Special Economic Zones and Firm Performance: Evidence from Vietnam

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Abstract

This paper examines the performance of Vietnamese firms located inside and nearby Special Economic Zones (SEZs) during the period 2007-2019. Applying a staggered Difference-in-Differences approach, we find that firms within SEZs experience significant increases in terms of their employment, sales, and labor productivity. The labor productivity and sales of firms located in the proximity of SEZs also increases. Foreign, large, science-based, and supplier-dominated firms appear to benefit the most. We also provide insights on the mechanisms behind these effects: firms within SEZs appear to benefit from enhanced credit access, while input-output linkages likely explain firm growth in the neighboring area. Nevertheless, technological distance seems to remain a challenge, as co-locating with foreign firms from developing countries appears to drive the gains in labor productivity.

Keywords: Special Economic Zones (SEZ), Industrial upgrading, Firm-level analyses, Developing economies

JEL Codes: F21, R58, D24, H25

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1 Introduction

Industrial upgrading in developing economies typically occurs through the adoption of existing knowledge and technologies. The process, however, is complicated and policymakers must be aware of the mechanisms that mediate the diffusion of knowledge into the local economy. While the attraction of foreign direct investments (FDI) by multinational enterprises (MNEs) are seen as pre-requisites, a recent review by Verhoogen (2023) highlights the role of learning from customers' preferences, worker mobility between local and foreign firms, as well as process innovations and access to better inputs. Yet, empirical evidence is still scarce, as suitable data and methods to disentangle these channels are often lacking.

This paper seeks to advance our understanding of the mechanisms underlying industrial upgrading in developing economies, whose outcomes are observable at the firm level. Specifically, we exploit information on the location and setup of special economic zones (SEZs) in Vietnam to evaluate their impact on the performance of (local) firms that co-locate either within or nearby such zones. Our findings reveal significant positive effects on various measures of firm performance that appear to be mediated partly through supply-chain linkages, an appropriate technological distance, as well as fewer financial constraints in some cases.

SEZs are geographically confined areas in which firms enjoy access to advanced infrastructure, as well as logistical and administrative services.[1] Although they can be found in virtually all countries around the world, they proliferate most noticeably in developing economies where they often entail fiscal incentives and regulatory exceptions to attract MNEs (World Bank, 2017; EBRD, 2024).[2] Theoretically, SEZs provide ground for agglomeration economies and local industrial development through knowledge spillovers and the formation of production networks (Neumark and Simpson, 2015). However, the empirical evidence is quite mixed, and especially so for developing and emerging economies. While SEZs in China have been found to be successful in attracting FDI and fostering local economic activity (Wang, 2013; Lu et al., 2019, 2023), programs in India (Alkon, 2018; Görg and Mulyukova, 2024) or Indonesia (Rothenberg et al., 2017) were less positively evaluated. Reasons for this can be manifold, but it is often suggested that local contextual factors matter. These would

[1] The definitions of SEZs and the related terminology often varies, depending on the country and their specific context. In this paper we consider a SEZ in a broader context, as we explain in further detail below. Nevertheless, their general purpose and underlying reasoning remain broadly the same.

[2] According to the UNCTAD (2019) World Investment Report, numbers increased from 79 SEZs in 29 in 1975 to around 5400 SEZs in 147 economies in 2018.

include the specific (policy) design of SEZs, the absorptive capacity of firms and skill-levels of workers, as well as the type of activities that are taking place in SEZs.[3]

By focusing on Vietnam, we analyze a rapidly transforming emerging economy that is located in geographic proximity to East Asia's manufacturing powerhouses. Since the late 1990s, when the country prepared to integrate into the global economy, the number of SEZs and similar demarcated areas grew from a mere 50 to almost 500.[4] Our analysis concentrates on the sub-period 2007-2019, during which the expansion was most pronounced. Using records on the setup of these SEZs over time, and their detailed geographical location, we observe and follow firms that are located either inside or very close to these zones.

Indeed, the mechanisms at work inside an SEZ can be quite different from those working outside of their boundaries. Firms located *inside* an SEZ are expected to benefit from cost reductions, which can occur both directly, through fiscal benefits, or indirectly, through better infrastructure and other amenities. At the same time, they are arguably more likely to benefit from economic complementarities with co-locating firms through well-coordinated buyer-supplier relationships, exposure to new technologies, and better access to skilled labor. In turn, the effects on firms located *outside* of an SEZ are more ambiguous. While they may face increased competition from the technologically superior firms inside the SEZs, they could also benefit, if general agglomeration forces enable them to integrate into an emerging industry cluster. By supplying to firms inside of SEZs, they might benefit from an increased market potential with opportunities to learn and adopt best practices. To better capture the diffusion of economic activity into the local economy, we distinguish between the direct (*i.e.*, within) and indirect (*i.e.*, spillover) effects of SEZs on firm performance. This distinction constitutes a unique feature of our study and has, to the best of our knowledge, not been made before.

To identify the impact of SEZs on firm performance, we employ a staggered differences-in-differences (DiD) model, which is appropriate for a setting like ours, which features firms in treated and non-treated geographic areas, as well as differential treatment moments. To

[3]More nuanced but potentially very important points are made by Guillouet et al. (2021), who argue that language barriers can be a significant obstacle for knowledge transfer, and Atkin et al. (2017), who found that upgrading might face (active) resistance by workers if they are not compensated for the time they need to effectively make use of a superior technology.

[4]Numbers are based on reports by the Vietnamese Ministry of Investment and Planning and include national industrial parks, export processing zones, high-tech zones and border zones. (see: https://datafiles.chinhphu.vn/cpp/files/duthaovbpl/hosodenghixaydungluat.pdf). More details in the next section.

implement this approach, we rely on geographically highly disaggregated data that enables us to identify whether a firm resides inside or (just) outside of an SEZ. To achieve this, we use the address-information of firms that is reported in the annual Vietnam Enterprise Survey and make use of the fact that SEZs typically cover some area within a narrowly defined administrative unit of Vietnam — so-called *communes*. Firms residing within the same commune as an SEZ, but not inside of it are considered as geographically proximate firms exposed to indirect treatment. Firms that resided within an SEZ commune before the zone was established and inside of it after it came into existence are subjected to the direct (within-SEZ) treatment. To address potential endogeneity concerns regarding the location of SEZs, we compare both types to a control group of firms that is located in communes where SEZs were planned, but eventually not realized — *i.e.*, canceled SEZs.

Our empirical results indicate that SEZs have a statistically significant and positive impact on employment, sales, and productivity of firms inside of SEZs. We also find noticeable spillover effects on firms located outside of them. Quantitatively, our baseline results suggest that, within SEZs, firm-level employment, sales, and labor productivity increase by 18.3, 55.3, and 25.9 percent, respectively, relative to the control group. The average increase among firms residing outside but close to SEZs are about 50-67 percent smaller.

We consider alternative specifications and control groups, which reveal that our baseline estimates are statistically and quantitatively robust. Nevertheless, we find heterogeneity in the responsiveness to SEZs across firms. Noticeably, very small firms (with fewer than 20 employees) are less likely to be found in SEZs and therefore benefit mainly via spillover effects, increasing sales and employment, but not labor productivity (measured as value-added per employee). In turn, workers become more productive in large firms as well as in small- and medium-sized enterprises (SMEs), and employment increases concentrate among the latter group. We further find that foreign and private domestic firms alike benefit, which is suggestive of positive spillovers on general economic activity in the region where SEZs are located.

In addition to the heterogeneous effects, we also explore potential mechanisms that could be at work. Our data allows us to take an exclusive look at the firms that operate inside of Vietnam's SEZs and to observe their industry affiliation. Using input-output tables, we evaluate whether firms that operate in industries that typically supply to industries in which SEZ firms operate reveal systematically different adjustments. While we can confirm strong complementarities among firms inside of SEZs, the increase in economic activity outside of

SEZs appears to be unrelated to such input-output relationships. This suggests that either general agglomeration forces are at work or that the production networks that are formed are too complex to be captured by the idea that local non-SEZ firms provide inputs to firms inside of SEZs. We also consider other channels, and find that firms inside of SEZs are more likely to get credit, which might explain the quantitatively larger estimated effects of SEZ on their performance. Finally, we consider adjustments in labor productivity among, depending on the prevalence of high- or middle-income origin of FDI in SEZs. SEZs that are predominantly invested by foreign firms from other developing and emerging economies appear to increase value added per worker faster than SEZs where foreign invested firms are mainly from high-income countries. This finding suggests either that technological distance is an obstacle for industrial upgrading among Vietnamese firms or that MNEs controlled by entities from these two groups differ in their intentions and willingness to share or transfer knowledge and technologies.

Our paper relates to a large empirical literature which evaluates the economic development effects of place-based policies. In this context, we focus on SEZs, a widely used and debated policy tool to promote local and regional economic activity. Numerous studies have made similar efforts, but typically focus more aggregated units of analysis (e.g., Wang, 2013; Alkon, 2018; Nguyen and Tien, 2021; Brussevich, 2024; Gallé et al., 2023; Lu et al., 2019). Although these studies occasionally mention the effects of SEZs on firms, their main research question concerns aggregated effects.[5] Only very few studies explicitly focus on the effects of SEZs on firms, where Görg and Mulyukova (2024) is probably most similar to ours. They focus on an SEZ program in India, but cannot find any significant effects on firm performance, which they attribute to a policy design that entailed the formation of single-firm SEZs and proliferating rent-seeking behavior. SEZs in Vietnam are set up in a different way and are populated by several firms, which might explain why our findings are different from theirs.

A key innovation of our study is our ability to distinguish firms inside and outside of SEZs while maintaining a high level geographical disaggregation. Doing so, we can exactly determine whether a firm is located inside or outside an SEZs, even if they are located within the same *commune*, which corresponds to the third layer of Vietnam's administrative division, below provinces and districts. We can therefore estimate more precisely the impact of SEZs and differentiate between the economic mechanisms at play inside and outside of their boundaries. Our data further allows us to observe the industry affiliation of firms inside

[5] Abagna et al. (2025) study the impact of SEZs on household wealth in several African countries.

of SEZs. This enables us to investigate the relevance of potential supply-chain linkages among firms, which only very few studies have been able to do in the context of emerging economies (e.g. Javorcik, 2004; Ciani and Imbruno, 2017; Bajgar and Javorcik, 2020; Alfaro-Ureña et al., 2022). While these studies focus on FDI inflows and MNE activity more generally, our evidence for backward-linkages in SEZs appears to be in line with theirs.

