4
gvco	Participate in GVCs or FVA, %	26.285	12.431	6.587	75.750
lnL	Log variable of the total number of full-time employees of the enterprise	2.060	1.053	0	5.298
size	Size = 1 if the enterprise is a micro enterprise, = 2 if the enterprise is a small enterprise, = 3 if the enterprise is a medium enterprise	1.406	0.533	1	3
lnsale	Log variable of sales revenue value	7.946	1.997	-5.097	17.208
lnM	Log variable of the value at cost price	4.570	3.774	-2.826	16.957
lnK	Log variable of the total value of the enterprise's fixed assets	6.007	3.600	-3.337	17.146
lnva	Log variable of enterprise’s value added	6.368	2.429	-5.097	17.191
lnwage avg	Log variable of the average salary per unit of labor represents the quality of human resources	2.874	1.719	-2.985	10.256
lncap em	Capital intensity, measured as average capital per worker	4.304	2.758	-6.802	15.128
exportD	Export = 1 for businesses participating in export	0.044	0.206	0	1
importD	Import = 1 for businesses participating in import	0.066	0.248	0	1
GVCs participation	GVCs=1 for businesses participating in the global value chain	0.076	0.265	0	1

Note: Observation is 481,547

Source: Author’s calculations

Table 2: Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) fva_vnm	1.0000												
(2) gvco	0.5894	1.0000											
(3) lnL	0.2520	0.1202	1.0000										
(4) size	0.2218	0.1017	0.8356	1.0000									
(5) lnsale	0.0310	0.0809	0.5303	0.4420	1.0000								
(6) lnM	0.0153	0.0357	0.1986	0.1634	0.3532	1.0000							
(7) lnK	0.0346	0.0075	0.3564	0.2861	0.3323	0.2271	1.0000						
(8) lnva	0.0755	0.0986	0.3553	0.3031	0.6891	0.1867	-0.0376	1.0000					
(9) lnwage_avg	-0.0304	-0.0471	0.1277	0.0994	0.1324	0.6057	0.2008	-0.2187	1.0000				
(10) lncap_em	-0.0332	-0.0273	0.1118	0.0767	0.2455	0.2413	0.9534	-0.1164	0.2403	1.0000			
(11) exportD	0.0680	0.1403	0.1962	0.1706	0.1929	0.1504	-0.0237	0.2390	0.0813	-0.0638	1.0000		
(12) importD	0.0275	0.1194	0.2283	0.1997	0.2468	0.0973	0.0526	0.2090	0.0965	0.0066	0.6827	1.0000	
(13) Cs_participant	0.0414	0.1341	0.2464	0.2141	0.2433	0.0899	0.0647	0.2147	0.0697	0.0105	0.7497	0.9265	1.0000

Source: Author's calculations

This approach ensures a robust comparison between SMEs benefiting from industrial park agglomeration effects and those operating in alternative locations, enabling a comprehensive evaluation of the causal relationship between industrial park participation and firm performance. For the robustness check, the study also supplements the findings with results from the Mahalanobis nearest-neighbor matching algorithm to further reinforce the evaluation outcomes. The balancing test results will be presented in Table 6.

5. Results

Table 3 presents the results of fixed effects (FE) estimation with panel data. Research results show that there is a positive impact of industrial parks on the TFP of enterprises. This result is specific to each model. In model (1), a basic model is established to evaluate the net impact of IP on TFP with control variables including business characteristics and industry concentration. In addition, further environmental conditions are controlled in the study through additional control of the provincial competitiveness index (PCI). The results of model (1) show that participating in industrial parks has a positive and significant impact on business performance, helping businesses increase TFP value by 1.88 units (e 0.633). Participation in industrial parks increases TFP through various mechanisms, such as technology spillover effects, reduced transaction costs, improved market access, and enhanced labor quality (Diez-Vial, 2011).

