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Keiichiro Suenaga

od03008@yahoo.co.jp

Meiji University - Surugadai Campus: Meiji Daigaku https://orcid.org/0000-0003-0644-9864

Minh Tam Bui

Srinakharinwirot University

Eksan Miyazaki

Meiji University - Surugadai Campus: Meiji Daigaku

Masami Saito

Meiji University - Surugadai Campus: Meiji Daigaku

Yusuke Shibata

Meiji University - Surugadai Campus: Meiji Daigaku

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Dynamic Changes in Location Choice and Fragmented Flying-Geese Theory: An Empirical Analysis Using Microdata from Thailand and Japan

Minh Tam Bui[1], Eksan Miyazaki[2], Masami Saito[2],
Yusuke Shibata[2], Keiichiro Suenaga[2], *

1 Faculty of Economics, Srinakharinwirot University, Bangkok, Thailand
2 School of Political Science and Economics, Meiji University, Tokyo, Japan
* Corresponding author: suenaga@meiji.ac.jp

Abstract

This paper analyzes the evolving determinants of Japanese multinational enterprises' (MNEs) location choices in Thailand from 2006 to 2020, drawing on a uniquely constructed panel dataset that integrates industry–province level aggregated from the Thai Industrial Census microdata with detailed firm-level information on Japanese affiliates in Thailand. Using this dual lens through the conditional logit models, we conduct a dynamic examination of how agglomeration forces, supply-chain linkages, and the roles of local versus foreign firms shift over time in determining the location choice of MNEs within Thailand—addressing key limitation of the existing literature, which has largely relied on static, single-period analyses. Our results indicate that intra-provincial supply and sales networks—particularly those formed by Japanese and other foreign firms—remain the strongest drivers of Japanese investment, while cross-provincial linkages carry considerably weaker influence. As Thailand's industrial capabilities deepen, both upstream and downstream spillover effects emerge, with local firms increasingly participating in production networks previously dominated by foreign enterprises. Over time, the influence of pre-existing foreign firms declines, whereas the prominence of domestic firms rises, reflecting the strengthening of local technological and organizational capabilities. Japanese entrants initially interact more closely with foreign than local firms, suggesting that downstream integration of Thai firms proceeds more gradually. Overall, our paper highlights a structural transition from cost-driven to network-driven investment dynamics and demonstrate how Thailand's increasing production complexity underpins the growing importance of localized, capability-based agglomeration.

Keywords: Dynamic shifts, New economic geography, Location choice, Fragmented flying geese, Thai manufacturing industry, Japanese foreign direct investment
JEL codes: O14; O19; O11; O12; F63; F21; F23; O53

1. Introduction

The determinants of multinational enterprises' (MNEs) location choices have traditionally been explained by frameworks emphasizing wage costs, infrastructure, and market size (Dunning, 1977, 1980; Brainard, 1997; Markusen, 1984). However, since the mid-1990s, research grounded in New Economic Geography (NEG) and agglomeration theory has increasingly highlighted the importance of supplier access, market potential, and industrial clustering (Fujita and Mori, 1996; Fujita et al., 1999; Hanson, 1996; Krugman, 1991; Krugman and Venables, 1995).

Thailand provides a particularly suitable context for examining these dynamics. Over the past two decades, its manufacturing sector has undergone substantial upgrading, supported by trade liberalization under ASEAN frameworks, the Japan–Thailand Economic Partnership Agreement (JTEPA), and more recent initiatives such as Thailand 4.0 and the Eastern Economic Corridor (EEC) (MoI, 2018). These policies have promoted high-technology and R&D-intensive industries (12 targeted industries under the S-curves), while large-scale investments in transport infrastructure—particularly ports and highways—have strengthened connectivity across industrial clusters. At the same time, significant increases in the minimum wage, including the nationwide increase to 300 Baht per day in 2013, have altered the relative attractiveness of provinces, making network-based advantages increasingly critical for foreign investors. Despite these changes, Japanese FDI has continued to grow, suggesting that agglomeration economies and localized supply networks now outweigh cost-based motives in shaping location decisions.

However, Thailand faces intensifying competition from neighboring ASEAN countries with lower labor costs, such as Vietnam, Cambodia, Laos, Myanmar and even Indonesia to align with Malaysia's mid-range. Those emerging economies have become attractive alternatives for manufacturing MNEs under "China +1" strategies, eroding Thailand's cost advantage. At the same time, it reinforces the need for non-wage determinants like supplier ecosystems, logistics infrastructure, and policy incentives to sustain FDI inflows. This regional wage dynamic underscores why Thailand's ability to leverage agglomeration and complexity-driven upgrading is critical for maintaining its position as a preferred investment destination. Despite rising wages, Japanese FDI has continued to grow, suggesting that agglomeration economies and localized supply networks have become significant factor besides cost-based motives in shaping location decisions (Bui et al, 2022).

Objectives and Key Research Questions

Against this backdrop, this study raises critical questions about the evolving determinants of location choice and the role of domestic networks in sustaining investment. Thailand's manufacturing sector has become increasingly sophisticated, yet Japanese FDI continues to grow despite rising wages and regional competition. To address these issues, this study focuses on Thailand's manufacturing industry—central to regional value chains (RVCs) and industrial upgrading—and examines dynamic changes in the factors influencing Japanese firms' entry. This

sector is also critical for technology transfer, productivity growth, and integration into global production networks, making it a strategic entry point for studying dynamic changes in FDI and agglomeration patterns. This study aims to clarify the evolving determinants of Japanese MNEs' location choices within Thailand's manufacturing sector, focusing on the interplay between wage levels, agglomeration economies, and localized supply-chain networks. Specifically, we seek to:

1. Examine whether the relative importance of wage costs versus network-based advantages has shifted over time.
2. Assess the role of local firms in shaping Japanese FDI location decisions and identify potential upstream and downstream spillover effects.
3. Investigate the spatial dimension of agglomeration by comparing intra-provincial and inter-provincial supplier and market access.

Additionally, we incorporate the influence of infrastructure (e.g., ports, highways) on location decisions and situate the above dynamics within Thailand's trajectory of product complexity upgrading and regional value chain integration, asking the following key research questions:

- How have location choice determinants by Japanese MNEs in Thailand shifted across three sub-periods (2006–2010, 2011–2015, and 2016–2020)?
- Do localized networks and agglomeration effects outweigh wage considerations in attracting Japanese FDI?
- What role do local firms play in strengthening supply and sales networks, and how does this influence foreign entry?
- How do infrastructure investments affect provincial attractiveness?

By employing a conditional logit model across three distinct periods (2006–2010, 2011–2015, and 2016–2020), we demonstrate how the relative importance of key factors—such as supplier access, market access, and minimum wage—has shifted over time. Our findings reveal that Japanese firms entering Thailand increasingly prioritize agglomeration effects and robust supply and sales networks over wage considerations, aligning with the evolving dynamics of global production networks (Krugman, 1991b; Baldwin & Okubo, 2014). Notably, while foreign firms initially dominated as critical nodes in supply chains, our results indicate a growing role for local firms, suggesting the emergence of upstream and downstream spillover effects (Javorcik, 2004) that strengthen domestic production networks.

Thereby, our paper makes several contributions to the literature. First, we challenge the conventional wisdom that low wages are the primary driver of foreign direct investment (FDI) in developing countries. Second, we provide a dynamic perspective on location choice determinants, addressing a critical gap in existing research that has largely relied on static analyses (Yeung & Coe, 2015). Third, by combining microdata from both the host country (Thailand) and the home country (Japan), matching at the industry-provincial level, our study offers a within-country, time-varying

analysis and provides new insights into the interplay between product complexity, agglomeration, and MNE location strategies. This paper introduces a unique dimension by situating these dynamics within Thailand's broader trajectory of product complexity upgrading. Furthermore, methodologically, we bring a modest novelty beyond Amiti and Javorcik (2008) by introducing a more granular decomposition: we separate supplier access into contributions from local firms and foreign-invested firms in Thailand. This distinction allows us to examine whether Japanese MNEs rely more on domestic networks or foreign affiliates when choosing locations—a question that has gained prominence in recent literature on FDI spillovers and local capability building (see VoxDev's recent synthesis on FDI for policy relevance). By doing so, we provide empirical evidence on the evolving role of local firms in regional value chains and address calls for research on how FDI interacts with domestic firm development and network formation. This is an important question recently highlighted in the literature review on FDI spillovers and local capability building with local firms featured in Vox's development paper (Garetto et al, 2025).

By employing a conditional logit model and decomposing supplier and market access into local and foreign firm contributions, we introduce a dynamic perspective that situates location choice within Thailand's trajectory of industrial upgrading and regional value chain integration. Furthermore, by incorporating indicators such as the Product Complexity Index (PCI), we contextualize these dynamics within structural changes in production sophistication, thereby extending the fragmented flying geese (FFG) framework to an empirical setting.

Finally, by incorporating indicators of product sophistication, such as the Product Complexity Index (PCI), we show that Thailand's manufacturing production structure has evolved toward higher-complexity goods, reflecting deeper specialization and integration into regional value chains. Therefore, we situate these dynamics within Thailand's trajectory of product complexity upgrading to contextualize why localized networks and industrial sophistication have become decisive factors for sustaining FDI.

The remainder of this paper is organized as follows. Section 2 reviews the theoretical framework and related empirical literature. Section 3 provides the context of trade and investment in Thailand and its relation with Japan. Section 4 describes the data sources, constructed variables, and empirical methodology. Section 5 presents the estimation results and discusses their implications. Section 6 concludes with policy recommendations and directions for future research.

Our study contributes to the ongoing debate in the FDI literature on whether MNEs generate meaningful linkages with local firms. Recent evidence from Garetto, Pavcnik, and Ramondo (2025) in VoxDevLit highlights both the potential for positive spillovers through shared-supplier linkages and the persistent limitations arising from technological incompatibilities and affiliates' reliance on imported inputs.

Research on spillovers has emphasised that by raising demand for inputs, MNEs can stimulate the emergence of more specialised suppliers, creating positive externalities for other final-good producers. Yet, these benefits are not automatic. Heavy reliance on imported inputs, coupled with

incompatibilities between foreign and domestic technologies, constrains the opportunities for local firms to integrate into MNE supply chains and capture productivity gains. This has led to rising concerns in the FDI literature about whether MNEs crowd out domestic firms or foster genuine upgrading.

These concerns are particularly salient for middle-income countries such as Thailand, where policymakers invest heavily in attracting MNEs with the expectation of domestic upgrading and technology transfer. By examining the Thai case, our analysis underscores the conditions under which MNEs can strengthen local supply chains and the policy levers needed to maximize developmental impacts. In doing so, we respond directly to the current debate and highlight important policy implications for countries navigating the challenges of FDI-driven growth.

2. Theoretical framework and related empirical literature

With the above-mentioned objectives and key questions, we ground our research around five strands of literature, including the theory of location choice of MNEs, the New Economic Geography, the Fragmented Flying Geese theory, the Production network and GVCs, and the theory of FDI motives around the cost-based vs. capability-based determinants. By weaving these theories together, our study situates Japanese FDI location choices within Thailand's trajectory of industrial upgrading and regional integration.

Early work on FDI framed multinational enterprises' (MNEs) location choices primarily as cost minimizing decisions, highlighting low wages as a central driver (e.g., Dunning, 1981; Bartik, 1985; Carlton, 1993). As economies upgrade, however, this narrow cost focus gives way to a richer set of ecosystem and capability considerations. Since the mid-1990s, research informed by New Economic Geography (NEG) has shifted attention toward agglomeration economies, including supplier access, market potential, and industrial clustering (Krugman, 1991; Fujita et al., 1999; Head et al., 1995). These studies argue that as economies upgrade, localized networks and capability accumulation increasingly outweigh wage considerations. Empirical evidence from Japanese FDI in the United States, China, and East Asia confirms this transition, showing that network-based advantages dominate cost factors in advanced stages of industrial development.

Recent evidence shows a dynamic hierarchy of determinants: wage advantages loom large in initial industrialization, but over time agglomeration economies and supplier access become more decisive for where firms invest (Amiti & Javorcik, 2008; Cheng & Stough, 2006; Tokunaga et al., 2017). Theoretical frameworks such as supplier and market access to investigate the implications of these supply and distribution networks can alternatively be articulated as backward and forward linkages, respectively, as delineated by Hirschman (1958). Amiti and Javorcik (2008) conducted a quantitative analysis of supplier and market access for both intra- and inter-provincial firms in China, aiming to evaluate the impact of provincial border barriers.