Finally, we contribute to a growing literature that focuses on industrial upgrading in Vietnam, which covers also a range of socio-economic and labor market outcomes (McCaig and Pavcnik, 2018; McCaig et al., 2022; Sakakibara, 2023). More recent developments are studied in the context of product relocation to Vietnam amid the US-China trade war (Rotunno et al., 2023; Mayr-Dorn et al., 2023; Utar et al., 2023), highlighting its continuous integration and growing importance in the global economy. Our paper is the first to study the firm-level impacts of SEZs in Vietnam, which complements recent findings on their impact on structural employment dynamics by Tafese et al. (2025). Overall, we provide evidence in support of a positive impact of SEZs on industrial upgrading in Vietnam.

The rest of the paper is organized as follows. Section 2 presents the Vietnamese SEZ program. Sections 3 and 4 discuss the data and empirical strategy, while Section 5 presents our main findings. Section 6 explores potential mechanisms through which SEZs affect firm performance. Section 7 concludes.

2 Background on SEZs in Vietnam

2.1 Regulatory changes and policies

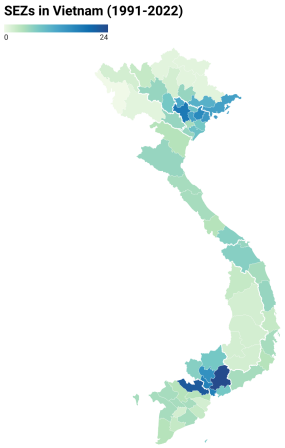
In this paper, we define SEZs as officially recognized and geographically confined areas which are subject to differential administrative and regulatory procedures. This means that the specific local industrial development projects we include into our analysis can have different names, such as industrial zones, export processing zones, or border economic zones, but we consider them as conceptually identical. Following this definition, Vietnam started SEZ programs in 1991 with the aim to attract foreign and domestic investment, to promote international trade and to increase employment and stimulate technology transfer.

The legislative process unfolded in several stages, starting with the *Political Report of the 7th Congress*, which outlined a five-year plan (1991-1995) to enhance economic stability and growth, emphasizing policies to attract foreign investment, particularly in the manufacturing

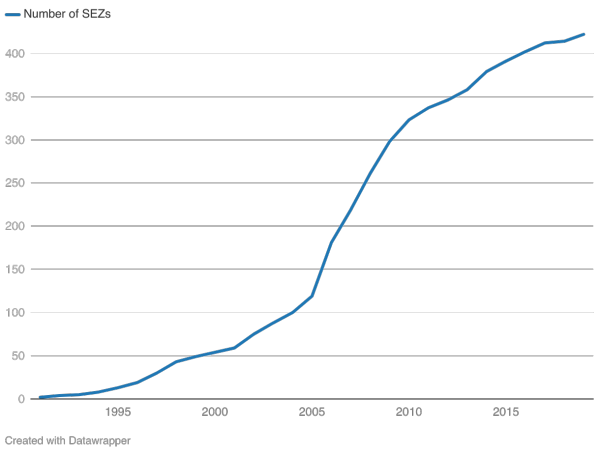
sector. This strategy laid the groundwork for the first Export Processing Zones (EPZs, or *Tan Thuan*) and Industrial Parks in Vietnam. The first EPZ was created in Ho Chi Minh City in 1991, and was followed by the establishment of further SEZs in 1995, primarily in Hanoi and Ho Chi Minh City. Further legal frameworks followed in 1994, with the *Law on Domestic Investment Promotion*, the 1992- and 1996-amendments of the *Foreign Investment Law of 1987*, as well as with specific decrees on EPZs and SEZs in 1994 its and subsequent amendments. By December 2022, Vietnam had developed a large number of SEZs that spread across all geographic regions and includes both national as well as provincial SEZs. Panel (a) of Figure 1 shows how the total number of SEZs evolved over time, while Panel (b) indicates their geographic distribution across Vietnam in 2022.[6]

Figure 1: Vietnam's SEZs, 1991-2022.

(a) Geographic distribution



(b) Evolution over time



Source: Authors' representation based on data from the Ministry of Foreign Investment and Planning of Vietnam, 2022.

Firms that locate inside of an SEZ can enjoy different benefits, which may vary across different types of zones, as well as across firms (foreign or domestic). While our data does not allow us to distinguish or directly observe these benefits, legal documents and anecdotal evidence suggest that they often include (temporary) tax reductions and customs duty exemptions. Concrete examples are a 2-year tax exemption or a reduced corporate income tax

[6]Appendix Table A.1 provides an overview of these different types of SEZs and their establishment over time.

rate for foreign firms.[7] Firms in high-tech and export processing zones could benefit from additional tax exemptions and a longer tax exemption period. SEZs in regions with challenging socio-economic conditions might offer further advantages, such as land rent exemptions during the construction and start-up period. In some cases SEZ policies also include preferential access to finance via state-backed investment credits,[8] or income tax reductions for employees working in SEZs.

2.2 SEZ characteristics and economic mechanisms

Like many other placed-based policies, also Vietnam's SEZs are set up to attract firms with specific capabilities that are deemed instrumental to promote industrial upgrading. Despite their geographically confined nature, SEZs are popular in developing economies, as their setup and monitoring costs are arguably lower than country-wide reforms and infrastructure development programs.[9] Indeed, Vietnam's SEZ program is reminiscent of China's approach. By establishing zones gradually and across the country, governments can experiment with different policy designs and identify best-practices (Wang, 2013; Lu et al., 2019, 2023). Moreover, by developing SEZs through public-private partnerships, their economic impact and underlying mechanisms can be better monitored and evaluated. This is particularly the case in Vietnam, where most SEZs are set up in previously unbuild areas (Tafese et al., 2025), requiring firms to relocate to get access to the fiscal benefits they entail. In contrast, India's more decentralized SEZ program has not been able to generate evident economic gains (Alkon, 2018; Görg and Mulyukova, 2024). One reason could be that it effectively worked though a licensing system that required only minor commitments by firms and incentivized rent-seeking behavior that undermined productivity growth.

Table 1 gives an overview of the industries represented by firms operating in Vietnamese SEZs, according to our data, and compares them to the rest of the country. It is noticeable that manufacturing sector activities are relatively over-represented in SEZs and, among them, some heavy and resource intensive industries, like metals and coke, but also rubber, chemicals, and plastic. Firms producing textiles, apparel and leather products are less often found inside than outside of an SEZ. The focus on manufacturing and on specific activities within

[7] Decree 192/CP, 1994 sets rates equal to 12-18 percent in the manufacturing sector and 22 percent in the service sector. The tax rate facing domestic firms is 25%, within and outside of an SEZ.

[8] See details at Government News of the Socialist Republic of Viet Nam (accessed: 20 March 2025).

[9] SEZs in high-income countries have similar objectives, but typically focus on the local economy and aim at reducing regional inequalities (Neumark and Simpson, 2015).

this sector is in line with the more general notion that SEZs seek to promote industrial development. The patterns are also in line with the documented shift from agricultural to industry sector jobs in SEZ provinces (Tafese et al., 2025). In the lower panel of Table 1, we also observe that the percentage of foreign owned firms is higher within than outside of SEZs, which suggests a relative concentration of foreign and arguably more advanced technologies within these areas.

Table 1: Industry structure within SEZs vs. the rest of Vietnam, 2019

	(1)	(2)	(3)	(4)
	% of Firms		% Foreign Firms	
Sector	SEZs	Rest of VNM	SEZs	Rest of VNM
Agriculture, Forestry, and Fishing	0.73	2.33	0.06	0.02
Mining and Quarrying	0.73	0.65	0.07	0.004
Manufacturing, total	65.09	14.59	37.29	1.09
Within manufacturing (%)				
Food, Beverages, and Tobacco	*9.9*	*13.0*	*5.5*	*3.7*
Textiles, Apparel, and Leather	*15.6*	*16.3*	*18.8*	*19.3*
Wood and Wood Products	*10.0*	*19.2*	*5.8*	*4.6*
Coke, Rubber, and Chemicals	*19.3*	*11.3*	*19.6*	*9.2*
Metals	*17.3*	*20.2*	*16.0*	*5.5*
Machinery	*27.9*	*20.0*	*34.4*	*15.6*
Services	27.67	68.33	2.86	1.31
Others	5.78	14.1	0.49	0.12
All	100	100	25.09	1.07

Note: Authors' calculations based on Vietnamese firm-level data and Special Economic Zones (SEZs) described in the following section. Numbers are based on the last year of our sample period, 2019. Shares of firms in SEZs (column 1) are calculated as the number of firms in SEZs for each industry divided by the total number of firms in SEZs across all industries, multiplied by 100. Shares of foreign firms in SEZs (column 3) and the rest of Vietnam (column 4) for each industry are calculated as the number of foreign firms in SEZs (or non-SEZs) in that industry divided by the total number of firms in SEZs (or non-SEZs) across all industries, multiplied by 100. Within-manufactuing shares add up to 100.

Based on the characteristics of Vietnam's SEZs described above, one can expect that firms residing inside these areas will use the fiscal and infrastructural benefits to invest in better technologies or production capacity more generally to expand its operations. Moreover, by being exposed to foreign firms more, there might be scope for learning effects — either through observations or through direct buyer-supplier relationships. In this respect, to the extent foreign knowledge and technology matters, also the technological distance between local and foreign firms can become relevant. Importantly, the latter effects are not necessarily constrained to SEZ firms, but can also be expected to affect firms located in the vicinity of SEZs. Indeed, place-based policies are typically found to impact economic activity also in adjacent regions, though to a lesser extent (Abagna et al., 2025). However, there might also be negative effects that arise from intensified competition between SEZ and non-SEZ (or between foreign and domestic) firms. These could dampen the positive learning and productivity effects of SEZs. Yet, by attracting (new) firms and knowledge into SEZs and their surroundings, agglomeration effects can generate economic gains that go beyond the direct interactions between SEZs and the local economy. Our empirical analysis will therefore focus first on evaluating the general performance of (incumbent) firms that reside inside or close to SEZs.

3 Data

3.1 Firm-level data

To analyze the impact of SEZs on firm performance, we use information from the *Vietnam Enterprise Survey* (VES), which is administered by the General Statistics Office of Vietnam. The data features annual information about the activities and performance of all formally registered firms in Vietnam.[10] Although the VES data starts already in the year 2000, our analysis focuses on the period 2007-2019 when SEZs began to spread widely across the country. As we discuss in further detail below, SEZs were much less common in earlier years so that including these would exacerbate selection bias in our sample. Moreover, focusing on this later period makes it significantly easier for us to follow firms over time, using their unique tax identifier variable, which is not available for earlier years. Following McCaig et al. (2022), we use the firms' tax ID number ("`ma_thue`") to create a firm-level panel data set,

[10] See Nguyen and Lim (2023) for further details about the VES.

and we use the reported firm ID ("madn") as a secondary firm identifier, whenever the tax ID is not available, incomplete or has duplicates.[11]

For the purposes of our study, we are interested in a firm's reported location within a Vietnamese *Commune*, as well as its address to verify its location inside or outside an SEZ, as we explain below. Next to this, we select a number of balance sheet variables and performance indicators to evaluate the impact of SEZs on firm-level employment, sales, and labor productivity. Total employment refers to all employees covered by social security, which is mandatory in Vietnam, at the end of a year. Labor productivity is computed as value added over total employment, where value added is defined as revenues minus input costs. Firms' sales, employment and labor productivity constitute the main outcomes of interest in our analysis. To clean our data, we therefore remove firms with missing information on employment, sales, industry affiliation, firm type, or province/city and commune, as well as those with negative or zero values of employment or sales. Our final sample features an unbalanced panel of more than 900,000 firms and a total of about 4.3 million observations spanning 13 years.