In model (2), with concerns about SMEs, medium-sized enterprises are selected to consider the impact of industrial parks on this group of enterprises compared to small- and medium-sized enterprises and microenterprises by adding interactive elements between industrial parks and medium enterprises. The results show that for medium-sized enterprises participating in industrial parks, TFP will increase by 4,044 units compared to other types, including microenterprises and small enterprises. Schiffer & Mauro (2001) argue that small businesses encounter more problems from the business environment than larger businesses because they have advantages in the economical factor of scale and costs, market entry, and opportunities to link with guest businesses as well as the public sector.

To highlight the commercial benefits of businesses located in industrial parks, as suggested by Antràs (2020), export activities and GVCs participation are proxies for trade openness. Trade in which participation in GVCs is defined as businesses that exchange goods with foreign businesses, including export, import, processing, and outsourcing (Baldwin, 2013). The results in models (3) and (4) explain that for SMEs with export activities and participating in GVCs, being located in industrial zones helps them operate more effectively than businesses located outside; in other words, trade openness has a positive impact on improving productivity through cluster development policies. Therefore, this creates the expectation that countries or localities with greater trade openness can achieve higher growth rates (Belloumi, 2014). Rivera-Batiz & Romer (1991) also argue that trade openness can promote long-term economic growth, increase efficiency in resource allocation, and improve TFP thanks to the development of technological capacity.

Business ownership is an important determinant of technical efficiency in Vietnam, in which businesses with FDI capital are more likely to score higher in efficiency (Van Ha et al, 2024). Model (5), in industrial parks, SMEs with FDI capital have the strongest and most positive impact on TFP compared to state-owned enterprises and private enterprises, implying the ability to use resources most effectively. In developing countries like Vietnam, FDI enterprises benefit more from internationalization thanks to

close linkage with international markets, opening the door to modern technology in production. This connection strengthens the learning activities of FDI enterprises more deeply than that of private/household enterprises. Not only in Vietnam, the superior performance of FDI also has been studied in the rapidly growing literature on firm internationalization (Buraschi et al., 2010).

Table 3: Impact of Industrial Parks on Business Efficiency

	(1) Base	(2) Top_Firm	(3) Export	(4) GVCs	(5) FDI
IP	.633***	.4369***	.4489***	.398***	.5733***
	(.0153)	(.0144)	(.0161)	(.0171)	(.0169)
IP*med		1.3974***			
		(.0204)			
IP*Export			.6973***		
			(.0227)		
IP*GVC				.6065***	
				(.0233)	
IP*FDI					.2264***
					(.0255)
_cons	-4.4891**	-4.2916**	-2.3261	-4.0602*	-4.8691**
	(2.0958)	(2.0882)	(2.0861)	(2.093)	(2.1011)
Obs	481547	481547	481547	481547	481547
R-squared	.4508	.456	.4528	.4526	.451
Industry and Firm control	Yes	Yes	Yes	Yes	Yes
Fixed effects	Industry and year	Industry and year	Industry and year	Industry and year	Industry and year
Cluster	Taxcode	Taxcode	Taxcode	Taxcode	Taxcode

*Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1*
Source: Author's calculations

Vietnamese government has implemented innovative zoning policies to upgrade infrastructure in special economic zones (SEZs) (Francois & Nguyen, 2013). As of the end of 2023, Vietnam had 414 industrial parks, including four export processing zones, with a total area of 128,126 hectares. The results from Table 4 indicate the presence of heterogeneous effects among different types of industrial parks across the three regions. Among them, the southern region demonstrates the highest performance across all four types of industrial zones, compared to the northern and central regions. A reasonable explanation for this outcome is the concentration of large industrial clusters, primarily in the southern region, especially in provinces with strong industrial development strategies, such as Ho Chi Minh City and Binh Duong. This distribution facilitates inter-industry linkages, helping businesses efficiently find trade partners or service providers (Korwatanasakul & Tran, 2022). Moreover, the concentration of manufacturing enterprises in the southern region is further supported by a more developed infrastructure system, thereby accelerating industrialization and enhancing the region's economic performance.