The Fragmented Flying Geese (FFG) framework extends the traditional flying-geese model by emphasizing production fragmentation and intra-regional agglomeration. Rather than complete industry relocation, FFG emphasizes specialization at the component and process level, enabling countries to integrate into regional value chains (RVCs) without replicating entire industries and the vertical structures (Ozawa, 2016; Baldwin & Okubo, 2014).

Since the 2000s, the evolution from Global Value Chains (GVCs) to Regional Value Chains (RVCs) has transformed the geography of production and investment. FDI plays a central role in embedding firms within these networks, facilitating technology transfer and industrial upgrading (World Bank, 2020). In Southeast Asia, regional integration initiatives and trade agreements have reinforced RVC formation, making network depth and connectivity critical determinants of location choice (Tokunaga & Ikegawa, 2019). This literature underscores the importance of supplier and market access, as well as the interplay between foreign affiliates and local firms, in shaping investment patterns.

Agglomeration and spatial dynamics constitute another critical dimension of FDI location choice. Evidence from Japanese FDI in the United States and China demonstrates strong clustering effects at subnational levels (Head et al., 1995; Belderbos & Carree, 2002). Initially, intra-provincial clustering dominates, reflecting firms' preference for proximity to specialized suppliers and logistics hubs. Over time, as infrastructure improves, cross-provincial linkages become increasingly relevant (Cheng, 2007; Jin & Tokunaga, 2006). These patterns suggest that the spatial scale of agglomeration evolves alongside infrastructural development, influencing regional planning and industrial policy. However, agglomeration effects operate at multiple spatial scales. Evidence from Japanese FDI in China and Thailand shows strong clustering at the provincial level, driven by proximity to specialized suppliers and logistics hubs (Head et al., 1995; Belderbos & Carree, 2002). This strand highlights the need to distinguish between intra-provincial and inter-provincial access and to assess their relative importance in shaping location decisions.

In addition, the role of local firms and production spillovers has also attracted considerable attention in the literature. Javorcik (2004) finds positive productivity effects for domestic suppliers linked to multinational enterprises (MNEs), highlighting the potential for knowledge transfer and process upgrading. Nevertheless, spillovers are not automatic. Firm-level studies in Asia reveal that foreign affiliates often rely heavily on imported inputs, limiting integration with local suppliers and constraining spillover effects (Boermans et al., 2011; Mukim & Nunnenkamp, 2012). This conditionality underscores the importance of supplier development programs and absorptive capacity in domestic firms for realizing productivity gains.

Empirically, while early research consistently emphasized labor cost minimization as a primary determinant of FDI's location choice. Studies such as Liu et al. (2010) and Nielsen et al. (2017) documented strong associations between low wages and inward FDI during initial industrialization phases. However, more recent evidence suggests that the relative importance of wage effects is not uniform across contexts. While wage considerations remain significant in some cases, agglomeration

economies and supplier access increasingly dominate location decisions (Head et al., 1995; Amiti & Javorcik, 2008).

Research on China and East Asia further confirms this shift, showing that network-based factors often outweigh cost advantages as regions upgrade industrial capabilities (Cheng & Stough, 2006; Tokunaga et al., 2017). These findings indicate a dynamic hierarchy of determinants, where cost advantages matter most early on, but ecosystem benefits gain prominence over time.

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At the same time, infrastructure and policy incentives further shape FDI dynamics. Empirical studies confirm that ports, highways, and trade agreements significantly influence location choices (Wattanadumrong et al., 2010; Carstensen & Toubal, 2004). In Southeast Asia, regional integration initiatives such as ASEAN and bilateral agreements like the Japan–Thailand Economic Partnership Agreement have altered sourcing strategies and reinforced regional agglomeration patterns (Tokunaga & Ikegawa, 2019). These findings highlight the interplay between hard infrastructure and institutional frameworks in configuring production networks. These theories, particularly, shed light on Thailand's trajectory of structural upgrading and deeper integration into RVCs.

The knowledge gaps

Although the literature provides valuable insights into FDI location determinants, several gaps remain. First, most studies adopt a static perspective, failing to capture how the relative importance of wage costs, agglomeration economies, and supplier networks evolves over time (Yeung & Coe, 2015). This lack of dynamic analysis limits our understanding of how firms reorganize production in

response to industrial upgrading, infrastructure improvements, and policy changes. Second, existing research is heavily concentrated on China and the United States, leaving middle-income eco ???

Despite extensive research on FDI and multinational enterprises' (MNEs) location choices, notable gaps persist in the empirical literature. First, most studies rely on country-level or occasionally provincial-level data, which obscures sectoral heterogeneity in determinants of location choice. Industry-level analyses remain scarce, even though sectoral differences in supplier and market access are critical for understanding agglomeration dynamics. As highlighted by Islam and Beloucif (2024), the majority of existing research employs aggregated data, and to the best of our knowledge, Amiti and Javorcik (2008) is among the few studies that operationalize supplier access indices at the sectoral level within a single country context.

Second, the literature lacks a dynamic perspective on how location choice determinants evolve over time. While recent work increasingly draws on Global Value Chain (GVC) frameworks, these models inherently emphasize structural linkages rather than temporal shifts, thereby overlooking dynamic changes in agglomeration and cost-based factors. Yeung and Coe (2015) explicitly note that GVC approaches fail to incorporate a dynamic dimension or how the relative importance of wage costs, agglomeration economies, and supplier networks evolves, resulting in analyses that remain largely static despite rapid industrial upgrading and policy reforms in emerging economies.

Third, intra-country analyses outside major economies are underrepresented. Among developing and emerging economies, China have attracted substantial scholarly attention; smaller middle-income countries such as Thailand—despite being a key manufacturing hub and a major recipient of Japanese FDI—are often subsumed into regional studies. This neglect limits our understanding of subnational dynamics, including how provincial networks, infrastructure, and wage policies interact to influence foreign entry. As Wattanadumrong et al. (2010) observe, evidence specific to Thailand remains particularly limited, underscoring the need for focused analyses that capture intra-provincial and inter-provincial variations in agglomeration and network effects.

Taken together, these limitations underscore a pressing need for research that combines industry-level granularity, dynamic analysis across multiple periods, and intra-country focus. Addressing these gaps is essential for capturing the evolving interplay between cost factors, agglomeration economies, and network-based advantages. Our study responds to this need by leveraging establishment-level microdata from the Thai Industrial Census and Japanese firm-level data from *Kaigai Shinshutsu Kigyo Soran* to construct industry–province-level panels across three distinct periods (2006–2010, 2011–2015, and 2016–2020).

3. The context of trade and investment in Thailand

3.1. FDI promotion policy

The deregulation of FDI in Thailand has experienced significant evolution over the years, particularly in response to the changing economic landscape. Initially, the government's strategy aimed at fostering an inviting environment for foreign investors was predominantly centered on the liberalization of entry protocols for foreign firms and the provision of attractive tax incentives, a policy framework that remained largely intact until approximately the year 2000. However, as Thailand entered the mid-2000s, it faced the pressing challenge of what has been characterized as the 'middle-income trap.' This phenomenon highlighted the stagnation in economic growth that often afflicts countries that have reached a certain income level but struggle to transition into higher income brackets. In light of this situation, the Thai government recognized the necessity for a paradigm shift and began to pivot its focus towards the enhancement of the nation's industrial framework. In response to the emerging economic realities, new tax incentives were crafted with the explicit aim of fostering advancements in energy efficiency, the adoption of alternative energy sources, and the expansion of the high-tech sector. These measures were not merely reactive; they were part of a broader strategic vision to modernize and elevate Thailand's industrial capabilities to compete in a global economy increasingly driven by innovation and sustainability. The introduction of the Thailand 4.0 initiative in 2015 marked a pivotal moment in the country's economic strategy. This comprehensive long-term vision for economic development sought to transform Thailand into a value-based economy, leveraging technology and innovation as key drivers of growth. Under this initiative, the government began to extend significant incentives to priority industries and projects that emphasized research and development. In a decisive move to streamline the focus of investment, certain labor-intensive and low-value industries were deliberately excluded from receiving preferential treatment, thereby steering resources towards sectors that promise greater economic returns and sustainability.

The National Competitiveness Enhancement for Targeted Industries Act, which was implemented in February 2017, aimed to provide support for five established sectors, including next-generation vehicles and smart electronics, over the short to medium term, while concurrently fostering the development of five emerging sectors in the long term, specifically automated machinery, industrial robots, aerospace, biotechnology, and digital industries. Furthermore, the Eastern Economic Corridor Act, enacted in 2018, endeavored to attract investment across 12 designated industries, including those previously identified, to specific regions. The goal of this initiative is to draw the aforementioned 12 sectors to three eastern provinces characterized by industrial clusters, namely Rayong, Chonburi, and Chachoengsao provinces. The intention was to further concentrate on these industries to facilitate their enhancement and the integration of higher value. In addition to the provision of substantial investment incentives, such as exemptions from corporate income tax and

various subsidies, measures have been instituted with the purpose of improving the investment climate. These measures encompass the enhancement of infrastructure and the deregulation of pertinent areas.

Overall, the evolution of FDI deregulation in Thailand reflects a responsive and strategic approach to economic development, aimed at not only attracting foreign investment but also ensuring that such investments contribute to the long-term sustainability and competitiveness of the Thai economy in the global arena.

In conjunction with the previously discussed policies, an additional variable that may significantly affect the site selection of such enterprises is the magnitude of the minimum wage. Over the preceding two decades, Thailand has executed a succession of minimum wage augmentations commensurate with the nation's economic advancement and the escalation of income levels. The most prominent augmentation was recorded in 2012, characterized by a 40% increase in the minimum wage. In 2013, the minimum wage was uniformly raised nationwide to 300 Baht per day, aligning it with the level established in Bangkok. These two augmentations have culminated in an approximate 90% enhancement of the minimum wage in certain regions. As the Thai economy has burgeoned, the labor market has become progressively constricted, with the unemployment rate plummeting below 1% since 2010. The rising labor costs have posed a significant barrier for enterprises seeking to establish operations, particularly within industrial clusters. The enforcement of a standardized national minimum wage in 2013 may have significantly impacted the locational choices of firms.

FDI, particularly from Japan, has played a crucial role in the development of Thai manufacturing industry. According to the Bank of Thailand's "Foreign Direct Investment Position Classified by Country," Japan's share of FDI (stock) in Thailand was 34.5% in 2006 and 31.7% in 2021, making it the highest share. As suggested by the flying geese theory (e.g., Ozawa 2016), the destinations of Japan's FDI in Asia have changed from Asian NIES to ASEAN4, China, and CLMV (especially Vietnam).[1] This shift occurred because, as wage levels (and the exchange rate) rose in Japan, labor-intensive industries, goods, and processes that became less price competitive were relocated to Asian countries with lower wage levels where they could maintain a certain level of quality. As wage levels in these destination countries increased, the industries were then relocated to even less developed countries with lower wage levels. Figure 1 shows the trend in the number of local subsidiaries of Japanese manufacturers in Asia (excluding China) listed in Toyo Keizai's *Kaigai Shinshutsu Kigyo Soran* (comprehensive list of firms expanding overseas). While until the 1980s, most of the expansion was to Asian NIES, after the Plaza Accord in 1985, the number of exports to ASEAN4 and, more recently, to CLMV (especially Vietnam) has increased. However, despite these changes, the number of firms expanding into Thailand is continuing to grow in spite of rising wages.

[1] Asian NIES refers to South Korea, Taiwan, Singapore, and Hong Kong, while CLMV refers to Cambodia, Laos, Myanmar and Vietnam.

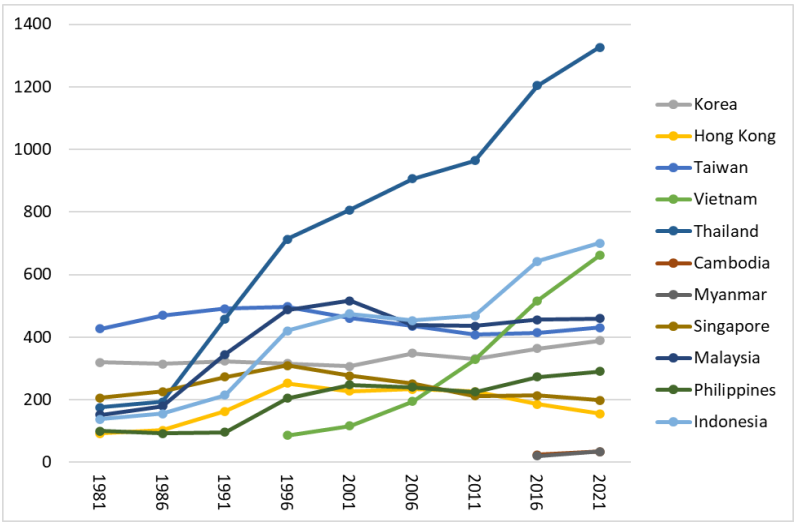


Figure 1. The number of Japanese affiliates working in the manufacturing industry
Data: Toyo Keizai, various issues, *Kaigai Sinshutsu Kigyo Soran: Kuni Betsu Hen*, (Overseas Japanese Affiliated Companies: by Country), Toyo Keizai Shimposha.