3.2 SEZ location and status

To measure the location of an SEZ, as well as the timing of its operations, we manually collect data from the *Vietnamese Ministry of Planning and Investment*, related published laws and regulations, as well as other news sources. Doing so, we obtain, for each SEZ, information about its type, name, address, year of notification and start of operations. Importantly, the notification of an SEZ refers to the moment in which the central or local government (for national or provincial SEZs respectively) announces the formal decision to establish an SEZ in a particular location, while its actual operations begin at a later point. It can also happen that SEZs stop operations after some time, for example, if it fails to attract sufficient investment, or if the focus of local economic policies changes. Since we are not able to evaluate such events in a systematic way, we assume that any active SEZ continues their operations throughout our sample period. The potential measurement error entailed by this assumption might result in a downward bias of our estimates.

We determine the operational status of announced SEZs in two ways. First, we use

[11]The tax ID variable is a unique identifier for the firms across all years in our sample, displayed as a 10-digit code. However, in the years 2007-2010, it is reported only as a 9-digits code. To differentiate between firms during these years, we use their address, number of employees and name to verify their identity.

the *Google Earth Historical Imaginary* tool, which provides satellite imagery from different points in time, giving us visual evidence of the year in which physical infrastructure, such as buildings or roads, first appeared in the designated SEZ area. A similar technique was used by Tafese et al. (2025), but unlike them, we do not consider the size of the build-up area in these satellite images and limit ourselves to a binary indicator that switches from zero to one for a *commune* that hosts an operational SEZ.[12] In some cases, we were unable to determine the exact location of an SEZ or the historical satellite images did not extend far enough back to capture their start-up moment. In these cases, we rely on administrative records as a secondary source to determine the year in which operations started.[13]

Our ability to distinguish between announced and operational SEZs equips us with a convenient tool for causal inference. Indeed, not all announced SEZs actually become operational, which reveals from cases where we cannot visually observe any activity and where the official announcement of an SEZ is removed from governments records. While the underlying reasons for these "cancellations" are not documented, anecdotal evidence suggests that local administrative barriers, delays, or realigned policy agendas could lead to such outcomes.[14] To compile a list of all "canceled SEZs", we collect information on announcements of their removals either in local news reports on SEZ developments or in official government documents and records. Firms residing in communes where announced but canceled SEZs were planned will constitute the control group in our baseline specification. We thereby acknowledge the possibility that the initial announcement of an SEZ might be not random and assume that the cancellation of these plans is not systematically related to local firm characteristics.

[12]Since we focus on the impact of SEZs on firms' sales, employment and productivity, there is no immediate reason to assume that a larger build-up area results in differential changes of those outcomes. This is different from the regional labor market effects studied by Tafese et al. (2025), where the size of the SEZ could proxy for overall changes in (the structure of) regional labor demand.

[13]Specifically, we identified the year when the national or local government officially designated the area for SEZ activities. This designation typically involves formal approval and allocation of land for the SEZ, indicating its readiness for economic activity even if physical infrastructure was not yet visible.

[14]For example, in the case of Ho Chi Minh City (HCMC), three industrial zones—Xuan Thoi Thuong, Phuoc Hiep, and Bau Dung, located in Cu Chi and Hoc Môn districts - were removed from the national industrial zone development plan, despite their initial approval in 2014 (e.g., Government Document No. 1300/TTg-KTN dated July 24, 2014). According to the HCMC Department of Planning and Architecture, their declared areas were never converted into SEZs and became an obstacle for other projects to convert land-use purposes, so that the prolonged inaction eventually led to their cancellation (see The Saigon Times - 05/05/2023, accessed 04/04/2025).

3.3 Firms inside and outside of an SEZ

Combining our VES data with the time-varying *commune*-level information on SEZs, we identify a firms' SEZ status. This can manifest in three ways: a firm is located either (i) within an SEZ; or (ii) outside of an SEZ, but within the same *commune* of an SEZ; or (iii) not in an SEZ and also not in an SEZ-*commune*. The SEZ status of a firm changes whenever an SEZ is established in the firm's *commune* and we distinguish between (i) and (ii), depending on whether the firm ends up residing inside the SEZ or not. This is revealed based on their indicated address or SEZ residence in the VES data. Since SEZs are mostly built on previously unused land, we observe that firms typically move into the SEZ area. In our analysis of within-SEZ firms, we concentrate on those that already operated in the same *commune*. Doing so, we can better control for *commune*-specific characteristics and pre-trends. Firms that reside in *communes* without any announced SEZs before or during our sample period constitute our alternative (broader) control group. To avoid potentially confounding effects from regional spillovers of SEZs, we remove all never treated firms that operate in neighboring *communes*.

4 Empirical strategy

4.1 Sample selection

Our approach to assessing the impact of SEZs on firm performance leverages spatiotemporal variation at the level of Vietnam's *communes*. Using a difference-in-differences (DiD) approach, we compare firm-level performance before and after the start of SEZ operations in their *commune* (i.e., the first difference) and relate it to the performance of firms in our control group (i.e., the second difference). As discussed above, we consider two types of treatments, where the first is *direct*, affecting only firms located inside of an SEZ, while the other is *indirect* and focuses on firms operating outside of an SEZ, but in the same *commune*. To infer causality running from SEZs to firm performance, we pay attention to potential factors that determine the location of an SEZ, which might be correlated with firm-performance and commune-specific characteristics. Indeed, numerous factors can influence such decisions, but are often not observable for researchers and, hence, difficult to control for (e.g. Neumark and Simpson, 2015). To address this challenge, we take advantage of the *canceled* SEZs in our data, assuming that initial conditions in these locations were similar to those where SEZs

were eventually realized.[15]

Table A.2 provides general summary statistics of the different types of firms and SEZs in our main sample. It reveals substantial size difference across firms with different ownership structures (i.e., foreign, state-owned, domestic) and across types of SEZs. In terms of labor productivity, however, there are no obvious systematic difference, besides the well-known feature that foreign-owned firms tend to be more productive. In our analysis, we will explore potentially heterogeneous effects of SEZs along these different dimensions. Table A.3 presents a more systematic comparison between firms in different treatment and control groups. Firms residing inside of an SEZ and exposed to direct treatment are on average larger in terms of both sales and employment. This is regardless of whether the control group consists only of firms with canceled SEZs or whether we consider any never-treated firms. However, we find no difference in terms of labor productivity between firms of these groups. For the indirectly treated firms, which reside in an SEZ-*commune*, we also find that they are larger in terms of their employment number, although their average sales are statistically indistinguishable. Given these evident differences between treated and non-treated firms, we scrutinize our findings with a number of robustness checks .

4.2 Estimation framework

To estimate the impact of SEZs on firm performance, we adopt a staggered DiD approach which takes into account the differential timing of SEZ treatments across locations:

$$Y_{i,t} = \alpha + \sum_{g \in G} \sum_{t=t_0}^{g-1} \theta_{g,t}^{pre} D_{i,g,t} + \sum_{g \in G} \sum_{t=g}^{T} \theta_{g,t}^{post} D_{i,g,t} + \gamma' \mathbf{X}_{i,t} + \xi_i + \xi_t + \varepsilon_{i,t}. \quad (1)$$

The dependent variable, $Y_{i,t}$ represents the outcome variable for firm i in year t and will measure the (log) number of employees, sales or labor productivity), respectively. Our main variable of interest is $D_{i,g,t}$, which is a dummy variable that indicates whether firm i of group g has been treated at time t. Importantly, g denotes the year of a treatment, as we explain below. The vector $\mathbf{X}_{i,t}$ denotes a vector of firm-level control variables, such as their size-

[15] Similar approaches have been used in other contexts where researchers attempt to mitigate endogeneity concerns. A famous example is the study by Greenstone et al. (2010), who compare "winning" to "losing" counties in the context of location choices for large plant openings in the. In their analysis, losing counties were the runner-up for the location of a new production plant, and are used as a control group to the winning ones.

group and sector affiliation. They complement our fixed effects, ξ_i and ξ_t, which capture for firm- and year-specific variation in our data. The error term $\varepsilon_{i,t}$ might be correlated across regions, so we adjust our standard errors for clustering at the *commune* level.

To interpret our results, we compute the average treatment effects on the treated (ATT) by aggregating the post-treatment coefficients $\theta_{g,t}^{post}$ across all treated groups and time periods. The ATT provides a summary measure of the overall impact of SEZs on firm outcomes. Next to this, we also consider the dynamic effects of SEZs over time, by plotting the coefficients ($\theta_{g,t}^{pre}$ and $\theta_{g,t}^{post}$) on a time axis that displays the differential performance of firms in the years before and after the treatment. Doing so, we can trace potential anticipation effects in our data as well as the persistence or decay of effects over time.

The implementation of a staggered DiD approach faces several econometric challenges that arise from the fact of non-simultaneous treatments (Borusyak et al., 2021; Goodman-Bacon et al., 2019). The first challenge concerns the identification of an appropriate control group, which Callaway and Sant'Anna (2021) suggest should be addressed by comparing treated units only to not-yet or never-treated firms. Their approach has been widely adopted in the recent empirical literature, as it reports both dynamic and ATTs in an easy-to-interpret and straightforward way. Nevertheless, their method is also computationally intensive in large datasets like ours and offers users only little insights and control over model specification. An alternative is therefore the Event-Time Weighted Fixed Effects (ETWFE) approach introduced by Wooldridge (2023). It offers more flexibility for including fixed effects and other controls into our specification, allowing us to compare our treated firms to never treated firms, as discussed above. The ETWFE approach also takes directly into account the parallel-trends assumption, which constitutes the second challenge underlying staggered DiD estimation approaches.[16] This assumption is important for the causal interpretation of our results. It ensures that any observed *post-treatment* differences between the performance of treated and never-treated firms can be attributed to the establishment of an SEZ. The dynamic effects reported in an event-study figures will allow us to assess the validity of this assumption, which must reveal statistically insignificant differences between the treated and never-treated during the *pre-treatement* period.

[16] We implement ETWFE using the user-written command "jwdid" in Stata (see Rios-Avila, 2024).

5 Results

In this section, we present our main findings for the impact of SEZs on firm-level sales, employment and value added per worker. Next to our baseline results for both direct effects (on firms within SEZs) and indirect effects (on firms located nearby SEZs), we also assess their robustness by using alternative control groups and sample compositions.