Notably, the results from Table 4 emphasize that high-tech zones (HTZs) are emerging as the key drivers of enterprise performance growth, scientific-technological innovation, and industrialization progress (Li & Zhao, 2023). These findings align with the research of Gornig & Schiersch (2024), which highlights that urban economies have the most significant impact on TFP for high-tech enterprises but do not have a substantial effect on low-tech industries. This difference may stem from technological development

levels, workforce quality, and infrastructure, which have played a crucial role in attracting investment from major technology corporations such as Samsung, Intel, and LG to this region. As a result, businesses operating in high-tech zones achieve significantly higher TFP than those in traditional industrial zones. These advantages underscore the critical role of high-tech zones in driving innovation-based economic growth while increasing value contribution to Vietnam's economy.

Table 4: Expand Durability by Type of Industrial Parks

	(1) North Vietnam	(2) Central Vietnam	(3) South Vietnam
Type 1	.6726***	.491***	.7989***
	(.0246)	(.0413)	(.0295)
Type 2	.3574***	.2699**	.4501***
	(.1103)	(.1311)	(.1668)
Type 3	.1465***	.1321	.3051***
	(.0391)	(.1031)	(.0949)
Type 4	.6852***	.016	1.0924***
	(.2022)	(.3027)	(.2467)
_cons	-10.1504***	-.107	9.9666**
	(2.6467)	(5.2206)	(4.2874)
Observations	319411	72088	90048
R-squared	.4244	.5177	.5322
Industry and Firm control	Yes	Yes	Yes
Fixed effects	Industry and year	Industry and year	Industry and year
Cluster	Taxcode	Taxcode	Taxcode

*Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1*
Source: Author's calculations

However, as shown in Table 3, the research also raises the question of whether firms were already operating effectively on their own before participating in the industrial park or whether participating in the industrial park helps businesses operate better; there might be an endogeneity. To corroborate this causal relationship, propensity score matching technique is used (Liau et al., 2023). Table 5 reports the results of PSM and MNN, based on comparisons between treated units (firms located in industrial zones) and a control group of firms located outside industrial zones, defined as mean and matched by options of 1, 5, 10, or 20 nearest neighbors, in terms of propensity score. The estimated values of ATT are calculated on the entire standard sample. In general, being located in an industrial park has a positive causal impact on firms improving TFP. In contrast to the estimates obtained from the FE regression model, the impact is clear but lower in magnitude.

The reason for implementing PSM is to compare firms in the treatment group with those in the control group that share similar characteristics. Additionally, the authors integrate exact matching, as previously discussed, ensuring that firms from both groups are compared within the same year, industry sector, and geographic region. This approach helps reduce selection bias, leading to more accurate results and demonstrating the impact of participating in industrial parks as well as the learning effect derived from them. In the second result of Table 5, the authors replace the Propensity Score with the Mahalanobis Score, which measures the distance between two firms based on multiple attributes. This robustness check further confirms that the results are consistent with those obtained using the PSM method.

Table 5: Results of Propensity Score Matching

PSM+EM	Effect	Coef.	SE	t	P>t	[95%Conf	Inter]
NN1	ATT	0.187	0.030	6.190	0.000	0.128	0.246
NN5	ATT	0.224	0.020	11.280	0.000	0.185	0.263
NN10	ATT	0.242	0.019	12.450	0.000	0.204	0.280
NN20	ATT	0.276	0.020	14.100	0.000	0.238	0.314
MNN+EM	**Effect**	**Coef.**	**SE**	**t**	**P>t**	**[95%Conf.**	**Inter]**
NN1	ATT	0.204	0.030	6.870	0.000	0.146	0.262
NN5	ATT	0.250	0.020	12.590	0.000	0.211	0.288
NN10	ATT	0.266	0.020	13.590	0.000	0.228	0.305
NN20	ATT	0.293	0.019	15.030	0.000	0.255	0.331

Source: Author's calculations

The balancing test results in Table 6 show that the balance between groups located in industrial parks and groups not located in industrial parks reduces bias and produces cause-effect results. Specifically, StdDif measures the standardized mean difference, aiming for values close to zero, indicating better balance between groups. The variance and variance ratios aim for equivalence between treated and non-treated groups, ideally close to 1 after comparison.