3.2. Trade policy in Thailand

The surge of FDI from Japan to Thailand can be partly attributed to a series of strategic initiatives undertaken by the Thai government aimed at fostering trade liberalization and implementing proactive policies designed to attract foreign investment.

Until the 2000s, the Thai government pursued a policy of economic development through the liberalization of trade and investment throughout the country. In alignment with international frameworks such as the WTO and the ASEAN agreements, the Thai government embarked on a robust program of liberalization. This included significant measures such as the reduction of tariffs and the loosening of restrictions on FDI, which collectively created a more inviting environment for foreign investors. The reduction of intra-ASEAN tariffs has had a profound impact, leading to a marked increase in trade among member countries within the region.

Furthermore, the elimination of local content restrictions has played a critical role in enhancing the investment landscape. By removing the obligation for firms to source intermediate goods locally, companies have gained the flexibility to procure materials and components from any country within the ASEAN region. This shift has facilitated a more dynamic and efficient supply chain, enabling businesses to optimize their operations and reduce costs. As a result of these liberalization efforts, there has been a notable increase in the horizontal division of labor within ASEAN. Countries are now able to specialize in specific sectors and industries, leading to a more integrated and collaborative economic environment. This transformation not only benefits individual nations but also strengthens the overall economic framework of Southeast Asia, fostering greater competitiveness on a global scale.

However, since the ASEAN Trade in Goods Agreement (ATIGA) established a significant intra-regional content requirement of 40%, it fundamentally shaped and limited the operational landscape

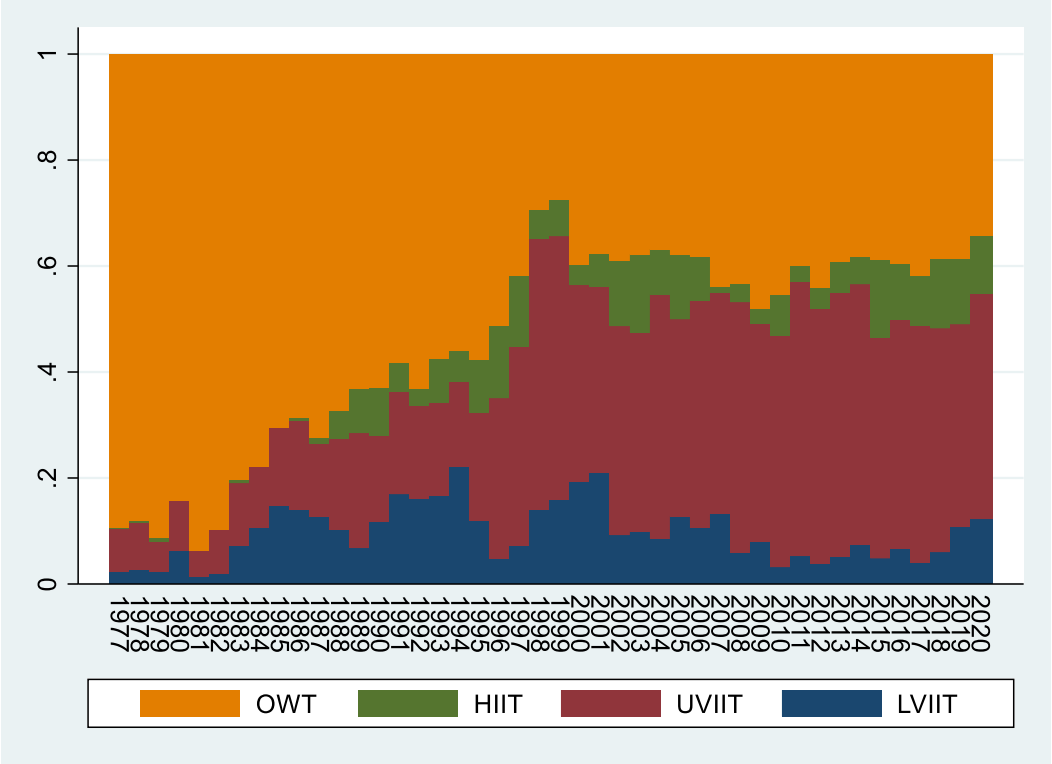
for companies in Thailand. This stipulation did not grant firms the freedom to import intermediate goods from any global supplier of their choosing; rather, it necessitated a strategic focus on regional sourcing. To fully leverage the low preferential tariff rates provided by the ASEAN Free Trade Area (AFTA), Japanese enterprises operating within Thailand were compelled to prioritize the procurement of intermediate goods from other ASEAN member states. Despite the introduction of the Japan-Thailand Economic Partnership Agreement (JTEPA) in 2007, which aimed to enhance trade relations and economic cooperation between the two nations, there was not an immediate surge in the importation of components from Japan. Instead, the prevailing trend was a continued commitment to sourcing from local Thai firms, particularly for general parts. This preference for local suppliers emphasizes the importance of local partnerships in achieving compliance with ATIGA's requirements and maximizing the benefits of trade agreements.

In this context, it has become increasingly evident that every trade agreement should incorporate provisions for cumulation as a vital exception to the established rules of origin. Cumulation allows countries to count materials or components sourced from partner nations towards meeting the origin criteria, thereby facilitating smoother trade flows and enhancing economic cooperation. However, the rapid proliferation of bilateral agreements has given rise to a complex scenario often referred to as the “spaghetti bowl” effect. This term highlights the intricate web of trade agreements, each characterized by its own unique set of rules of origin, which significantly complicates the processes involved in importing and exporting goods. As a result of this convoluted landscape, businesses face challenges in navigating the diverse and often conflicting requirements that govern the origin of products. The lack of standardization not only increases compliance costs but also hinders the efficiency of trade operations. Therefore, it has become imperative to pursue the harmonization of rules of origin across the various agreements.

These challenges are being mitigated through the enactment of multilateral free trade agreements. The Regional Comprehensive Economic Partnership (RCEP), ratified in 2020, facilitates intra-regional cumulation. The ASEAN-plus-one FTAs have failed to ameliorate the previously mentioned challenges, as the provisions of the ASEAN Trade in Goods Agreement (ATIGA) limit the transactions eligible for cumulation to those conducted between ASEAN member states and countries that have executed an FTA. Nonetheless, the RCEP has offered a promising pathway for nations to capitalize on FTAs without necessitating substantial modifications to pre-existing production networks. Furthermore, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), finalized in 2018, established a framework for full cumulation, albeit Thailand has yet to accede to this agreement. Although there have been indications that it may seek membership in the near future, significant domestic opposition persists, and as of now, it has not formally applied for accession.

3.3. Changing trade structure between Thailand and Japan

Figure 2 illustrates the trade structure between two countries. Here, using UN Comtrade's trade value data (three-digit SITC Rev.2) for each industry (each good), one-way trade between the two countries is defined as inter-industry trade (OWT: One-Way Trade) and two-way trade is defined as intra-industry trade (IIT: Intra-Industry Trade), and the price (quality) of each trade good is evaluated using trade value and volume data to examine the quality of trade between the two countries.[2] Specifically, if the export value of a particular industry is less than 10% of the import value (or the import value is less than 10% of the export value), it is classified as OWT; otherwise, it is classified as IIT. Among IITs, if the price (trade value/volume) difference between the two countries is within 15%, it is classified as Horizontal IIT; otherwise, it is classified as Vertical IIT. Furthermore, in this paper, we define industries in the Vertical IIT with a price difference of more than 15% (for Japan) as UVIIT (Upper Vertical IIT), and industries with a price difference of less than -15% (i.e., the price of export goods from Japan to Thailand is more than 15% lower than the price of export goods from Thailand to Japan) as LVIIT (Lower Vertical IIT).[3]



[2] SITC Rev.2 stands for Standard International Trade Classification, Revision 2.

[3] For indicators of intra-industry trade, refer to Grubel and Lloyd (1971), Greenaway et al. (1995), and Fontagné and Freudenberg (1997). However, the concepts of UVIIT and LVIIT are newly constructed in this paper. In regions such as East Asia where vertical specialization takes advantage of differences in factor endowments, it is extremely important to distinguish between UVIIT and LVIIT. Using a 25% threshold instead of 15% does not change the basic trend.

Figure 2. Analysis of the trade structure between Japan and Thailand using intra-industry trade index

Source: UN Comtrade, SITC Rev.2

While OWT declined sharply from the 1970s through the 1990s, the trade structure has stabilized since 2000, with steady exports of UVIIT (high value-added products) from Japan to Thailand. This indicates that FDI has flowed from Japan to Thailand, leading to a more advanced Thai industrial and trade structure. Concurrently, Japan is exporting high value-added goods to Thailand and Thailand is exporting low value-added goods to Japan, and the trade structure between Japan and Thailand has become more or less fixed.[4]

4. Data and methodology

4.1. Data

The data employed in the subsequent analysis are from three different sources, delineated as follows. The primary dataset comprises establishment-level microdata sourced from the Thai Industrial Census, as compiled by the National Statistical Office (NSO). We use microdata from the 2007, 2012, 2017, and 2022 editions (data for 2006, 2011, 2016, and 2021, respectively) to examine the development of Thai manufacturing, dividing it into local and foreign firms.[5] The 2007 iteration aligns with ISIC Rev.3, whereas the 2012 and 2017 iterations correspond to both ISIC Rev.3 and

[4] This trend is also evident in an analysis using PCI (see Figure A2). In fact, when we look at the changes in the level of export goods from Thailand to Japan, we can see a fragmented flying geese pattern of development as in the previous figure, but the pattern is not as clear as in Figure 2, and there has been less fluctuation since 2000.

[5] The 2007 edition lists 73,931 establishments, the 2012 edition 98,482, the 2017 edition 118,639, and the 2022 edition 110,521. However, since multiple establishments within the same firm often report data for other establishments within the same firm, we removed samples that were considered to be the same establishments. Specifically, we excluded establishments with identical values for the following variables: amount of registered capital, total male employees, total female employees, raw materials and composite materials at the beginning and end of the year, product sales value, and net fixed assets at the beginning and end of the year. See Kohpaiboon (2009) for more details. We also focus on enumerated firms. As a result, the number of establishments used in the analysis is 62,567 for the 2007 edition, 73,047 for the 2012 edition, 85,387 for the 2017 edition, and 66,996 for the 2022 edition.

The 2007 edition corresponds to ISIC Rev.3, the 2012 and 2017 editions correspond to ISIC Rev.3 and TSIC 2009, and the 2022 edition corresponds to TSIC 2009, but in terms of two-digit codes, TSIC 2009 corresponds to ISIC Rev.4. ISIC Rev.3 stands for International Standard Industrial Classification, Revision 3, and TSIC stands for Thailand Standard Industrial Classification. The two-digit codes for manufacturing are 15 to 37 for ISIC Rev.3, and 10 to 33 for TSIC 2009 and ISIC Rev.4. Data from the 2007 edition is not used in Figures 1 and 2 because the industry codes are different. In line with the standards used in the *Thai Industrial Census*, any firm that contains even the slightest bit of foreign capital is considered a foreign firm. However, we also conduct robustness tests using different standards.

The Census does not provide firm IDs, making it difficult to verify changes in each firm.

Rev.4, and the 2022 iteration corresponds exclusively to ISIC Rev.4. Consequently, a dataset for the period from 2007 to 2017, corresponding to ISIC Rev.3, and a dataset for the period from 2012 to 2022, corresponding to ISIC Rev.4, are constructed, with the overlapping period also utilized to assess robustness. As a standard practice, two-digit industrial classifications are employed. Utilizing this data, supplier access (SA), market access (MA), and average wages (wages) are computed by province and industry, as explicated below.[6] The Industrial Censuses are not in the panel format at the firm level and we simply have pooled-cross-sectional data for three rounds. We only make it a panel by aggregating to the industry-provincial level.

Furthermore, we employ microdata derived from Toyo Keizai Inc.'s Kaigai Shinshutsu Kigyo Soran to acquire empirical data concerning Japanese manufacturing enterprises that operate within Thailand.[7] We systematically assign two-digit ISIC Rev.3 and Rev.4 classifications to each firm's actual production activities by meticulously examining the business specifics contained within the microdata as well as their respective websites, subsequently correlating these classifications to variables such as supplier access.