5.1 Main findings

Average treatment effects. Table 2 presents the Average Treatment Effect of the Treated (ATT) obtained from estimating Equation (1), using two different samples. Panel A corresponds to our baseline, where the control group consists of firms residing in communes where SEZs were planned and approved but eventually not realized. Panel B uses a significantly larger sample, where the control group consists of all firms in non-SEZ (and neighboring) communes.

Table 2: Baseline results - Average Treatment Effects on the Treated.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep var.:	Number of employees		Sales		Labor productivity	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Panel A. Control group is firms in the canceled SEZ communes						
SEZ	0.183**	0.071**	0.553***	0.292***	0.259**	0.085**
	(0.073)	(0.026)	(0.128)	(0.035)	(0.106)	(0.041)
Obs	21,962	146,800	21,947	146,681	18,072	118,377
Panel B. Control group is firms in non-neighboring communes						
SEZ	0.162**	0.074***	0.494***	0.339***	0.245**	0.138***
	(0.065)	(0.011)	(0.113)	(0.024)	(0.095)	(0.029)
Obs	3,608,392	3,611,910	3,603,769	3,607,242	3,054,861	3,048,655

Note: Direct effects indicate the impact of SEZs on firms operating inside of and SEZ area. Indirect effects indicate impact on firms located in SEZ communes but outside the SEZ area. Coefficients indicate the Average Treatment Effect of the Treated (ATT). Standard errors in parentheses. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Focusing on columns (1) and (3) of Panel A, we observe that local firms that continued to operate inside of an SEZ after its establishment experienced significant growth in terms

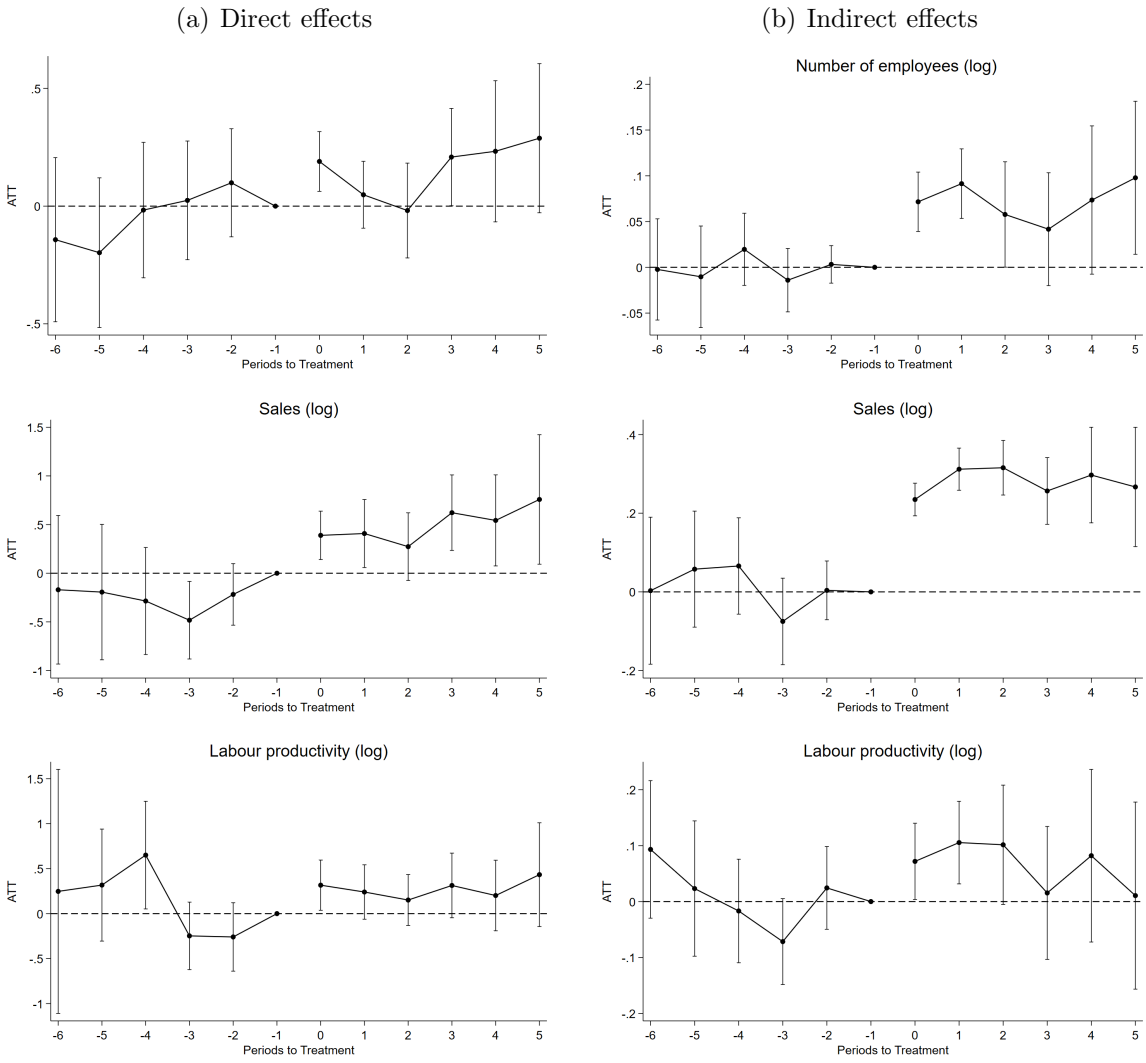
of sales and employment, compared to firms in regions where SEZ projects were canceled. Their relative growth in sales appears to be larger than that of employment, which indicates that firms have been able to scale production by increasing their output per worker. Column (5) further suggests that labor-productivity (measured as value-added per worker) increased significantly, which can be interpreted as evidence of upgrading by local firms after moving into an SEZ. The estimated effects are also quantitatively large, given that the relative increase amounts to about 18 percent for employment, 50 percent for sales, and 25 percent for value-added per worker — even if we consider the alternative and broader control groups in Panel B.

Considering the indirect effects in columns (2), (4) and (6) of Table 2, we notice that they are quantitatively smaller and amount to at most half of the size of the estimated direct effects. Overall, the point estimates in Panels A and B appear to be quite comparable, although the indirect effects are slightly more conservatively estimated in our baseline sample with only firms from communes where SEZs were planned but not realized.

Event-study diagrams. Our empirical specification takes into account the possibility of non-linear effects while enabling us to take a closer look at the identifying assumption that there are no differential pre-trends. In Figure 2 we display the relative performance of treated versus non-treated firms at different points in time before and after the establishment of an SEZs. Panel (a) presents event-study diagrams for the logs of employment, sales and labor productivity among the directly treated firms. Panel (b) shows how the same measure evolve among indirectly treated firms. In both cases, the control group is comprised of firms operating in communes where SEZ projects were canceled.

Panel (a) of Figure 2 suggests that the positive effect on employment is relatively fragile and materializes only a few year after the treatment. Similar observations apply to firms' sales and value-added per worker, where the positive ATT seems to result primarily from the increased probability of observing a positive effect rather than a clear response to the event. Moreover, a pre-existing differential trend cannot be fully ruled out for employment and sales. This is different for the indirect effects reported in Panel (b). None of the three outcome variables indicates a differential pre-trend, while the estimated effects become evident almost immediately after the treatment. Although the reported ATTs for indirect effects are quantitatively smaller and less precisely estimated than the direct effects, they appear more reliable in terms of a causal response to nearby SEZs.

Figure 2: Event studies for SEZs and firm performance



Note: Figures display event study coefficients obtained from estimating Equation (1), following Wooldridge (2021). The timing of an event corresponds to the year in which an SEZ is established. The control group consists of firms located in communes with canceled SEZ projects. The coefficient obtained for the year prior to the event is normalized to zero. The vertical lines represent 95% confidence intervals.

5.2 Robustness checks

Alternative specifications. Next to our baseline analyses and event-study diagrams, we consider three alternative specifications that include (i) additional province-year fixed effects; (ii) no control variables; or (iii) separately included province and year fixed effects. The results are displayed in Table A.5 and can be compared to Panel A of Table 2. Overall, we notice that controlling for province-level trends and dynamics leads to a slight downward correction of the estimated direct effects of SEZs, while indirect effects remain stable. As expected, the coefficients are also less precisely estimated, which results in a loss of statistical significance for the increased labor productivity among directly treated firms. In Figure A.1 we also reproduce the event-study diagrams for the direct treatments, which confirms these results.

Propensity Score Matching. As an additional robustness check, we implement a propensity score matching (PSM) approach to account for the significant differences between firms operating inside and outside of SEZs (see Section 3 and Table A.3). Doing so, we attempt to compare treated firms i to similar firms C_i only, which we identify by estimating a selection equation based on firm characteristics X_{it}. Specifically, we estimate whether firm i is located in an SEZ in year t by employing a year-by-year probit model, where the treatment indicator $D_i = 1$ if firm i is located in a SEZ area at any point in time, and $D_i = 0$ otherwise. The vector X_{it} includes pre-treatment characteristics such as two-digit sector fixed effects, firm ownership type (foreign, private, or state-owned), and firm performance indicators (mean sales and mean number of employees) measured two years prior to the SEZ entry. After this matching procedure, we re-estimate Equation (1) to compare the performance of directly and indirectly treated with the respectively matched similar firms in the control group.[17]

Table 3 Panel A shows that the results for our PSM based estimation are remarkably similar to our baseline findings. Firms inside of SEZs report almost the same increases in employment and labor productivity, while only their relative growth in sales is corrected downwards (from 55 to 22 percent). The same applies for the indirect effects, where the relative performance in terms of employment and labor-productivity are comparable to the baseline, while that for sales is less pronounced but still significantly higher.

[17]Note that our baseline strategy entailed a comparison with firms in communes with canceled SEZ projects. When using PSM, this is no longer needed, as the matching is based on firm rather than regional characteristics, which we can subsequently take into account with commune- or province-level controls.