Table 6: Covariate Balancing Before and After Matching with PSM and MNN

PSM		Raw			Matched	
Means	**Treated**	**Un-treated**	**StdDif**	**Treated**	**Un-treated**	**StdDif**
lncap_em	5.671	4.254	0.546	5.612	5.370	0.093
lnwage_avg	3.099	2.866	0.132	3.080	2.999	0.046
PCI	64.702	65.470	-0.248	64.784	64.784	0
size	1.908	1.388	0.907	1.886	1.880	0.011
gvco	37.386	25.881	0.755	37.290	37.290	0
FDI	0.285	0.010	0.843	0.250	0.250	0
MNN		**Raw**			**Matched**	
Variances	**Treated**	**Un-treated**	**Ratio**	**Treated**	**Un-treated**	**Ratio**
lncap_em	5.891	7.596	0.775	6.066	5.808	1.045
lnwage_avg	3.248	2.944	1.103	3.232	3.114	1.038
PCI	11.002	8.228	1.337	11.033	11.033	1.000
size	0.389	0.271	1.436	0.385	0.367	1.048
gvco	321.037	143.838	2.232	322.536	322.532	1.000
FDI	0.204	0.009	21.471	0.188	0.188	1.000

Source: Author's calculations

6. Conclusions and Recommendations

Focusing on SMEs, this study provides a comprehensive analysis of the role of industrial agglomeration in economic development in emerging and developing countries. Using the case of Vietnam, the study utilizes data from the GSO for the period 2016–2020 to examine the impact of industrial concentration on SME productivity.

The study highlights the positive effects of industrial parks on firm productivity, particularly for medium-sized enterprises, export-oriented firms, and those engaged in GVCs; thus, locating businesses in industrial parks is currently an inevitable trend in

Vietnam, because it brings more advantages than locating outside, helping businesses improve operational efficiency, reduce costs, and enhance competitiveness. Our paper results also confirm that firms benefit more from internationalization due to their strong links with global markets, which facilitate access to modern production technologies. Notably, SMEs with FDI capital contribute the most to productivity improvements, implying a more efficient use of resources compared to state-owned enterprises, private firms, and family businesses. Furthermore, geographical differences in industrial park performance are evident, with the Southern region showing higher efficiency because of its concentration of large industrial clusters and advanced infrastructure. High-tech zones have emerged as pivotal drivers of regional productivity, promoting technological innovation and industrialization.

Our policy suggestion is that in the industrial park development policy, priority should be given to attracting FDI projects with advanced technology that are environmentally friendly and have the ability to spread and connect with domestic enterprises. In terms of longer-term strategy, developing industrial parks that are linked to the global value chain is an important direction for Vietnam to improve its competitiveness and deeply integrate into the world economy. To ensure better business efficiency, enterprises in industrial parks also need new production strategies; for example, instead of just focusing on processing and assembling, they need to focus on stages with higher added value such as research and development (R&D), design, marketing, logistics. Therefore, government policy also needs to focus on developing supporting industries within the industrial park to provide intermediate materials and components, especially for larger FDI enterprises in the industrial park.

7. Limitations

In this study, we primarily focus on analyzing the short-term impact of industrial agglomeration on firm productivity. However, in reality, this impact may vary across economic cycles and be influenced by technological development trends. Additionally, the study classifies industrial parks into four main categories (conventional, export processing, economic, and high-tech zones). However, due to data limitations, we are unable to assess the specific impact of each type on firm productivity over time. In future research, we plan to expand the analysis to evaluate the long-term effects of industrial agglomeration on firm productivity using the Autoregressive Distributed Lag (ARDL) model. Furthermore, we aim to clarify the role of spillover effects in explaining the productivity gap between firms inside and outside industrial parks.

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