For Thai input-output tables, the 2015 and 2021 editions of the OECD Input-Output Tables (IOTs) are employed. The 2015 edition exhibits compatibility with ISIC Rev.3, providing data up to the year 2011. Consequently, within datasets that adhere to ISIC Rev.3, input coefficients corresponding to 2011 remain applicable for the years 2012 and subsequent. The 2021 edition, on the other hand, aligns with ISIC Rev.4, offering data up to the year 2018. Thus, in datasets conforming to ISIC Rev.4, input coefficients for the year 2018 are likewise applicable for the years 2019 and thereafter. Within the IOTs, in certain instances, two or three industries are amalgamated into a single entity within the two-digit ISIC classification. In such instances, values such as input coefficients are merely partitioned by the total number of industries involved.[8]

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[6] As mentioned above, the *Industrial Census of Thailand* is published once every five years, and only one year's value of data is provided. For the four years in between, the data for 2006, 2011, 2016, and 2021 are used, and the difference is divided equally to calculate the values (however, most data other than the census are for individual years). If there are missing values, the average value for that province and industry is used. In all censuses, there are cases where the province- and industry-specific wages are not calculated because there are industries in which there are no business establishments in the province. In such cases, the average value for the entire year is used. In addition, there are cases where there are provinces and industries in which foreign or Japanese firms have not entered, so the values for supplier access and other variables for foreign firms in the province are zero. For these variables, the minimum value for each variable is added to the entire sample. In addition, the wages by province and industry are converted to real values using the consumer price index (exclude raw food and energy) of the Trade Policy and Strategy Office of the Ministry of Commerce of Thailand.

[7] The manufacturing industry covers firms in the following industries: food, textiles and clothing, pulp and paper, chemicals, pharmaceuticals, petroleum and coal, rubber products, glass and stone, iron and steel, non-ferrous metals, metal products, machinery, electrical equipment, transportation equipment, precision equipment, and other manufacturing industries. The firms listed may differ depending on the edition, but this paper uses data from 2006-2020 from the 2013, 2018, and 2023 editions. It is possible that firms that have withdrawn from the market may not have been captured, but the impact on the analysis results is thought to be minor.

[8] It is also possible to divide it according to the production value of each industry.

Other provincial attributes encompass the nominal Gross Regional Product (GRP) attributed to each province, as disseminated by the Office of the National Economic and Social Development Council, along with the nominal minimum wage (mw) designated by the Department of Labour Protection and Welfare, Ministry of Labour.[9] These figures are subsequently transformed into real Gross Regional Product (rGRP) and real minimum wage (rmw) correspondingly, employing the consumer price index (excluding raw food and energy) provided by the Trade Policy and Strategy Office of the Ministry of Commerce of Thailand. Furthermore, the trade volume, measured in Twenty-foot Equivalent Units (TEU), reported by the Ministry of Transport and the Bangkok Shipowners and Agents Association, is utilized to compute the Port Access (PA) index elucidated in the subsequent section.[10]

4.2. Constructed variables

Supplier access

The presence of established supply and distribution networks within Thailand plays a critical role in shaping firms' production and market outcomes. In this paper, we employ theoretical frameworks such as supplier access and market access to investigate the implications of these networks. These frameworks can alternatively be articulated as backward and forward linkages, respectively, as delineated by Hirschman (1958). Amiti and Javorcik (2008) conducted a quantitative analysis of supplier and market access for both intra- and inter-provincial firms in China, aiming to evaluate by the the impact of provincial border barriers. In the context of Thailand, provincial border barriers are not as prominent as in China, therefore, we further disaggregate the analysis by firm ownership. Drawing upon the definitions posited by Amiti and Javorcik (2008), we categorise the firms further into local and foreign entities and emphasise their relative roles as well as the dynamic transformations occurring within this framework.

Supplier access is an index related to the availability of intermediate inputs and can be divided into $SA(I)^{i}_{p,t}$ within the province and $SA(O)^{i}_{p,t}$ outside the province. In this paper, however, it is classified into $SA(I)^{i}_{L,p,t}$ and $SA(O)^{i}_{L,p,t}$ related to local firms, and $SA(I)^{i}_{F,p,t}$ and $SA(O)^{i}_{F,p,t}$ related to foreign firms. Supplier access within the province is defined as follows:

$$SA(I)^{i}_{B,p,t} = \sum_{j=1}^{J} a_{ij} * \phi^{j}_{B,p,t} * D^{-1}_{pp}, where\ \phi^{j}_{B,p,t} = \frac{Y^{j}_{B,p,t}}{Y^{j}_{B,Thailand,t}}$$

[9] The nominal minimum wage is based on the value as of June of each year. Bueng Kan province was separated from Nong Khai province on March 23, 2011, but since there was no data for 2011, data for Nong Khai province was used for that year. Note that Bueng Kan province is not included in the analysis before 2010.

[10] The trading volume for Ranong Port from 2006 to 2010 was not published, and since the trading volume from 2011 onwards has also been negligible, it has been excluded from the analysis here.

Here, $\phi^{j}_{B,p,t}$ is the ratio of the production value of industry j produced in province p at time t to the total production value of industry j produced throughout Thailand, and if $B = L$, it is the value for local firms, and if $B = F$, it is the value for foreign firms. Since each industry uses multiple intermediate goods, the ratio of these production values is weighted by the coefficient a_{ij} of the output of industry j supplied to industry i as intermediate inputs, where a_{ij} is derived from Thai input-output table. In particular, for industries with high input-output coefficients with other industries, the agglomeration of related industries also has a very significant impact, so weighting by the input-output coefficients for all industries is very important when considering location. Then, to make it possible to compare with supplier access outside the province, we assume that the province is a circle, as in Leamer (1997), and adjust for the intra-provincial distance D_{pp}.[11]

$$D_{pp} = \sqrt{\frac{Area_p}{\pi}}.$$

Additionally, the availability of intermediate inputs from other provinces in Thailand is calculated as follows:

$$SA(O)^{i}_{B,p,t} = \sum_{j=1}^{J} a_{ij} \sum_{l \neq p}^{P} \phi^{j}_{B,l,t} * D^{-1}_{lp},$$

This equation is similar to the intra-provincial index, but the share of output produced in each province is weighted by the inverse of the distance from province p to province l, as in Harris (1954).

Market access

Market access is an indicator of the extent to which each industry in a province has sales destinations. It can be divided into $MA(I)^{i}_{p,t}$ within the province and $MA(O)^{i}_{p,t}$ outside the province. In this paper, it is classified into $MA(I)^{i}_{L,p,t}$ and $MA(O)^{i}_{L,p,t}$ for local firms, and $MA(I)^{i}_{F,p,t}$ and $MA(O)^{i}_{F,p,t}$ for foreign firms. Market access within a province is defined as follows:

$$MA(I)^{i}_{B,p,t} = \left[\sum_{j=1}^{J} b_{ij} * \phi^{j}_{B,p,t} + b_i * \lambda_{p,t} \right] * D^{-1}_{pp}, with\ \lambda_{p,t} = \frac{GDP_{p,t}}{GDP_{Thailand,t}}$$

The share of output from industry i produced in province p is weighted by the proportion b_{ij} of output from industry i sold to industry j as intermediate inputs and the proportion b_i of output finally consumed by households. The coefficients b_{ij} and b_i are calculated based on the input-output table for Thailand. If $B = L$, it is the value for local firms, and if $B = F$, it is the value for foreign firms, but since λ is an indicator for final consumption by households, no distinction is made between local and foreign firms. Similarly, market access outside the province is defined as follows:

[11] Assuming the province is a circle, D_{pp} is equal to the radius of the circle.

$$MA(O)^{i}_{B,p,t} = \sum_{j=1}^{J} b_{ij} \sum_{l \neq p}^{P} \phi^{j}_{B,l,t} * D_{lp}^{-1} + b_i \sum_{l \neq p}^{P} \lambda_{l,t} * D_{lp}^{-1}$$

Here, each province's consumption of industry i output is weighted by the inverse of the distance between provinces, similar to supplier access.

We also define the related indicators for supplier and market access as follows, with omitted symbols used where appropriate.

$$SA(I)^{i}_{L,p,t} + SA(I)^{i}_{F,p,t} = SA_IL + SA_IF = SA_I$$
$$SA(O)^{i}_{L,p,t} + SA(O)^{i}_{F,p,t} = SA_OL + SA_OF = SA_O$$
$$MA(I)^{i}_{L,p,t} + MA(I)^{i}_{F,p,t} = MA_IL + MA_IF = MA_I$$
$$MA(O)^{i}_{L,p,t} + MA(O)^{i}_{F,p,t} = MA_OL + MA_OF = MA_O$$

Here, SA_I is the supplier access of local and foreign firms within the province, and SA_O is the supplier access of local and foreign firms outside the province. The same is true for market access. Each value is calculated for each industry, province, and year.

Japanese access

The above supplier and market access were calculated by using data on foreign capital from the Thai Industrial Census to distinguish between local and foreign firms. However, when Japanese firms enter the market, foreign firms, especially Japanese firms that are already in the market, may have a significant impact.[12] Therefore, in this section, we calculate the supplier and market access of Japanese firms by using $\tau^{j}_{p,t}$ instead of $\phi^{j}_{F,p,t}$ based on the status of Japanese firms entering the market in the *Kaigai Shinshutsu Kigyo Soran*.

$$\tau^{j}_{p,t} = \frac{Y^{j}_{JPN,p,t}}{Y^{j}_{JPN,Thailand,t}}$$

Here, $\tau^{j}_{p,t}$ is the ratio of the production value of industry j produced in province p by Japanese firms at time t to the total production value of industry j produced throughout Thailand by Japanese firms. However, since the production value of Japanese firms is often unknown, we will assume that the production value of all Japanese firms is the same.[13]

Port access

When selecting a site for a business entity, it is of paramount importance to ensure the availability of infrastructure that facilitates the efficient exportation and importation of goods. Specifically, both

[12] The data from the *Thailand Industrial Census* includes information on whether foreign capital is included, but the nationality of the foreign capital is unknown, except for the 2007 edition. There are many studies on the significant impact of the presence of existing Japanese firms (especially affiliated firms). For example, see Belderbos and Carree (2002).

[13] Of the sample firms, only about one-third had data on production value. Although it is possible to calculate the access index based on this data, the number of samples per industry is small, and sample bias is large.

Bangkok Port and Laem Chabang Port, the latter of which was established in Chonburi Province within the Eastern Seaboard Industrial Zone, have significantly contributed to the enhancement of the Thai economy and have markedly fostered the progression of enterprises into the Eastern Seaboard Industrial Zone, including regions such as Chonburi and Rayong Province. Furthermore, privately-operated ports, such as those in Samut Prakan Province, which operate independently of the Port Authority, also exert considerable influence. In this context, access to ports is delineated as follows:

$$PA_{p,t} = \varphi_{p,t} * D_{pp}^{-1} + \sum_{l \neq p}^{P} \varphi_{l,t} * D_{lp}^{-1}, with\ \varphi_{p,t} = \frac{EX_{p,t}}{EX_{Thailand,t}}$$

Here, $\varphi_{p,t}$ is the ratio of the transport volume (total volume of exports and imports, unit: TEU) of the port in province p at time t to the handling volume of ports in Thailand as a whole. Even provinces that do not face the sea or large rivers are given port access value according to the distance to the port.[14]

4.3. Empirical strategy and summary of descriptive statistics

Empirical strategy

The analysis is conducted for three sub-periods—2006–2010, 2011–2015, and 2016–2020—corresponding to major policy shifts and structural changes in Thailand's economy. This approach allows us to capture **dynamic changes in location choice determinants** and test hypotheses derived from the fragmented flying geese framework.

While we do not have a panel format data for firms in the Thai industrial censuses, the panel exists among Japanese affiliates and subsidiaries in Thailand over the years, across provinces and industries. i.e., the panel dataset of local subsidiaries × provinces × years was employed for the estimation process.