Table 3: Robustness checks - Average Treatment Effects of the Treated

	(1)	(2)	(3)	(4)	(5)	(6)
Dep var.:	Number of employees		Sales		Labor productivity	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Panel A. Propensity score matching						
SEZ	0.186***	0.091***	0.216***	0.154***	0.230**	0.066**
	(0.062)	(0.017)	(0.079)	(0.030)	(0.056)	(0.033)
Obs	25,375	287,011	25,278	286,890	21,912	250,532
Panel B. Removing Ho Chi Minh City and Ha Noi						
SEZ	0.147*	0.006	0.661***	0.250***	0.381***	0.061
	(0.080)	(0.018)	(0.153)	(0.034)	(0.114)	(0.040)
Obs	12,177	104,314	12,171	104,250	9,879	83,753

Note: Direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. In Panel A the control group is matched firms in non-neighboring communes, while in Panel B it is firms located in canceled SEZ communes. We remove two star cities from the sample of Panel B. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Exclusion of major cities. In Panel B of Table 3 we return to our baseline specification, but this time exclude Vietnam's two largest metropolitan areas, Ho Chi Minh City in the South and Ha Noi in the North. Besides economic activity being heavily concentrated around these cities they are also directly administered by the central government, which makes them also politically distinct. We therefore analyze to what extent our results are driven by the "Star-cities" and to what extent they hold also in other parts of the country. Our results suggest a mixed picture. The estimated direct effects survive, suggesting that the benefits of operating inside of an SEZ are comparable in Ho Chi Minh City, Ha Noi and other parts of the country. However, the indirect effects appear to be weaker, except for sales and especially so for firm-level employment. One explanation could be different labor market characteristics in large metropolitan areas and smaller cities. An alternative explanation could be that local employment effects outside these "Star-cities" materialize primarily through firm entry rather than through incumbent firms.[18]

[18] Lu et al. (2019) document for China that a substantial share of the industrial dynamics following the establishment of SEZs materializes via firms relocating into these areas.

5.3 Heterogeneous Effects

Until now, we have provided robust results concerning the overall effect of the SEZ program on all types of firms. In this section, we test whether the effect of SEZs on firm performance depend on i) the type of SEZ; ii) firm size; ii) firms' ownership type; or iv) industry type.

By type of SEZ All types of SEZs offer a favorable tax policy for firms operating there. However, they differ along several dimensions as explained in Sections 2 and 3. Table 4 performs the analysis using each type of SEZ in a separate subsample [19].

[19]The ETWFE methodology by Wooldridge (2023) used in our staggered DiD approach does not easily accommodate interaction variables for heterogeneous effects analysis. Including interaction terms between the treatment indicator and SEZ type (e.g., industrial zones, economic zones) would require estimating a large number of additional event-time-specific coefficients for each SEZ type, significantly increasing the model's complexity and computational burden. This can lead to issues such as overfitting, especially given the relatively small sample sizes for some SEZ types (e.g., border zones with 21,530 direct observations). Moreover, the interpretation of interaction terms in a staggered DiD setting with event-time interactions is less straightforward, as the effects would need to be aggregated across cohorts and time periods, potentially obscuring the heterogeneity across SEZ types. By contrast, the subsample approach allows us to estimate separate treatment effects for each SEZ type while maintaining the ETWFE framework's simplicity and transparency. This method ensures that the parallel trends assumption and dynamic effects can be assessed independently for each SEZ type, providing clearer and more interpretable results for understanding heterogeneity in SEZ impacts.

Table 4: Heterogeneity Results: By Type of SEZ

Dep var:	**Number of employees**		**Sales**		**Labor productivity**	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Industrial zones						
SEZs	0.114*	0.083***	0.369***	0.383***	0.235***	0.147***
	(0.058)	(0.020)	(0.087)	(0.039)	(0.074)	(0.035)
Obs	24,862	55,785	24,791	55,739	20,537	45,306
Panel B. Economic zones						
SEZs	0.215***	0.141***	0.107	0.297***	-0.003	-0.140**
	(0.036)	(0.029)	(0.098)	(0.062)	(0.096)	(0.066)
Obs	22,327	23,366	22,317	23,351	18,561	18,567
Panel C. Border zones						
SEZs	0.019	0.177***	0.097	0.352***	0.065	-0.265***
	(0.056)	(0.032)	(0.125)	(0.067)	(0.125)	(0.065)
Obs	21,530	25,532	21,498	25,519	17,590	20,074
Panel D. Provincial zones						
SEZs	0.135***	0.085***	0.351***	0.252***	0.006	0.060**
	(0.047)	(0.014)	(0.083)	(0.029)	(0.066)	(0.026)
Obs	23,710	99,698	23,678	99,620	19,803	82,056

Notes: The dependent variables in Columns (1)–(2), (3)–(4), and (5)–(6) are the number of employees, sales, and labor productivity (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The effects on employment vary considerably across SEZ types. The largest direct effect is observed in *economic zones* (0.215, significant at the 1% level), which exceeds the main result in table **??**, Panel A (0.183). This finding suggests that economic zones, which typically feature broader infrastructure and service provisions, attract firms that generate substantial employment opportunities. *Industrial zones* and *provincial zones* also exhibit positive direct effects on employment (0.114 and 0.135, respectively), though smaller in magnitude than economic zones. In contrast, the direct effect in *border zones* is close to zero (0.019) and statistically insignificant, reflecting the limited labor market and industrial base in border areas. Spillover effects on employment are significant across all SEZ types, with the largest

effect observed in *border zones* (0.177), followed by *economic zones* (0.141). These findings suggest that, despite weak direct effects, border zones stimulate local labor markets and supply chains, generating substantial spillovers. Spillover effects in *industrial zones* (0.083) and *provincial zones* (0.085) are smaller but remain significant, aligning closely with the spillover findings in table **??**, Panel A (0.071).

SEZs consistently demonstrate strong positive effects on firm sales across all types, though the magnitude varies. The largest direct effects are observed in *industrial zones* (0.369) and *economic zones* (0.297), both statistically significant at the 1% level. These findings are broadly consistent with the main results in table **??**, Panel A (0.553). *Provincial zones* also exhibit significant direct effects on sales (0.351), whereas *border zones* display smaller effects (0.097), suggesting that limited market access and infrastructure in border areas constrain sales growth for firms operating there. Spillover effects on sales are significant across all SEZ types, with the largest effects in *industrial zones* (0.383) and *border zones* (0.352).

The direct effects on labor productivity are positive and significant in *industrial zones* (0.235) and *provincial zones* (0.006), but insignificant or negative in *economic zones* (-0.003) and *border zones* (0.065). The positive effects in industrial zones likely reflect efficiency gains from sector-specific infrastructure and clustering. Conversely, the lack of significant productivity gains in economic and border zones may arise from these zones prioritizing broader development goals over efficiency improvements. Indirect effects on productivity vary significantly across SEZ types. Negative and significant effects are observed in *economic zones* (-0.140) and *border zones* (-0.265), potentially reflecting resource constraints or competitive pressures in SEZ communes. In contrast, *industrial zones* (0.147) and *provincial zones* (0.060) show positive and significant spillover effects, suggesting enhanced local firm productivity through knowledge spillovers and infrastructure access.

Industrial zones might benefit from sector-specific infrastructure, driving both direct and indirect effects on productivity and sales. In contrast, *economic zones* prioritize broader objectives, such as job creation, which may dilute productivity gains. *Border zones* face challenges such as limited market access, weaker infrastructure, and high transportation costs, which constrain direct benefits but stimulate local economic activity through spillovers.

By firm size and ownership We use the employment information to explore heterogeneous effects across firms of different size, differentiating between three groups: very small firms with < 10 employees; small and medium enterprises (SMEs) with 10-200 employees;

and large firms with > 200 employees. The VES data further allows us to differentiate between ownership types, i.e., state-owned enterprises (SOEs), private foreign-owned or private domestic firms, which we identify following the definitions of the General Statistics Office (GSO) of Vietnam.[20]

Firm size represents another critical dimension of heterogeneity, particularly in the context of Vietnam, where micro and small enterprises account for more than 90% of all firms. To examine the differential impacts of SEZs by firm size, we classify firms into four categories based on the official government standard[21]. Specifically, firms are categorized as follows: *very small firms* (fewer than 10 employees), *small firms and medium firms* (10 to 200 employees), and *large firms* (more than 200 employees). This classification allows us to explore how SEZs impact firms of varying sizes, given the substantial structural differences in resource availability, market reach, and growth potential across these categories.

[20] According to the GSO definitions, (i) state-owned firms include central, local, joint-stock firms with state capital, and collective firms; (ii) private domestic firms are private enterprises, collectives, private firms with small state capital shares, joint-stock firms without state capital, and joint-stock firms with state capital shares below 50%; and (iii) foreign firms are defined as firms with 100% foreign capital or joint ventures with a foreign firm.

[21] The classification is defined in Decree 80/2021/ND-CP. While the decree includes revenue as an additional criterion for defining firm size, this paper uses the number of employees at the end of the year as the sole measure.

Table 5: Heterogeneity Analysis - Firm Size

Dep var:	**Number of employees**		**Sales**		**Labor productivity**	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Very Small Firms						
SEZs	0.061	0.133***	-0.177	0.331***	-0.014	0.029
	(0.062)	(0.035)	(0.169)	(0.049)	(0.185)	(0.046)
Obs	13,099	81,253	13,092	81,219	10,928	65,269
Panel B. Small and Medium Firms						
SEZs	0.194**	0.010	0.585***	0.283***	0.218	0.145***
	(0.084)	(0.029)	(0.156)	(0.051)	(0.141)	(0.053)
Obs	8,210	61,892	8,207	61,863	6,651	50,258
Panel C. Large Firms						
SEZs	-0.149	0.026	0.822***	0.489***	0.715	0.290**
	(0.277)	(0.111)	(0.243)	(0.161)	(0.462)	(0.129)
Obs	653	3,655	648	3,599	493	2,850

Notes: The dependent variables in Columns (1)–(2), (3)–(4), and (5)–(6) are the number of employees, sales, and labor productivity (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 presents the estimated effects of SEZ establishment on firm performance by firm size. The outcomes include the number of employees, sales, and labor productivity, analyzed as direct effects (for firms operating within SEZs) and indirect effects (spillovers for firms located in SEZ communes but outside SEZ areas).

The direct effects on employment are significant for small and medium firms (0.194, significant at the 5% level), suggesting that SEZs are particularly effective in creating jobs for firms in this size category, which are likely to have the capacity to expand operations but may lack the resources to do so without SEZ support. For very small firms, the direct effect is positive but statistically insignificant (0.061), indicating that SEZs may not directly drive employment growth for micro-enterprises due to resource constraints or limited scalability. For large firms, the direct effect is negative and statistically insignificant (-0.149), suggesting that larger firms are less reliant on SEZ incentives for workforce expansion. Spillover effects on employment are strongest for very small firms (0.133, significant at the 1% level). Indirect

effects for small and medium firms and large firms are smaller and statistically insignificant (0.010 and 0.026, respectively).

The effects on sales are highly significant across all firm sizes, with the largest magnitudes observed for large firms (0.822, significant at the 1% level) and small and medium firms (0.585, significant at the 1% level). These findings suggest that larger firms benefit substantially from SEZ infrastructure and market access, while small and medium firms also experience strong revenue growth by scaling operations. For very small firms, the direct effect is negative and statistically insignificant (-0.177), indicating that very small firms may struggle to fully capitalize on SEZ opportunities. Spillover effects on sales are positive and significant for all firm sizes. The largest indirect effects are observed for very small firms (0.331, significant at the 1% level). Spillover effects for small and medium firms (0.283) and large firms (0.489) are also significant, reflecting the broader economic activity stimulated by SEZs.