To address the research questions, we employ a **conditional logit model** (McFadden, 1973, 1984) to estimate the probability of a Japanese manufacturing subsidiary locating in a given province-year combination. The dependent variable is a binary indicator of the presence or absence of a local

[14] Although data on transport value should be used instead of transport volume, data on transport volume is used in light of data availability. The Ministry of Transport also publishes the import and export volumes (unit: ton) of Chiang Saen Commercial Port and Chiang Khong Port, which face the Mekong River in Chiang Rai Province in northern Thailand, but does not publish container volume (unit: TEU), probably because the riverbed is shallow and large container ships cannot navigate or dock there, and therefore it is not included in the calculation of port access. However, the import and export volumes are very small compared to other ports. Meanwhile, railways have been laid in industrial parks built in Udonthani Province in northern Thailand, connecting them to Laos and China, and it is expected that trade will expand through these routes and that FDI will increase accordingly.

subsidiary of Japanese manufacturing enterprises situated in the province p in Thailand, during the year t, with a value of 1 assigned if the subsidiary is present and 0 if it is absent. Independent variables include:

- **Real average wage** and **real minimum wage** (cost factors)
- **Supplier access (SA)** and **Market access (MA)** indices for local and foreign firms (agglomeration/network factors)
- **Port access (PA)** and **real GRP** (infrastructure and market size)

The dataset utilized consists of microdata extracted from the Kaigai Shinshutsu Kigyo Soran referenced in section 4.1. The independent variables include the real average wage, supplier access, and market access within each province and industry, in addition to the real minimum wage, real Gross Regional Product (GRP), and port access for each province, with their logarithmic transformations being utilized.[15]

Summary of descriptive statistics

The investigation of Japanese firms' entry into Thailand is partitioned into three sub-periods, namely 2006-2010 (Analysis 1), 2011-2015 (Analysis 2), and 2016-2020 (Analysis 3), generally align with the intervals of the Thailand Industrial Census; however, analyses utilizing alternative timeframes are also undertaken to assess robustness and evaluate the implications of various policies. The sample sizes are 34,960 for Analysis 1, 79,310 for Analysis 2, and 25,025 for Analysis 3.[16] Through the execution of analyses across these varying timeframes, we can investigate not only the determinants influencing location decisions but also the evolving dynamics of the Thai economy, Japanese enterprises and the factors that affect location choices.[17] In what follows, we use a

[15] Although the real minimum wage and real wage are both indices related to the same wage, the former is prone to being influenced by political intentions. In addition, for firms that move into a country with the aim of low wages, the real minimum wage may be more important, while for firms that move into a country with the aim of producing higher added value, there are cases where higher wage levels are acceptable according to the level of ability, and the two wage indices may have different tendencies. Therefore, it is important to distinguish between the two and examine their economic and policy effects. The correlation coefficient between the real average wage and the real minimum wage was 0.5152 from 2006 to 2010, 0.1000 from 2011 to 2015, and 0.2768 from 2016 to 2020, which shows that not only is the correlation weak, but it is also susceptible to policy influences.

[16] For Analysis 2, we basically used ISIC Rev. 4, but also used Rev. 3 as a robustness test (see Table A1 in the Appendix). The results were almost the same.

[17] Some papers use data from one year ago as explanatory variables, but when a firm chooses a location, it may (or rather, is more common) make the decision while predicting future conditions rather than past conditions. However, since it is not easy to predict and verify future data, we have not generally included a time lag here. However, there is a possibility that problems with simultaneity or endogeneity may arise, and there is also the issue that Japanese firms are included in the foreign firms in the *Thailand Industrial Census*. But this is not thought to be a major problem because indices such as supplier and market access are intricately combined with data for the other provinces and industries, so each firm's share of these variables is very small.

conditional logit model to estimate the location choices of Japanese manufacturing subsidiaries in Thailand.[18] Descriptive statistics are as follows:

[18] It is also possible to use a mixed logit model to take into account the heterogeneity of Japanese firms, but verification is difficult due to insufficient data on Japanese firms.

Description	Variable	Mean	Std. dev.	Min	Max
real wage (Thai baht, 2019 constant price)	rwages	76177.06	33995.99	1212.222	284615.1
real minimum wage (Thai baht, 2019 constant price)	rmw	156.1119	13.94706	141.4141	198.8417
real Gross Regional Product (Thai baht, 2019 constant price)	rGRP	119812.9	313851.8	7698.925	3001447
port access	PA	0.0040592	0.004614	0.0008975	0.021897
supplier access within the province	SA_I	0.000641	0.002192	1.79E-08	0.022446
supplier access outside the province	SA_O	0.0517204	0.058389	3.14E-03	0.472818
supplier access of local firms within the province	SA_IL	0.0003195	0.001143	1.79E-08	0.016608
supplier access of foreign firms within the province	SA_IF	0.0003215	0.001196	3.70E-12	0.012507
market access within the province	MA_I	0.0006098	0.002117	2.61E-08	0.036038
market access outside the province	MA_O	0.0046641	0.005223	2.00E-04	0.063755
market access of local firms within the province	MA_IL	0.0003066	0.001133	1.39E-08	0.021002
market access of foreign firms within the province	MA_IF	0.0003032	0.001124	4.87E-09	0.018913
supplier access of Japanese firms within the province	SA_IJ	0.0003123	0.00118	1.38E-08	0.011507
supplier access of Japanese firms outside the province	SA_OJ	0.0024684	0.002865	0.0001298	0.023274
market access of Japanese firms within the province	MA_IJ	0.0055907	0.017306	4.03E-04	0.113621
market access of Japanese firms outside the province	MA_OJ	0.0023828	0.002771	0.0000948	0.035466
Number of observations for all variables	34,960				

Table 1. Descriptive statistics (Analysis 1)

Description	Variable	Mean	Std. dev.	Min	Max
real wage (Thai baht, 2019 constant price)	rwages	81981.88	35321.87	2412.886	291250.3
real minimum wage (Thai baht, 2019 constant price)	rmw	237.6169	41.14129	150	272.9233
real Gross Regional Product (Thai baht, 2019 constant price)	rGRP	148911.5	412710.7	8103.206	3919910
port access	PA	0.0039419	0.00447	0.0008918	0.02254
supplier access within the province	SA_I	0.0006928	0.002347	2.98E-08	0.025678
supplier access outside the province	SA_O	0.0581611	0.067315	3.45E-03	0.47426
supplier access of local firms within the province	SA_IL	0.0003507	0.001142	2.98E-08	0.010667
supplier access of foreign firms within the province	SA_IF	0.0003421	0.001327	3.70E-12	0.01648
market access within the province	MA_I	0.0005991	0.002141	2.97E-08	0.039656
market access outside the province	MA_O	0.0047379	0.006036	2.71E-04	0.080454
market access of local firms within the province	MA_IL	0.0003077	0.001122	1.58E-08	0.017431
market access of foreign firms within the province	MA_IF	0.0002913	0.001131	8.60E-09	0.023599
supplier access of Japanese firms within the province	SA_IJ	0.0003401	0.001242	1.38E-08	0.011419
supplier access of Japanese firms outside the province	SA_OJ	0.0027092	0.003157	0.0001397	0.022902
market access of Japanese firms within the province	MA_IJ	0.0053948	0.015905	4.03E-04	0.110831
market access of Japanese firms outside the province	MA_OJ	0.0024358	0.003229	0.0001299	0.03981
Number of observations for all variables	79,695				

Table 2. Descriptive statistics (Analysis 2)

Description	Variable	Mean	Std. dev.	Min	Max
real wage (Thai baht, 2019 constant price)	rwages	87406.72	45533.37	1415.115	1067978
real minimum wage (Thai baht, 2019 constant price)	rmw	237.6169	41.14129	150	272.9233
real Gross Regional Product (Thai baht, 2019 constant price)	rGRP	148911.5	412710.7	8103.206	3919910
port access	PA	0.0039419	0.00447	0.0008918	0.02254
supplier access within the province	SA_I	0.0006954	0.002409	2.30E-08	0.040349
supplier access outside the province	SA_O	0.0477923	0.053688	0.0030375	0.431802
supplier access of local firms within the province	SA_IL	0.0003485	0.00113	2.30E-08	0.010572
supplier access of foreign firms within the province	SA_IF	0.0003469	0.001402	1.42E-12	0.030013
market access within the province	MA_I	0.0008083	0.003688	1.06E-06	0.082916
market access outside the province	MA_O	0.006223	0.010693	0.0004985	0.170401
market access of local firms within the province	MA_IL	0.0004146	0.001873	5.90E-07	0.037352
market access of foreign firms within the province	MA_IF	0.0003937	0.001942	4.28E-08	0.052349
supplier access of Japanese firms within the province	SA_IJ	0.0003363	0.00123	6.54E-09	0.016935
supplier access of Japanese firms outside the province	SA_OJ	0.0315291	0.036146	0.0019457	0.30052
market access of Japanese firms within the province	MA_IJ	0.0003573	0.00213	4.65E-06	0.066049
market access of Japanese firms outside the province	MA_OJ	0.0035847	0.005721	0.000597	0.085122
Number of observations for all variables	79,310				

Table 3. Descriptive statistics (Analysis 3)

5. Empirical results and discussion

5.1. Key results

Table 4 presents the estimation outcomes for Analysis 1 (2006-2010). A considerable number of explanatory variables demonstrate statistical significance, revealing that an increase in real wages, real Gross Regional Product (GRP), and the port access index by province and industry correlates positively with the likelihood of Japanese firms establishing operations in that province.[19] Notably, it is particularly compelling that elevated wage levels exert a beneficial influence on the decision-making process regarding location. For instance, numerous scholarly investigations, including those conducted by Amiti and Javorcik (2008), have indicated that higher wage levels typically exert a detrimental effect on location selection within the host nation, suggesting that the objective of location choice is to identify regions characterized by low-wage labor. Nonetheless, it is evident that during this temporal juncture, the entry of Japanese firms into Thailand was not predicated upon the advantage of low-wage labor.[20] Conversely, the coefficient associated with the real minimum wage is significantly negative across multiple models, signifying that Japanese firms are preferentially relocating to provinces characterized by lower real minimum wages. The real minimum wage is subject to the influences of policy decisions and historical developments, which will be revisited in Analyses 2 and 3. However, as elucidated in Section 1, this phenomenon may correlate with the transformation in the motives of Japanese firms entering Thailand, shifting from

[19] Real wages by province and industry were calculated from the *Thai Industrial Census*, but because there is an endogeneity issue, such as wage levels being affected by FDI, we hope to reduce this endogeneity by also estimating real wages by province calculated from real GRP and number of workers (see the footnote for Analysis 3.) It is also possible to conduct an analysis using productivity instead of wages, but data constraints make it difficult to estimate productivity by prefecture and industry.

Furthermore, when speaking with people involved in industrial parks in Thailand, they said that access to Bangkok, Thailand's leading commercial city, and the presence of Japanese schools for children also play important roles in choosing a location (from an interview with the manager of Rojana Industrial Park in Ayutthaya on August 28, 2018.). We also estimated these variables, and the results were similar to those in this paper.

[20] According to Nielsen et al. (2017), 49% of studies reported a significant negative association between low wages and FDI location choice, 17% reported an inverse association, and 34% reported no correlation. In addition, wage levels and unobserved characteristics may not be independent, but Liu et al. (2010) argued that wages have a negative effect on FDI by controlling for them using the cross term between wage levels and technology intensity. However, these studies often focus on China around 2000, which is different from the situation in Thailand during the period covered by this study. In this regard, a comparison with analyses using the 1997 and 2002 versions of the *Thai Industrial Census* is desirable.

In addition, if only firms with a foreign capital ratio of 50% or more are considered foreign firms, the wage level in model (5) becomes insignificant. This may mean that foreign firms that hold more than 50% of the capital do not place importance on high wage levels as a factor in location choice (see Table A2).

a focus on low wages to the presence of production networks during the period spanning 2000 to 2010.

Upon comparison of models (2) and (3) alongside models (6) and (7), it is observed that supplier and market access within a province exhibit a statistically significant positive correlation, whereas such access outside the province is characterised by a statistically significant negative correlation. This indicates that firms are preferentially extending their operations into provinces that demonstrate elevated access indices within the province, rather than targeting those with substantial supplier and market access beyond provincial boundaries. This finding implies that supply and sales networks operating within the province, particularly among firms within the same industry or closely related sectors, hold considerable importance, whereas supply and sales networks that transcend provincial borders appear to be comparatively diminished.

Furthermore, an examination of models (4) and (5) reveals that supplier accessibility exerts a significantly positive influence on both domestic and international enterprises within the province. The general discussion is that insufficient development of local firms that provide intermediate goods disincentivize the entry of Japanese firms to certain provinces; however, it is evident that the provision of intermediate goods from local suppliers, alongside the existing foreign enterprises, has gained significance. In other words, this implies the potential existence of a spillover effect affecting local firms that are positioned upstream of foreign entities.[21] This is associated with the policy focus on the procurement from local firms, as articulated in Section 1.[22] This is associated with the policy focus on the procurement from local firms, as articulated in Section 1. Nevertheless, a comparison of models (8) and (9) indicates that while market access for foreign firms is considerably positive, the market access for local firms within the province does not achieve statistical significance. This observation suggests that upon entering a province, Japanese firms prioritize the opportunity to engage with foreign firms, while interactions with local firms are deemed less critical. This exemplifies the notion that downstream spillover effects from foreign entities to local firms may be insufficiently manifest.

Our findings reveal two complementary forces shaping Japanese FDI location choices in Thailand. First, structural upgrading toward higher product complexity has shifted the basis of competitiveness from low wages to network-based advantages. Provinces hosting industries with complex production processes offer stronger agglomeration benefits, explaining why supplier and market access dominate wage considerations in later periods. Second, the growing representation and capability of local firms amplify these effects by providing reliable intermediate inputs and distribution channels. This evolution is evident in the rising significance of local supplier access and

[21] Regarding the upstream and downstream spillover effects, see also Javorcik (2004). We plan to conduct a detailed analysis of the spillover effects of foreign firms in Thailand in other paper.

[22] It is possible to examine the impact of policies such as tariffs on specific provinces, but since there are as many studies showing a positive correlation as there are studies showing a negative correlation with the impact of such policies on FDI, and it would be difficult to examine differences by province, this is not addressed in this paper. See also Nielsen et al. (2017) on this point.

the emergence of positive market access effects for domestic firms, signaling deeper integration of local enterprises into regional value chains.

Furthermore, to what degree does the presence of established Japanese enterprises exert influence on new market entrants in Thailand? In the preceding analysis, we examined the effects of all foreign enterprises, inclusive of Japanese firms; however, in this discourse, we concentrate specifically on Japanese firms to investigate the disparities.[23] Nonetheless, due to the differing nature of the data, it is imperative that comparisons are conducted with a degree of caution.[24] The outcomes of models (10) and (12) exhibit similarities to those of models (5) and (9), indicating that the supply and sales networks of pre-existing Japanese firms in regions where new business ventures are contemplated are of paramount significance.[25] Furthermore, as indicated by models (11) and (13), the supplier and market access afforded by Japanese firms situated outside the province yield significantly adverse results. This finding implies that the supply and sales networks of Japanese firms within the industry or affiliated sectors that are concentrated in a specific province hold substantial importance, whereas the relevance of networks that extend across provincial boundaries is comparatively diminished.

[23] There are no significant differences between foreign firms overall and Japanese firms, but some differences are observed in Analysis 3, which we will re-examine later.
[24] Japanese share of FDI in Thailand is as mentioned in Section 1, but according to the 2007 *Thai Industrial Census*, which lists the nationalities of foreign firms, of the 1,972 business establishments containing foreign capital, Japanese firms hold the largest number of shares in 791 establishments.
[25] Since a simple comparison is not possible, it is not appropriate to calculate and compare marginal effects, but we will examine this point in more detail later.

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lnrwages	1.996***	1.223***	1.721***	1.752***	0.922***	1.380***	1.861***	1.938***	0.928***	0.559	1.863***	1.258***	1.820***
	(0.319)	(0.345)	(0.339)	(0.332)	(0.348)	(0.339)	(0.328)	(0.325)	(0.346)	(0.369)	(0.340)	(0.336)	(0.341)
lnrmw	-6.477***	-8.642***	-1.073	-7.582***	-8.260***	-8.214***	-3.080**	-6.821***	-8.651***	-6.963***	-0.292	-6.947***	-0.129
	(0.997)	(1.032)	(1.292)	(1.074)	(0.981)	(1.032)	(1.260)	(1.044)	(1.023)	(0.967)	(1.301)	(0.993)	(1.260)
lnrGRP	0.683***	0.420***	0.590***	0.582***	0.393***	0.472***	0.601***	0.643***	0.428***	0.0729	0.438***	0.225**	0.450***
	(0.0797)	(0.0902)	(0.0868)	(0.0879)	(0.0883)	(0.0884)	(0.0847)	(0.0881)	(0.0870)	(0.0946)	(0.0913)	(0.102)	(0.0907)
lnPA	1.463***	1.106***	2.279***	1.255***	1.176***	1.035***	1.925***	1.351***	1.167***	0.754***	2.499***	1.086***	2.492***
	(0.143)	(0.152)	(0.183)	(0.160)	(0.146)	(0.159)	(0.171)	(0.176)	(0.148)	(0.155)	(0.195)	(0.156)	(0.184)
lnSA_I		0.503***											
		(0.0856)											
lnSA_O			-1.759***										
			(0.255)										
lnSA_IL				0.218***									
				(0.0813)									
lnSA_IF					0.449***								
					(0.0656)								
lnMA_I						0.473***							
						(0.0878)							
lnMA_O							-1.049***						
							(0.228)						
lnMA_IL								0.0896					
								(0.0831)					
lnMA_IF									0.523***				
									(0.0721)				
lnSA_IJ										0.744***			
										(0.0797)			
lnSA_OJ											-1.923***		
											(0.248)		
lnMA_IJ												0.633***	
												(0.0928)	
lnMA_OJ													-2.030***
													(0.236)
Observations	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960
Pseudo R-squared	0.367	0.379	0.383	0.369	0.386	0.376	0.374	0.367	0.384	0.426	0.387	0.383	0.392

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Estimation results (Analysis 1)

With respect to analysis 2 (2011-2015) (refer to Table 5), similar to the findings of analysis 1, both real wages and real Gross Regional Product (GRP) exhibit statistically significant positive correlations. Moreover, upon juxtaposing models (2) and (3) alongside models (6) and (7), consistent with the outcomes of analysis 1, it is observed that supplier and market access within the provincial context are significantly positive, whereas those external to the province present significantly negative results. Nevertheless, while models (4) and (5) bear resemblance to the findings in analysis 1, models (8) and (9) reveal that market access for not only foreign enterprises operating within the province but also for domestic firms is significantly positive at the 10% significance level, thereby suggesting that transactions with local firms are increasingly gaining importance.

On the contrary, the coefficient associated with the real minimum wage exhibits a markedly positive correlation, which stands in stark contrast to the findings of Analysis 1. This observation is intrinsically linked to the decision made by the Thai government, as delineated in Section 1, to elevate the nominal minimum wage in 2012 for the purpose of mitigating disparities across provinces, and to standardize the nominal minimum wage nationwide at 300 baht per day from 2013 to 2016. In any event, it is posited that Japanese corporations have increasingly ventured into provinces characterized by elevated real minimum wages during this interval, and that the impetus for expansion predicated on lower wage structures has been significantly curtailed. This phenomenon may be attributable to the progression of industries, goods, and processes transitioning from labor-intensive frameworks reliant on low-wage labor to capital-intensive paradigms that necessitate higher skill levels, confirming what has hypothesized by the fragmented flying geese theory. Concerning the port access index, multiple models reveal either a lack of significance or a negative correlation, diverging from initial assumptions within the context of Analysis 2. This situation is related to the impairment of the ports in Bangkok and Samut Prakan due to the catastrophic flooding that occurred in 2011, which precipitated a decline in the port access index for both regions. In terms of the impact exerted by Japanese firms, the observed trends are, in general, consistent with those identified in Analysis 1.

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lnrwages	2.486***	2.584***	1.966***	2.718***	2.455***	2.635***	2.114***	2.521***	2.627***	2.087***	2.155***	2.096***	1.992***
	(0.138)	(0.204)	(0.169)	(0.170)	(0.239)	(0.168)	(0.154)	(0.142)	(0.219)	(0.241)	(0.151)	(0.227)	(0.151)
lnrmw	2.692***	2.583***	3.043***	2.609***	2.595***	2.666***	3.032***	2.678***	2.735***	2.796***	3.031***	2.941***	3.211***
	(0.417)	(0.420)	(0.428)	(0.418)	(0.423)	(0.419)	(0.427)	(0.417)	(0.422)	(0.423)	(0.426)	(0.424)	(0.430)
lnrGRP	0.674***	0.489***	0.842***	0.513***	0.504***	0.400***	0.743***	0.616***	0.310***	0.232***	0.683***	0.124**	0.679***
	(0.0429)	(0.0491)	(0.0495)	(0.0482)	(0.0488)	(0.0534)	(0.0459)	(0.0528)	(0.0545)	(0.0543)	(0.0449)	(0.0578)	(0.0454)
lnPA	0.706***	-0.0366	1.629***	0.208**	-0.0186	0.196**	1.404***	0.592***	0.171*	-0.317***	1.549***	-0.108	1.625***
	(0.0802)	(0.101)	(0.110)	(0.0988)	(0.0960)	(0.0958)	(0.105)	(0.101)	(0.0885)	(0.103)	(0.114)	(0.0966)	(0.108)
lnSA_I		0.466***											
		(0.0431)											
lnSA_O			-1.555***										
			(0.133)										
lnSA_IL				0.336***									
				(0.0396)									
lnSA_IF					0.387***								
					(0.0384)								
lnMA_I						0.461***							
						(0.0519)							
lnMA_O							-1.144***						
							(0.121)						
lnMA_IL								0.0951*					
								(0.0509)					
lnMA_IF									0.542***				
									(0.0471)				
lnSA_IJ										0.608***			
										(0.0535)			
lnSA_OJ											-1.230***		
											(0.129)		
lnMA_IJ												0.739***	
												(0.0470)	
lnMA_OJ													-1.573***
													(0.138)
Observations	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310	79,310
Pseudo R-squared	0.377	0.397	0.397	0.388	0.401	0.388	0.390	0.377	0.400	0.423	0.390	0.423	0.396

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Estimation results (Analysis 2)

Thirdly, in analysis 3 (2016-2020) (refer to Table 6), the real minimum wage, real Gross Regional Product (GRP), and port accessibility exhibit significantly positive correlations, in alignment with the findings of analysis 2. Nevertheless, the significance of the real wage has diminished, particularly in models that integrate the access index within the province, indicating a reduction in the relevance of wage levels. This observation may imply an augmented significance of supply and sales networks. Furthermore, an examination of models (3) and (7) reveals that supplier and market access external to the province were significantly negative at the 1% level in analyses 1 and 2, yet were significantly negative at the 5% level in analysis 3, indicating that the supply and sales networks spanning provincial borders have notably expanded compared to prior assessments. Specifically, a comparison of models (11) and (13) with earlier analyses demonstrates a marked decrease in the significance level, suggesting that Japanese enterprises are broadening their supply and sales networks not only within the province but also beyond its confines. Additionally, an evaluation of models (8) from Analysis 1 to Analysis 3 indicates that market access for local enterprises within the province was insignificant in Analysis 1, yet exhibited a significant positive correlation at the 10% level in Analysis 2 and at the 1% level in Analysis 3, underscoring that as local firms advanced, this factor became critical for the entry of Japanese firms into the province. This observation suggests the potential occurrence of spillover effects not solely upstream but also downstream of foreign firms during these temporal frames.

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lnrwages	1.211***	-0.0872	0.983***	0.532	0.0944	0.867**	0.994***	1.090***	0.499	-0.138	1.168***	0.0768	1.131***
	(0.351)	(0.437)	(0.354)	(0.418)	(0.442)	(0.399)	(0.349)	(0.375)	(0.425)	(0.436)	(0.349)	(0.411)	(0.348)
lnrmw	11.11***	13.53***	10.22***	11.13***	13.93***	12.68***	8.039***	11.27***	14.90***	11.77***	10.85***	12.25***	10.80***
	(2.560)	(2.553)	(2.528)	(2.546)	(2.579)	(2.620)	(2.786)	(2.575)	(2.724)	(2.550)	(2.550)	(2.580)	(2.542)
lnrGRP	0.651***	0.509***	0.723***	0.520***	0.567***	0.428***	0.690***	0.506***	0.334***	0.205**	0.649***	0.138	0.647***
	(0.0704)	(0.0776)	(0.0781)	(0.0769)	(0.0759)	(0.0930)	(0.0735)	(0.0880)	(0.0973)	(0.0919)	(0.0708)	(0.0924)	(0.0709)
lnPA	1.166***	0.782***	1.461***	0.936***	0.815***	0.969***	1.493***	1.004***	1.030***	0.409**	1.296***	0.491**	1.333***
	(0.160)	(0.179)	(0.192)	(0.177)	(0.170)	(0.175)	(0.201)	(0.176)	(0.170)	(0.189)	(0.194)	(0.192)	(0.189)
lnSA_I		0.533***											
		(0.0896)											
lnSA_O			-0.559**										
			(0.219)										
lnSA_IL				0.350***									
				(0.0791)									
lnSA_IF					0.335***								
					(0.0659)								
lnMA_I						0.364***							
						(0.103)							
lnMA_O							-0.538**						
							(0.214)						
lnMA_IL								0.237***					
								(0.0905)					
lnMA_IF									0.455***				
									(0.0993)				
lnSA_IJ										0.550***			
										(0.0852)			
lnSA_OJ											-0.216		
											(0.193)		
lnMA_IJ												0.727***	
												(0.0892)	
lnMA_OJ													-0.315
													(0.205)
Observations	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025
Pseudo R-squared	0.403	0.420	0.406	0.412	0.416	0.408	0.406	0.406	0.412	0.436	0.403	0.440	0.404

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Estimation results (Analysis 3)

Furthermore, to elucidate the divergent roles of domestic and international enterprises, we examine the trends in the coefficients related to supplier access and market access as presented in models (4), (5), (8), and (9) across analyses 1 to 3. Our findings reveal that while the coefficients for international firms exhibit a downward trajectory over the years, those corresponding to domestic firms show an upward trend. This observation indicates that as Japanese firms penetrate the Thai market, the influence of pre-existing international firms diminishes, concurrently with an enhancement in the prominence of local firms.