Spillover effects on productivity are significant for small and medium firms (0.145, significant at the 1% level) and large firms (0.290, significant at the 5% level). For very small firms, the indirect effect is positive but statistically insignificant (0.029), suggesting weaker spillover effects for very small firms.

Very small firms may lack the resources and workforce to fully exploit SEZ benefits, resulting in weaker direct effects on employment and productivity. However, they benefit significantly from indirect effects through supply chain linkages and local demand. small and medium firms and large firms are better positioned to scale operations, allowing them to realize substantial direct benefits from SEZs.

The reasoning behind the establishment of SEZs is the expectastion that they would attract foreign firms and provide positive agglomeration effect to neighboring domestic companies. In what follows we test whether the benefits of SEZs depend on they type of ownership.

Table 6: Heterogeneity analysis - Ownership type

Dep var:	**Number of employees**		**Sales**		**Labor productivity**	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Foreign Firms						
SEZs	0.663***	-0.072	1.611***	0.442*	0.476**	-0.198
	(0.124)	(0.101)	(0.230)	(0.252)	(0.185)	(0.232)
Obs	971	2,344	965	2,320	719	1,716
Panel B. Private Domestic Firms						
SEZs	0.161**	0.086***	0.397***	0.299***	0.130	0.079*
	(0.079)	(0.026)	(0.123)	(0.035)	(0.127)	(0.043)
Obs	20,411	135,882	20,402	135,798	16,893	109,431
Panel C. State Domestic Firms						
SEZs	0.078	-0.037	2.179**	0.168	0.227	0.150
	(0.279)	(0.076)	(1.018)	(0.156)	(0.344)	(0.129)
Obs	569	8,267	569	8,256	449	7,017

Notes: The dependent variables in Columns (1)–(2), (3)–(4), and (5)–(6) are the number of employees, sales, and labor productivity (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6 presents the effects of SEZ establishment on firm performance across three types of firms: foreign firms, private domestic firms, and state domestic firms. For the direct effect of SEZs on employment, the effect is largest for foreign firms (0.663, significant at the 1% level). This effect is much larger than the aggregate results in Table **??**, Panel A (0.183), indicating that foreign firms benefit significantly from SEZ incentives, likely due to their capital-intensive nature and ability to scale operations quickly. For private domestic firms, the direct effect is smaller but positive and significant (0.161, significant at the 5% level), reflecting their capacity to expand but facing more constraints compared to foreign firms. For state domestic firms, the direct effect is positive but statistically insignificant (0.078), suggesting that state-owned enterprises are less responsive to SEZ incentives for workforce expansion. Spillover effects on employment are significant only for private domestic firms (0.086, significant at the 1% level). This finding indicates that private domestic firms in SEZ communes benefit indirectly through supply chain linkages or subcontracting opportunities.

For foreign firms and state domestic firms, the indirect effects are negative and insignificant (-0.072 and -0.037, respectively), suggesting minimal spillover benefits for these firm types.

SEZs have the strongest direct effect on sales for state domestic firms (2.179, significant at the 5% level), much larger than the results in Table **??**, Panel A (0.553). This result suggests that state-owned enterprises may leverage SEZ policies to significantly increase output, potentially benefiting from preferential access to SEZ resources. For foreign firms, the direct effect on sales is also substantial (1.611, significant at the 1% level), highlighting their ability to utilize SEZ infrastructure and tax benefits to achieve significant revenue growth. For private domestic firms, the direct effect is smaller but still significant (0.397, significant at the 1% level), reflecting more limited capacity to expand compared to foreign or state firms. Spillover effects on sales are positive and significant for both private domestic firms (0.299, significant at the 1% level) and foreign firms (0.442, significant at the 10% level), indicating that SEZ communes stimulate broader economic activity, benefiting these firms through improved market linkages. For state domestic firms, the indirect effect is positive but insignificant (0.168), reflecting weaker spillovers, possibly due to their limited integration with local supply chains. SEZs significantly improve labor productivity for foreign firms (0.476 for direct effects, significant at the 5% level. Spillover effects on productivity are significant only for private domestic firms (0.079, significant at the 10% level).

Foreign firms benefit from access to international markets, advanced technology, and capital, allowing them to capitalize on SEZ incentives. State firms may gain preferential access to SEZ resources but face structural inefficiencies. Private domestic firms, while resource-constrained, benefit significantly from SEZ spillovers. They show stronger spillover effects due to their reliance on local supply chains. Foreign firms prioritize efficiency and profitability, leading to substantial productivity gains. Private domestic firms balance growth and efficiency, while state firms focus on output expansion, driving sales growth without proportional employment or productivity improvements.

By Pavitt industry The Pavitt taxonomy (Bogliacino and Pianta, 2010) groups firms based on their source of technological capability and innovation:

- **Supplier-dominated firms**: Firms in traditional sectors that rely on external suppliers for innovation.
- **Scale-intensive firms**: Firms benefiting from economies of scale, often in manufac-

turing and large-scale production.

- **Science-based firms**: Firms with strong in-house R&D capabilities, such as technology or pharmaceutical firms.
- **Specialized suppliers**: Firms that produce specialized inputs or machinery for other industries.

This taxonomy allows us to evaluate whether SEZ policies disproportionately benefit firms in specific industries.

Table 7 reports the results of SEZ effects on firm outcomes—number of employees, sales, and labor productivity—across industries classified under Pavitt's taxonomy. Science-based firms exhibit the strongest direct effects across all outcomes. The estimated coefficient for sales is 1.143 (significant at the 1% level), substantially larger than the baseline results for SEZ firms in table **??**, where the direct effect on sales was 0.553. Labor productivity also sees considerable gains (0.915, significant at the 1% level), reflecting the ability of SEZ policies to support R&D-driven activities. The direct effect on employment (0.370) further underscores the capacity of SEZs to facilitate workforce expansion in science-based industries. Indirect effects for science-based firms, however, are limited, with labor productivity (0.128) and employment (0.126) showing insignificant spillovers. This suggests that the benefits of SEZs for science-based firms are largely confined to firms operating within SEZs, with minimal knowledge diffusion to firms in SEZ communes.

Supplier-dominated firms benefit significantly from both direct and indirect effects. Direct effects include a positive and significant impact on employment (0.105, significant at the 1% level), sales (0.278, significant at the 1% level), and labor productivity (0.143, significant at the 5% level). Spillover effects are particularly notable, with significant positive coefficients for sales (0.361) and labor productivity (0.111), reflecting strong linkages between supplier-dominated firms in SEZ areas and those located in SEZ communes.

Specialized suppliers exhibit limited benefits from SEZ policies. This may stem from their focus on niche markets and high reliance on specific value chains that are not fully integrated with SEZ or commune-level activities. Scale-intensive firms exhibit weaker effects compared to other industry categories. Direct effects on sales (0.306, significant at the 5% level), while labor productivity (0.125) remains insignificant. Spillover effects are negligible, with labor productivity even showing a negative but insignificant coefficient (-0.060).

The strong spillovers for supplier-dominated firms reflect their reliance on local suppliers and value chains, which amplify the indirect effects of SEZs. Scale-intensive firms, which are highly capital-intensive, may not benefit as much from SEZ policies tailored to labor-intensive or R&D-focused industries, while specialized suppliers, which often operate in niche markets, may face limitations in leveraging SEZ resources or integrating with local value chains.

Table 7: Heterogeneity analysis - By Pavitt industry group

Dep var:	**Number of employees**		**Sales**		**Labor productivity**	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Supplier-dominated firms						
SEZ	0.105***	0.081***	0.278***	0.361***	0.143**	0.111***
	(0.037)	(0.013)	(0.069)	(0.029)	(0.062)	(0.027)
Obs	24,036	94,096	23,988	94,031	19,200	75,765
Panel B. Scale-intensive firms						
SEZ	0.110	0.038	0.306**	0.179**	0.125	-0.060
	(0.076)	(0.040)	(0.135)	(0.077)	(0.112)	(0.065)
Obs	4,454	10,457	4,422	10,445	3,619	8,605
Panel C. Science-based firms						
SEZ	0.370*	0.126	1.143***	0.158	0.915***	0.128
	(0.220)	(0.155)	(0.130)	(0.242)	(0.273)	(0.233)
Obs	1,145	2,242	1,115	2,236	891	1,859
Panel D. Specialized suppliers firms						
SEZ	0.156	0.110**	0.509*	0.180	0.083	0.015
	(0.119)	(0.052)	(0.243)	(0.111)	(0.217)	(0.097)
Obs	2,644	8,355	2,641	8,338	2,069	6,663

Notes: The dependent variables in Columns (1)–(2), (3)–(4), and (5)–(6) are the number of employees, sales, and labor productivity (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

6 Mechanisms

In this section, we investigate potential mechanisms driving the observed effects of SEZ establishment on firm-level outcomes. Specifically, we explore three key pathways: input-output

linkages, access to credit, and the technology gap (or absorptive capacity). First, we examine whether firms in SEZs stimulate demand for inputs from local suppliers (within the SEZ and the commune). Using the Vietnam Input-Output (IO) table, we construct sector-level input coefficients to capture the importance of specific sectors in the production networks of SEZ firms. We hypothesize that SEZ firms create backward linkages by sourcing inputs from firms within SEZ communes, which in turn boosts the performance of local non-SEZ firms through increased sales. Second, we assess the impact of enhanced access to credit facilitated by SEZ policies. SEZ firms often benefit from favorable financing conditions, such as lower interest rates or government funds. We test this hypothesis by examining whether SEZ firms have higher probability of accessing credit. Third, we explore the role of the technology gap (or absorptive capacity) in determining the spillover effects of SEZs. Foreign SEZ firms often introduce advanced technologies and management practices. However, the ability of local firms to learn from them depends on the technology distance between domestic and foreign firms. We test whether the level of income of the countries from which FDI originates (proxying whether it uses frontier or traditional technologies) is related to Vietnamese firms' ability to learn from them.

6.1 Input-Output Linkages

Finally, for the identification of specific economic mechanisms, we combine information on firms' main sector of activity, reported as a 5-digit VSIC code and relatable to the International Standard Industry Classification (ISIC), with the Vietnamese Input-Output Table for 2007. Doing so, we are able to test whether supply chain linkages between SEZs and local firms reveal any significantly different impact on firm performance. We explore further mechanisms by evaluating how SEZs impact firms' probability of obtaining loans, which we derive from VES information on firms' financial activities. To capture the role of technological distance between foreign-invested SEZs and local firms, we consider between the main origin of these foreign investments, reported in the VES data, and whether they stemming from advanced or emerging economies.