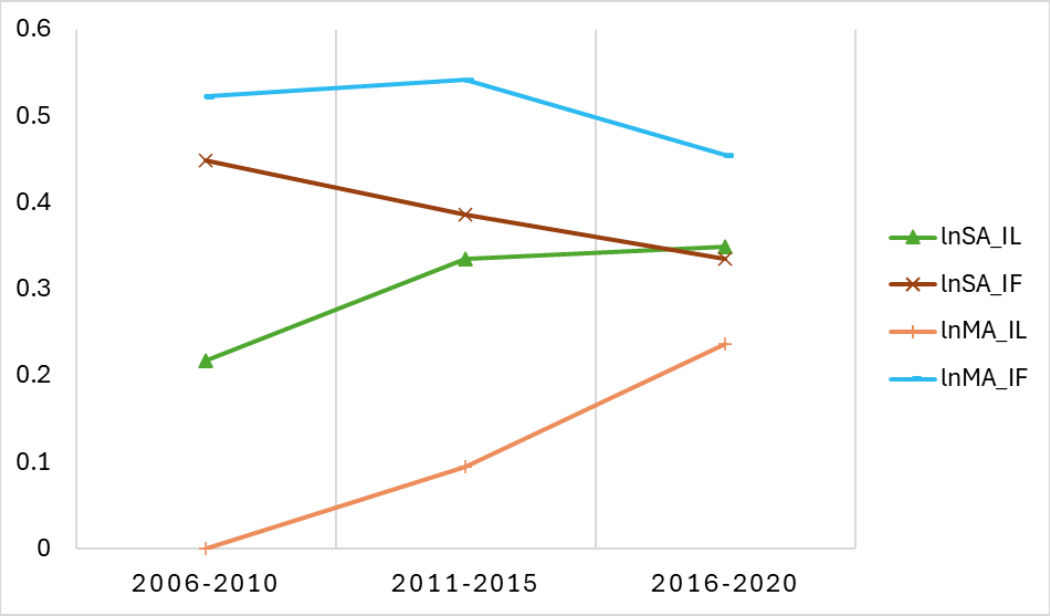


Figure 3: Changes in the coefficients of supplier and market access for local and foreign firms

Industrial Census microdata show expansion and upgrading of local Thai firms—with stronger presence in capital-intensive sectors and faster growth in real sales per worker for local firms relative to foreign firms—signaling rising domestic capabilities. This structural change maps directly onto the conditional-logit results: over time, coefficients for local supplier/market access increase, while those for foreign firms decline (Figure 3).

Due to the variability inherent in the data that constitutes the access index, one must exercise caution when conducting straightforward comparisons of the pseudo-R2 coefficients across different models. Nonetheless, it remains feasible to assess the dynamic transitions from Analysis 1 to Analysis 3. When contrasting models (4) and (8) from Analysis 1 to Analysis 3 with models (5) and (9), the pseudo-R2 coefficient of the former—specifically the model that incorporates the supplier and market access of local firms within the province—exhibits a more pronounced increase, thereby underscoring the escalating significance of local firms. In the comparison of models (5) and (10) from Analysis 1 to Analysis 3, the pseudo-R2 coefficient of the former, which utilizes the supplier and market access of local firms within the province, shows an upward trend, while the pseudo-R2 coefficient of the latter, which employs the supplier access of foreign firms within the province,

remains relatively stable. This observation suggests that Japanese firms are increasingly relying on local firms, rather than solely on other Japanese firms, for the procurement of intermediate goods.[26] Moreover, with the exception of model (10), which relies on supplier access within the province for Japanese firms and where the pseudo-R2 coefficient exhibited minimal variation, there has been a consistent annual increase in the pseudo-R2 coefficients across all other models. This trend indicates that the analytical framework employed in this study is progressively enhancing its efficacy over time.[27]

Although this examination encompasses a brief temporal scope (2006-2020), the assertion that supplier and market accessibility for domestic enterprises has gained significance is congruent with the progression of Thai manufacturing. Furthermore, Japanese corporations have fortified their supply chains not solely with fellow Japanese entities but also in collaboration with local enterprises, with supply and sales networks extending beyond the confines of individual provinces and transcending provincial boundaries. The trade dynamics between Japan and Thailand have exhibited a tendency towards stabilization since the year 2000; however, while networks with local and non-Japanese foreign firms have incrementally evolved, the relative significance of the concentration of pre-existing Japanese firms has experienced a decline, and supply and sales networks that incorporate both local and foreign firms, traversing both intra- and inter-provincial realms, have been progressively established. These observations suggest that, although distance and agglomeration—concepts emphasized by New Economic Geography—are indeed critical, as supply and sales networks expand incrementally and the division of labor evolves, a fragmented flying-geese model of development at the component level is underway, which also encompasses local firms.

5.2. Product complexity as a structural driver of network-based advantages

In this section, we aim to justify the above findings by relating them to the development of Thailand's export Product Complexity Index (PCI). We argue that its distribution shifts markedly from low-complexity goods in the 1990s to higher-complexity levels by the mid-2010s (Figure 4), revealing sustained upgrading at the product level consistent with fragmented flying-geese dynamics.

In industries characterized by more complex product architectures, Japanese entrants benefit disproportionately from proximity to specialized inputs and end-use markets, which explains why

[26] The trends in the pseudo-R^2 coefficient for several models from Analysis 1 to 3 are summarized below.
Model 4 (SA_IL): 0.369, 0.388, 0.412, Model 5 (SA_IF): 0.386, 0.401, 0.416
Model 8 (MA_IL): 0.367, 0.377, 0.406, Model 9 (MA_IF): 0.384, 0.400, 0.412
Model 10 (SA_IJ): 0.426, 0.423, 0.436, Model 12 (MA_IJ): 0.383, 0.423, 0.440

[27] In addition, because the impact of supplier access and other factors may differ depending on the industry, it is possible to analyze industries separately into those with relatively low and high added value. However, if we consider ISIC Rev. 4 industry codes 10-18 as the former and 19-33 (in fact, up to 30) as the latter, then the latter account for 89.3% of Japanese firms that entered the country in the period covered by Analysis 2, from 2011 to 2015. Therefore, focusing only on the former may lead to sample bias, and the results of this paper can be said to be largely centered on the latter.

supplier and market access within provinces dominate wage considerations in later periods. This complexity-driven mechanism also rationalizes the **attenuation of the wage signal** when intra-provincial access indices are included: as provinces accumulate capabilities (components, processes, and complementary services), the value of co-location with complex supply chains rises relative to marginal differences in labor costs

We use the Product Complexity Index (PCI) to examine the quality and sophistication of Thai export goods.[28] Figure 4 shows the trends in the proportion of export value of goods exported by Thailand based on the five-digit PCI calculated for each year and product from UN Comtrade export data (SITC Rev.3).[29] The PCI values are categorized into five levels, with an equal number of PCIs in each level. As can be seen from this figure, the proportion of export goods at levels 1 and 2, which was very high in the 1990s, has declined year by year, and the proportion of export goods at level 3 increased in the 2000s, and then to level 4 and level 5, with the level of export goods with the highest proportion rising year by year. The flying geese theory has been criticized for being inadequate in the current context of advanced division of labor, as it focuses on industry-level analysis, but this figure shows the flying geese development at the product level in Thailand. Bui et al. (2022) call such development fragmented flying geese (FFG) pattern, but this is the first time that FFG has been revealed using PCI.

[28] PCI calculates precise values by repeated computations, but here we use the value calculated 17 times (kp17) as the indicator of product complexity. For more information on PCI, refer to Hausmann et al. (2013) and Hidalgo (2021). Other indicators, such as PRODY and EXPY (Hausmann, Hwang, and Rodrik 2007), have limitations, including their reliance on each country's income level in the calculation process. Therefore, we use PCI, which does not incorporate such data.

[29] In practice, import data is used in place of export data to ensure accuracy. Since PCI values fluctuate annually, they are calculated using a five-year backward moving average, and in this figure, the average value for 2015 (average value from 2011 to 2015) is used as the basis.