To understand why treated firms grow in employment and sales, we investigate the role of the input-output linkage channel. To quantify and isolate the impact of SEZs on input demand, we develop a measure that incorporates both sector-specific pre-trends and annual fluctuations. This measure is designed to capture how SEZs influence the demand for inputs

within specific industries, accounting for the structural relationships in the economy and the temporal dynamics of sectoral activity.

The construction of this measure relies on the Vietnam Input-Output (IO) table from 2007 (General Statistics Office of Vietnam, 2007), which provides the input coefficients ($w^U_{ss'}$) needed to evaluate the significance of one sector s in the production processes of another one s'. These input coefficients reflect the technological importance of specific sectors in the production structure, serving as fixed weights derived from the IO framework. The assumption is that these coefficients remain stable over time, reflecting the underlying production technology,[22] serving as fixed weights derived from the IO framework. The assumption is that these coefficients remain stable over time, reflecting the underlying production technology in the economy.

In addition, the measure incorporates sector weights (w^m_{st}), which vary over time and capture the dominance of specific industries in SEZs relative to the economy as a whole. Sector weights are calculated as the share of sales by firms operating within SEZs in industry s at time t divided by the total sales of industry s at the same time. This dynamic weighting approach ensures that the measure adapts to the temporal changes in industrial activity and SEZ participation across industries.

Formally, the SEZ-induced input demand measure for sector s at time t is defined as:

$$SEZ_{st} = \sum_{s}^{'} w^U_{ss'} \times w^m_{st},$$

where $w^U_{ss'}$ denotes the fixed input coefficient capturing the interdependence between sectors s and s', and w^m_{st} represents the time-varying sector weight of sector s in this SEZ. The inclusion of w^m_{st} ensures that the measure reflects the economic weight of SEZ activities at any given point in time.

By combining these elements, the SEZ_{st} measure estimates the influence of SEZs on sectoral input demand over time. It reflects both the structural dependencies captured by the input coefficients and the dynamic changes in SEZ-related activity captured by the sector

[22]The term "technological importance" refers to the extent to which sector s is a critical input for the production process of sector s', as determined by the production technology of sector s'. A higher coefficient ($w^U_{ss'}$) indicates that sector s supplies a larger share of inputs per unit of output in sector s', reflecting a stronger technological dependency. For example, if sector s is the steel industry and sector s' is automobile manufacturing, a high $w^U_{ss'}$ would mean that steel is a vital input, dictated by the technological requirements of automobile production.

weights. This approach enables us to disentangle the role of SEZs in shaping production linkages and input demand while controlling for sectoral-specific pre-trends and broader economic fluctuations.

In table 8, we separate the analysis in two samples: treated firms in sectors with high values of SEZ_{st} (above the 90th percentile, high input demand) and firms in sectors with low values (below the 10th percentile, low input demand). In the case of firms with high input demand, the direct effects of SEZs on both employment (0.408, significant at the 5% level) and sales (1.043, significant at the 5% level) are substantial. These findings suggest that SEZs enable high-input-demand firms to expand their operations by leveraging enhanced access to critical inputs, specialized suppliers, and infrastructure provided by SEZs. The indirect effects on employment (0.361, significant at the 1% level) and sales (0.543, significant at the 1% level) further demonstrate that SEZs generate significant economic spillovers to non-SEZ firms within the same commune. These spillovers are likely driven by increased local demand for intermediate goods and services, which stimulates production and employment among firms outside the SEZ boundaries. The strong performance of high-input-demand firms supports the hypothesis that SEZs create backward linkages by fostering robust local supply chains. Firms within SEZs may source inputs from local non-SEZ firms, incentivizing these firms to scale their production and workforce capacity in response to higher demand.

For firms with low input demand, the direct effects of SEZs on employment (0.108) and sales (0.115) are positive but statistically insignificant, indicating limited direct benefits for these firms. However, the indirect effects remain significant, particularly for sales (0.537, significant at the 5% level). These findings suggest that low-input-demand firms located in SEZ communes benefit indirectly from the economic dynamism generated by SEZs. Such spillover effects on sales may arise from participation in downstream activities or from increased local consumer demand stimulated by the higher incomes of SEZ employees.

Table 8: Mechanism - Input-Output Linkages

Dep var:	**Number of employees**		**Sales**	
Effect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)
Panel A. High input demand				
SEZ	0.408**	0.361***	1.043**	0.543***
	(0.194)	(0.088)	(0.404)	(0.149)
Obs	1,884	3,336	1,859	3,330
Panel B. Low input demand				
SEZ	0.108	0.309**	0.115	0.537**
	(0.131)	(0.134)	(0.269)	(0.226)
Obs	922	2,080	921	2,072

Notes: The dependent variables in Columns (1)–(2), (3)–(4) are the number of employees and sales (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

6.2 Access to credit

The results in table 9 highlight the impact of SEZ participation on the likelihood of firms obtaining credit. The findings reveal a statistically significant and positive direct effect of SEZ participation (0.072, significant at the 1% level) on the probability of securing credit, while the indirect effect is small and statistically insignificant (0.004). These results underscore that the benefits of SEZs in facilitating credit access are largely concentrated among firms operating within SEZ boundaries, as expected. Firms outside the SEZ boundaries are typically excluded from such programs, which limits their ability to benefit indirectly from these policies. Second, The reason might not be solely driven by the access to specific policies and funds (subsidized credit, loan guarantees or public loans); many financial institutions co-locate in SEZs to serve the firms there, reducing transaction costs and improving firms' ability to secure financing. Firms in the same commune but outside SEZ boundaries do not have the same level of access, as financial institutions may prioritize firms located directly within SEZs.

Table 9: Mechanism - Probability of Getting Credit

Dep var:	**Probability of getting credit**	
Effect	Direct	Indirect
	(1)	(2)
SEZ	0.072***	0.004
	(0.013)	(0.005)
Obs	34,854	127,337

Notes: The dependent variable in Columns (1)–(2) is the probability of getting credit. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

6.3 Technology gap

Absorptive capacity refers to a firm's proficiency in identifying, assimilating, and utilizing new information for commercial purposes (Cohen and Levinthal, 1990). Cohen and Levinthal suggest that firms enhance their absorptive capacity by participating in activities that require related prior knowledge. Kokko (1994), using cross-sectional industry-level data from Mexico, tested the idea that FDI spillovers on domestic firms depend on the technological distance between foreign multinationals and domestic firms. The hypothesis that the degree of FDI spillover hinges on the absorptive capacity of domestic firms has been further explored in the literature. For example, Blalock and Gertler (2009), using a panel dataset of Indonesian manufacturing firms for the 1988-1996 period, find that firms with more R&D investment benefit more from the presence of foreign multinationals. Our evidence shows that low absorptive capacity may hinder firms'ability to benefit from SEZs.

To explore the role of the technology gap in promoting learning within SEZs, we classify SEZs based on the prevalence of firms receiving Foreign Direct Investment (FDI) from developed or developing countries. This classification provides insights into the extent of technological transfer and its implications for local economic development.

The methodology comprises three main steps.

First, at the firm level, firms are categorized based on the origin of their FDI, as reported in the firm-level survey. The VES includes a section on "Making charter capital contribution divided by country and territory," which records the country of origin of FDI contributions for

firms with foreign direct investment capital. For each firm, the survey reports the contributing charter capital (in thousands of USD) and the accumulated charter capital, along with the corresponding country of origin for each contribution. Using this information, we identify the primary country of origin for each firm's FDI by selecting the country with the largest share of charter capital contribution. We then classify countries into developed or developing categories based on the United Nations classification of economies (United Nations, 2020).[23] Firms receiving FDI primarily from developed countries (e.g., the United States, Japan, or Germany) are coded as FDI source = 1, while those receiving FDI primarily from developing countries (e.g., China, India, or Thailand) are coded as FDI source = 0. This classification differentiates firms based on their potential access to advanced technologies and management practices associated with FDI from developed economies.

Second, at the commune level, aggregation is performed for each commune that hosts a SEZ. For each of these communes, we calculate the share of firms receiving FDI from developed countries, defined as the number of firms receiving FDI from developed countries divided by the total number of firms receiving FDI in the commune. Subsequently, the median share of such firms across all SEZ communes is determined. This median serves as a threshold for identifying communes with relatively higher or lower exposure to FDI from developed countries.

Finally, communes are classified based on the median threshold of the share of FDI from developed countries. Communes where the share of firms receiving FDI from developed countries exceeds the median are classified as receiving *FDI from developed countries*. These communes are hypothesized to have greater exposure to advanced technologies and advanced managerial practices. In contrast, communes where the share of firms receiving FDI from developed countries is equal to or below the median are classified as *FDI from developing countries*. These communes are presumed to rely more heavily on technological inputs and practices from developing countries, which may be less advanced.

[23]The United Nations classification categorizes economies into developed, developing, and transition economies based on criteria such as per capita income, human development index, and economic structure. For this study, we group transition economies with developing economies, as their technological capabilities are generally closer to those of developing countries.

Table 10: Mechanism - Origins of FDI

Dep var:	**Labor productivity**	
Effect	Direct	Indirect
Panel A. FDI from developed countries		
SEZ	-0.077	0.043
	(0.196)	(0.051)
Obs	16,338	30,455
Panel B. FDI from developing countries		
SEZ	0.544***	0.201***
	(0.184)	(0.029)
Obs	14,071	77,092

Notes: The dependent variable in Columns (1)–(2) is labor productivity (in logs). The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. The control group is firms located in canceled SEZ communes. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10 reports the role of the origin of FDI in shaping the effects of SEZs on labor productivity. The results in Panel A suggest that FDI from developed countries has no statistically significant impact on labor productivity for firms operating directly within SEZs (-0.077 or indirectly in the surrounding communes (0.043. This finding may reflect a mismatch between the advanced technologies introduced by firms from developed countries and the absorptive capacity of local firms, particularly those in SEZs. The large technology gap between firms from developed countries and local firms might limit the potential for effective knowledge transfer and spillovers, thereby diminishing the benefits of such FDI in improving labor productivity.

In contrast, Panel B shows that FDI from developing countries significantly enhances labor productivity both directly within SEZs (0.544, significant at the 1% level) and indirectly in neighboring communes (0.201, significant at the 1% level). This result suggests that the smaller technology gap between firms from developing countries and local firms facilitates more effective technology transfer and adoption. Firms from developing countries often use technologies and production methods that are closer to the capabilities of local firms, allowing for easier assimilation and adaptation. This dynamic likely drives the observed productivity gains.

The difference between the effects of FDI from developed and developing countries highlights the importance of absorptive capacity in determining the productivity impacts of foreign investment, and SEZs. While FDI from developed countries introduces advanced technologies, the lack of complementary local capabilities may hinder the realization of productivity benefits. On the other hand, FDI from developing countries appears to provide technologies that are more accessible to local firms, enabling a smoother transfer of knowledge and skills.

7 Conclusion

This paper provides empirical evidence of the impact of SEZs on firm performance in Vietnam, employing a unique approach that uses canceled SEZ communes as a control group to address endogeneity concerns. Our findings indicate that the establishment of SEZs significantly improves firm outcomes. Specifically, firms located within SEZs experience notable direct effects, including an 18.3% increase in employment, a 55.3% rise in sales, and a 25.9% improvement in labor productivity. In addition, indirect spillover effects are observed within communes hosting SEZs, with non-SEZ firms benefiting from increased labor productivity, sales, and employment.

Our heterogeneity analysis reveals that the magnitude of these effects varies across firm characteristics and SEZ types. Foreign firms, large firms, science-based firms, and supplier-dominated firms exhibit the most substantial gains, while industrial SEZs drive the majority of the observed effects. Our analysis also sheds light on the mechanisms driving these effects. Enhanced access to credit emerges as a significant factor explaining the stronger direct effects within SEZs compared to spillovers outside SEZs. Furthermore, input-output linkages play a role in driving employment and sales growth, particularly through indirect effects on non-SEZ firms. However, the persistence of the technology gap for domestic firms underscores the need for targeted policies to facilitate knowledge spillovers and technological learning.

These findings carry important implications for the design and evaluation of SEZs as a policy tool for economic development. The success of SEZs in fostering firm performance hinges not only on tax incentives and infrastructure but also on fostering linkages between SEZ firms and local firms, promoting technology transfer, and addressing structural barriers to productivity growth for domestic firms. Moreover, the observed heterogeneity across firm types and SEZ configurations highlights the importance of tailoring SEZ policies to local eco-

nomic contexts and firm capabilities. As Vietnam and other developing countries continue to expand SEZs as a strategy for economic development, policymakers should prioritize mechanisms that enhance the absorptive capacity of domestic firms, reduce the technology gap, and maximize spillover effects to non-SEZ firms. Future research could explore the long-term effects, particularly in the context of shifting global trade patterns and the evolving role of SEZs in the global value chain. Whether SEZs can continue to drive economic growth in the face of these challenges remains a critical question requiring further investigation.

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A Appendix (for online publication)

Table A.1: Breakdown of newly established SEZs in Vietnam, by type and period

	1991-1993	1994-1996	1997-2002	2003-2011	2012-2019	All years
Number of national zones	5	14	56	262	85	422
Breakdown by type						
Industrial zones	3	14	43	237	77	374
High-tech zones	0	0	2	1	1	4
Export processing zones	2	0	0	1	0	3
Border economic zones	0	0	11	9	4	24
Coastal economic zones	0	0	0	14	3	17

Source: Authors' calculations based on data from the Ministry of Foreign Investment and Planning of Vietnam, 2022.

Table A.2: Summary statistics by type

Type	Nb of Obs	Nb of firms	avg. log Employees	avg. log Sales	avg. log Prod
Firm size					
Very small	32,684	7,342	1.48	7.33	4.13
Small and medium	76,252	9,348	3.58	9.87	4.55
Large	24,000	2,488	6.21	12.13	4.35
Ownership type					
Foreign	45,123	5,459	4.74	10.92	4.73
Private domestic	84,336	13,840	2.87	8.96	4.25
State domestic	3,477	547	3.96	9.51	4.28
SEZ type					
Industrial zones	71,458	9,804	4.14	10.43	4.61
Economic zones	11,504	1,990	2.42	8.13	4.07
Border zones	6,989	1,104	2.36	8.55	4.14
Provincial zones	28,559	4,035	3.73	9.93	4.34

Notes: This table presents summary statistics for the main sample, which includes direct treated firms and firms in canceled communes. Firm characteristics are categorized by size (very small, small and medium, large) and ownership type (foreign, private domestic, state domestic). "log Employees," "log Sales," and "log Prod" refer to the natural logarithm of the number of employees, total sales, and labor productivity, respectively.

Table A.3: Summary statistics for treated and control groups

Firm type	Nb of Obs	Nb of firms	avg. log Employees	avg. log Sales	avg. log Prod
Treated firms					
(1) SEZ firms	113,712	13,985	3.42	9.08	3.98
(2) SEZ commune	565,455	152,826	2.30	7.63	3.34
Control-group firms					
(3) Canceled commune	19,224	5,193	1.88	7.62	3.98
(4) Non-neighboring commune	3,607,664	771,370	2.00	7.55	3.95
T-tests					
(1) vs (3)			(***)	(***)	
(2) vs (3)			(***)		(***)
(1) vs (4)			(***)	(***)	
(2) vs (4)			(***)	(***)	(***)

Notes: The table presents summary statistics for treated and control firms. Treated firms include SEZ firms and SEZ communes, while control firms include firms in canceled SEZs and non-neighboring communes. The number of observations and number of firms represent the total sample size (before and after treatment), while average log values for employees, sales, productivity, and tax rates are calculated differently for each group. For treated firms, the averages represent pre-treatment values only. For control firms, the averages represent the entire period (pre- and post-treatment) due to the absence of treatment. The t-tests compare pre-treatment values for treated firms with the entire period values for control firms, testing for equality in baseline characteristics. The tax rate variable is calculated as the average tax paid divided by revenue for firms in each group.

Table A.4: Sample Construction

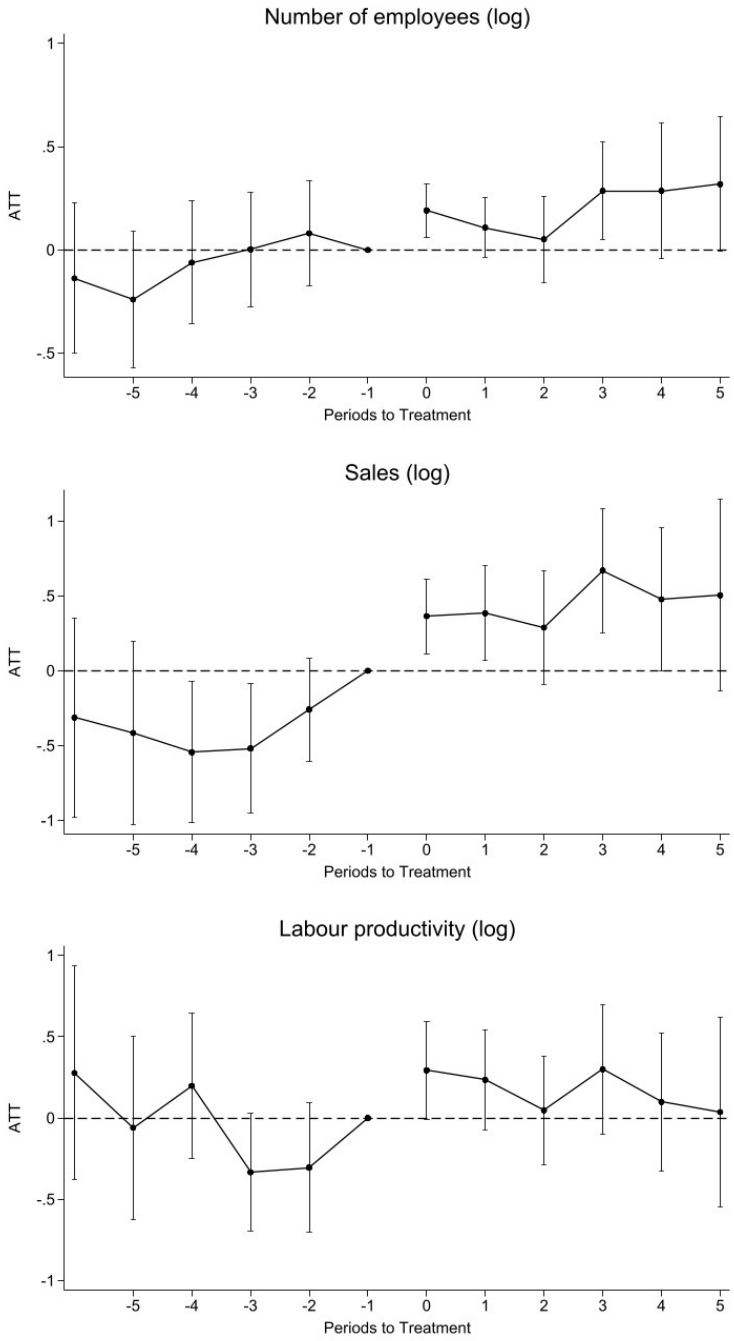
Panel	**Sample**	**Nb of Firms**	**Nb of Observations**
A	All Sample	172,004	285,762
	SEZ Firms	13,985	113,712
	Firms in SEZ Communes	152,826	565,455
	Non-SEZ Firms	5,193	19,224
B	All Sample	985,293	4,141,739
	SEZ Firms	13,985	113,712
	Firms in SEZ Communes	152,826	565,455
	Non-SEZ Firms	818,482	3,875,201

Table A.5: Baseline results - Average Treatment Effects on the Treated.

Dep var:	**Number of employees**		**Sales**		**Labor productivity**	
Effect	Direct	Indirect	Direct	Indirect	Direct	Indirect
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Control group is firms in the canceled SEZ communes; province*year fixed effect						
SEZ	0.226**	0.082***	0.515***	0.304***	0.180	0.085*
	(0.076)	(0.029)	(0.122)	(0.037)	(0.116)	(0.043)
Obs	21,962	146,800	21,947	146,681	18,072	118,377
Panel B. Control group is firms in the canceled SEZ communes: no covariates						
SEZ	0.559***	0.287***	1.060***	0.540***	0.161	0.092**
	(0.119)	(0.055)	(0.149)	(0.055)	(0.118)	(0.044)
Obs	21,962	146,800	21,947	146,681	18,072	118,377
Panel C. Control group is firms in the canceled SEZ communes: Province and Year						
SEZ	0.586***	0.287***	1.060***	0.540***	0.161	0.092**
	(0.120)	(0.055)	(0.149)	(0.055)	(0.118)	(0.044)
Obs	21,962	146,800	21,947	146,681	18,072	118,377

Notes: Panel A. Control group is firms in the canceled SEZ communes - covariate is firm size group. Fixed effects inlude firm fixed effect, year fixed effect, province*year fixed effect. Panel B. Control group is firms in the canceled SEZ communes - no covariate. The dependent variables in Columns (1)–(2), (3)–(4), and (5)–(6) are the number of employees, sales, and labor productivity (log), respectively. The direct effects capture the impact on firms located within SEZ areas, while the indirect effects capture the spillover impact on firms located in SEZ communes but outside the SEZ areas. We use ETWFE method by (Wooldridge, 2023). We report as SEZ coefficient the Average Treatment Effect of the Treated. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Figure A.1: Size and productivity indicators after entering into SEZ areas, direct effects



Note: Covariate is firm size group. Fixed effects include firm fixed effect, year fixed effect, province*year fixed effect.