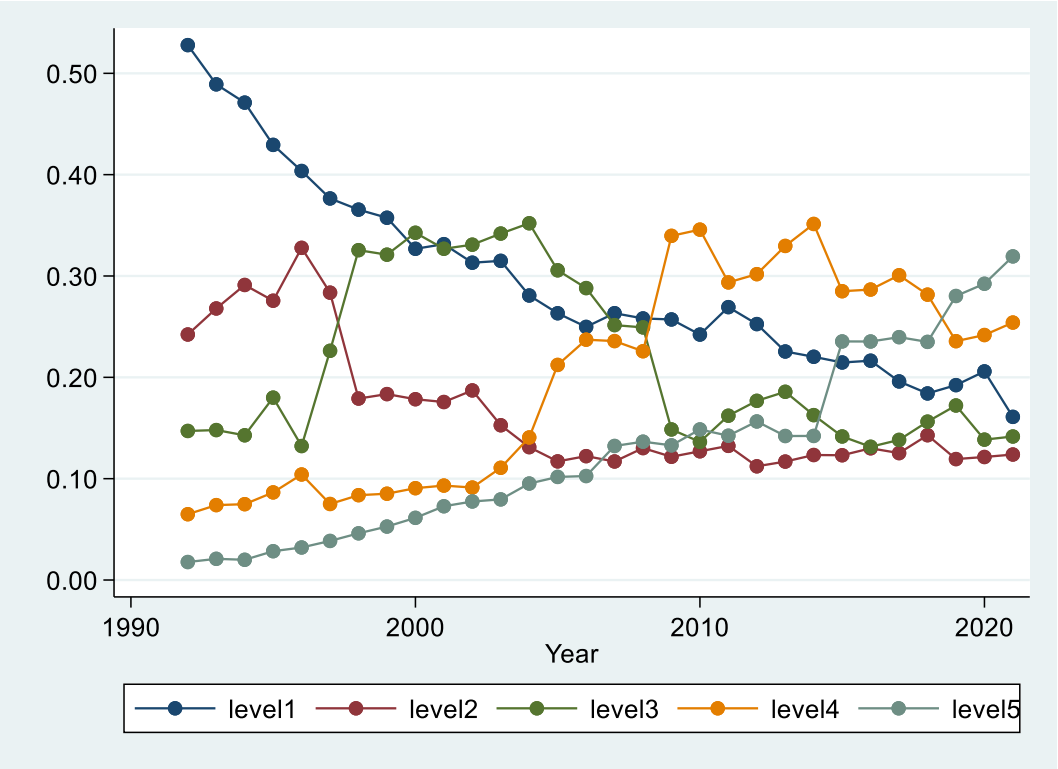


Figure 4. Trends in Thai export goods by PCI level

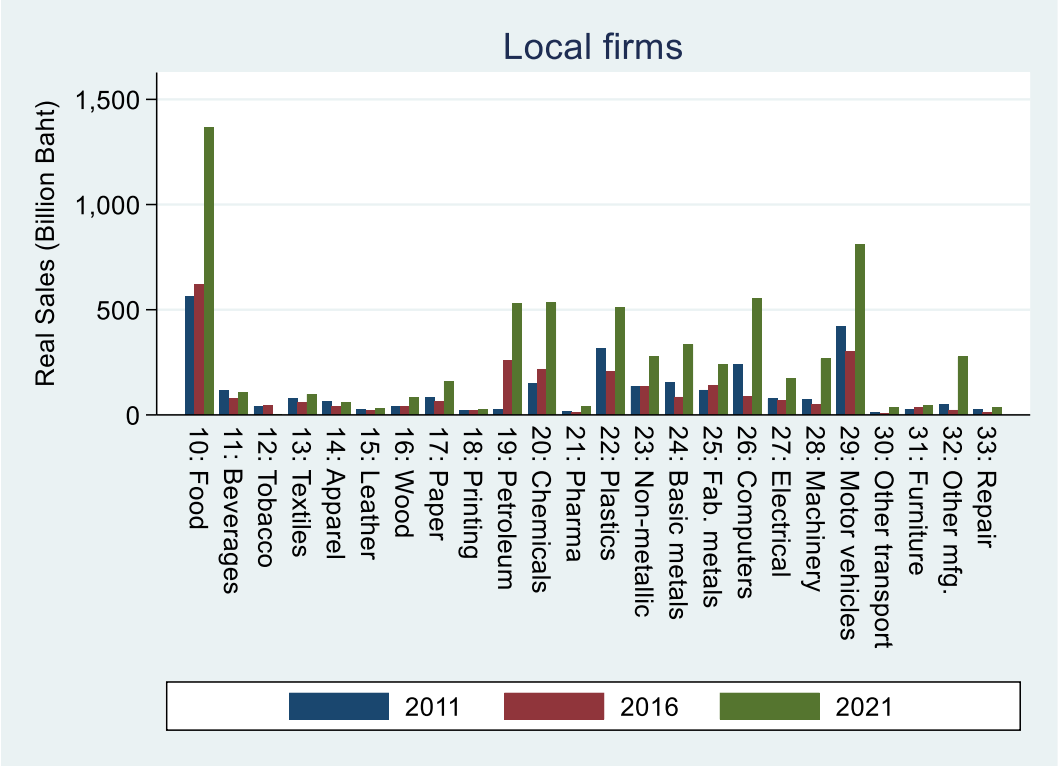
Source: UN Comtrade, SITC Rev.3

5.3. Increasing local firm representation as a dynamic mechanism

Our results align with our previous study's findings on Japanese MNEs in Thailand. According to Bui et al. (2022, especially Figure 14), in 2000, many Japanese firms in the electrical equipment industry in Thailand cited low wages and the domestic Thai market as reasons for moving into the country, but as of 2010 and 2020, there has been a significant increase in the number of firms citing the presence of production networks as a reason. The reason for this is that agglomeration in Thailand has made the country even more attractive, with an increasing number of Japanese firms moving there due to the presence of local production networks rather than the country's low wage levels.[30]

[30] The concept of agglomeration is often used ambiguously. Fujita et al. (1999) describe agglomeration as "the clustering of economic activity, created and sustained by some sort of circular logic" (p. 1). Supplier access and agglomeration are sometimes used in a similar sense, and when calculating indicators of agglomeration, the concentration of locations in terms of the number of employees is often used (e.g., Ellison and Glaeser, 1997). In this paper, we would like to take supply and sales networks, including sources and destinations of intermediate goods (but excluding final demand), as indicated by supplier and market access in the region as agglomerations, taking into account their measurability as objective figures. Such agglomerations may be limited to a small geographical area, but may also exist across a wider area as transportation costs (both narrow and broad) decline; the latter are sometimes called RVCs. See also Bui et al. (2022) on this point.

Thailand has been developing steadily, second only to Malaysia among the ASEAN4 countries.[31] It is said that foreign firms, especially Japanese firms, have played an important role in the development of Thai manufacturing. Figure 5 shows the trends in real sales (all in baht) for each industry, divided into local and foreign firms (industry code: ISIC Rev.4).[32] Local firms have a particularly strong presence in industry 10, food manufacturing, while foreign firms have increased their real sales in industry 26, electronics, and industry 29, automobile manufacturing.



[31] ASEAN4 refers to Malaysia, Thailand, Indonesia, and the Philippines.

[32] To calculate real values, we used the Manufacturing Producer Price Index (base year 2000) from the Trade Policy and Strategy Office of the Ministry of Commerce of Thailand.

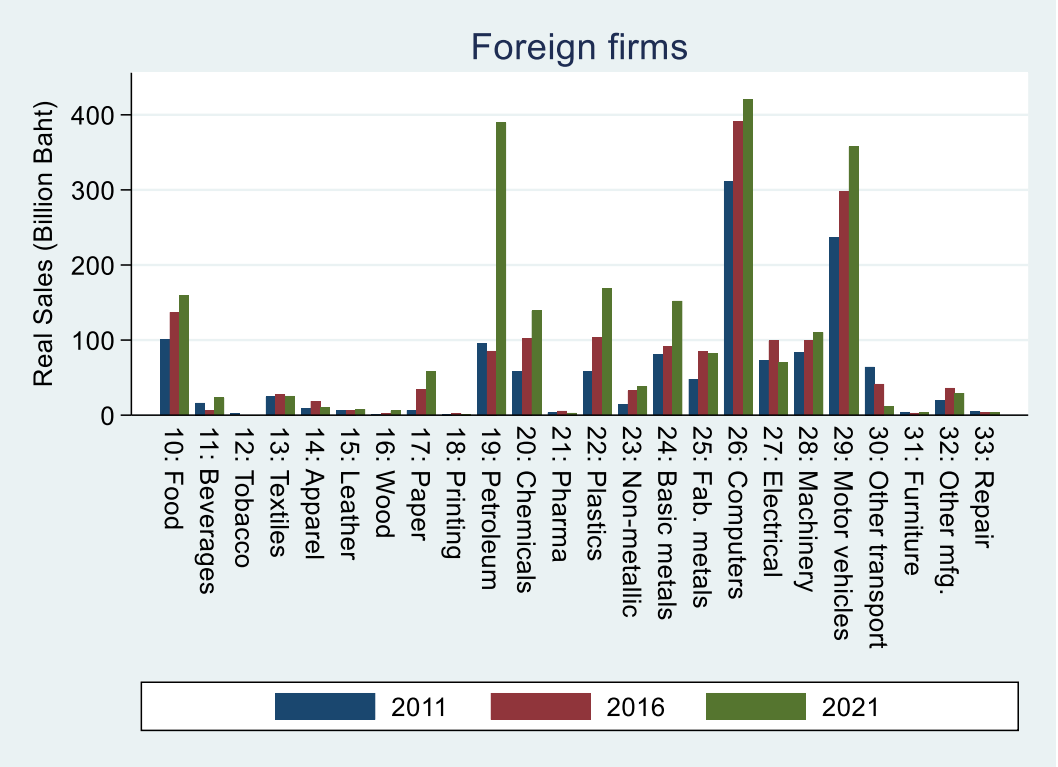


Figure 5. Changes in real sales by industry for local and foreign firms: 2011, 2016, 2021
Source: Thai National Statistical Office, *Thai Industrial Census*, 2012, 2017, 2022

In addition, looking at the growth rate of the number of workers by industry from 2011 to 2021 (Figure 6), in relatively labor-intensive and low value-added industries such as industry codes 13 to 15 (textiles, clothing, and leather), both local and foreign firms are reducing the number of workers. In contrast, in relatively capital-intensive and high value-added industries such as industry code 22 to 29 (plastics, non-metallic minerals, metals, computers, electronic products, machinery, and automobiles), both local and foreign firms are increasing the number of workers, indicating that the industrial structure is becoming more advanced.[33] Furthermore, in industries such as 10 (food), 11 (beverages), 19 (petroleum), 21 (pharmaceuticals), 30 (other transportation equipment), and 32 (others), the growth rate of foreign firms is negative, while the growth rate of local firms is positive, indicating that the role of foreign firms in these industries is declining and the role of local firms is increasing. In addition, while real sales per worker (baht) for all manufacturing workers has consistently been higher for foreign firms, the growth rate for local firms (119.1%) from 2006 to 2021 is much higher than that for foreign firms (24.9%) (see Figure A1).

[33] The numbers of workers and total wages referenced below are for workers engaged in the production process. The tobacco industry (industry code 12) is excluded from this discussion due to its unique influencing factors.

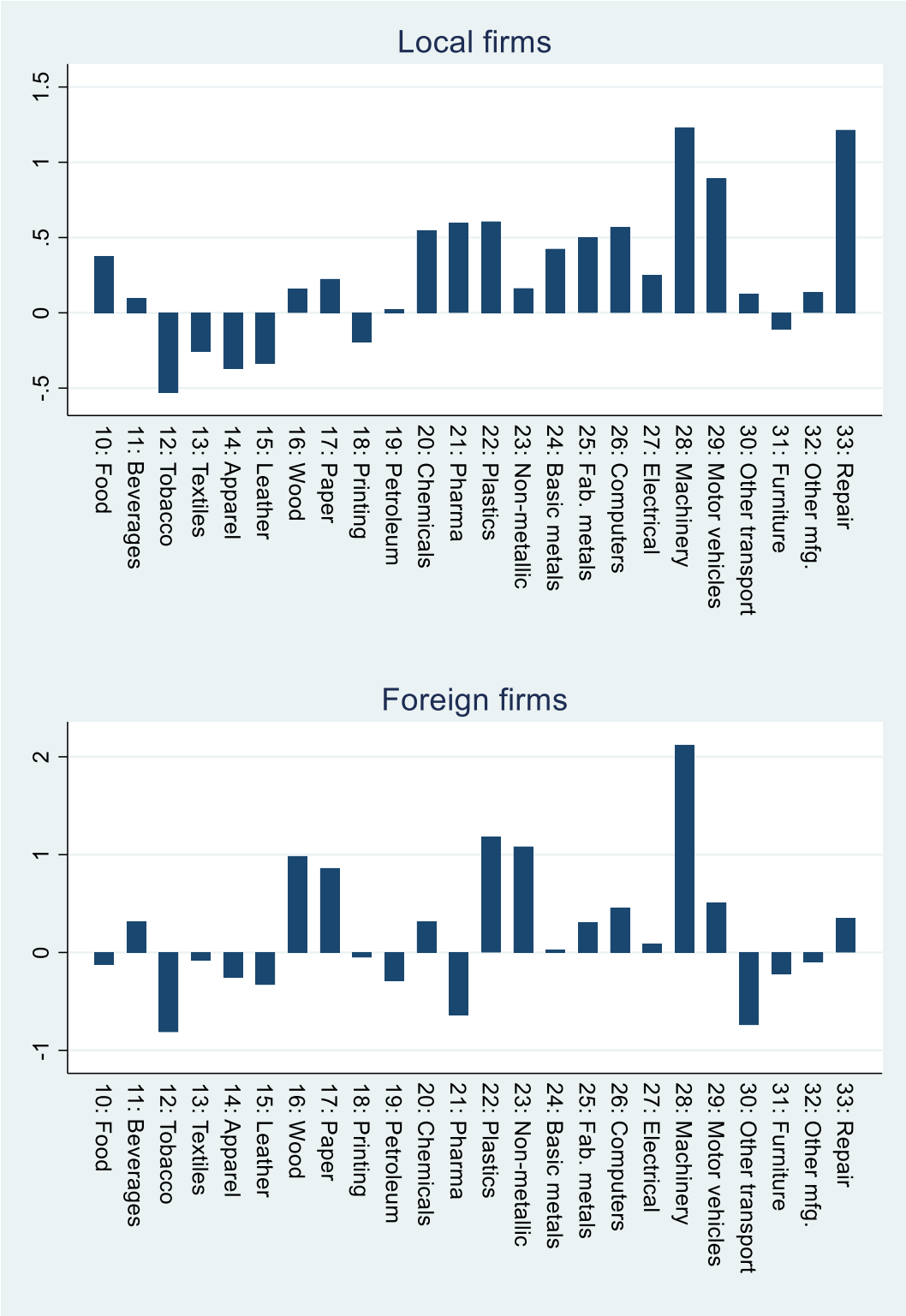


Figure 6. Growth rates of the number of workers by industry.

Source: Thai National Statistical Office, *Thai Industrial Census*, 2012, 2022.

6. Concluding remarks

In this paper, we have undertaken a comprehensive static and dynamic analysis of the dynamic changes in location choice and the evolving landscape of Japanese FDI in Thailand, utilizing the frameworks of new economic geography and the fragmented flying geese theory. Our empirical findings underscore the critical role of local supply chains and market accessibility in shaping the investment strategies of Japanese firms, challenging the conventional wisdom that emphasizes wage levels as the primary determinant of foreign investment decisions. In addition, the fact that the dynamic changes are clarified structurally using indicators such as PCI and IIT, rather than just econometrical analysis, is also an essential and original contribution.[34]

As Thailand's manufacturing sector becomes more matured, the significance of local firms and their networks has intensified, reflecting a shift in the motivations driving Japanese companies to invest in the region. The data reveals that rather than solely seeking low labor costs, Japanese firms are increasingly drawn to the robust agglomerations and regional value chains that have developed within Thailand. This evolution highlights the importance of supplier access and market potential, which have emerged as pivotal factors influencing location choices, particularly as the Thai manufacturing sector becomes more sophisticated and integrated into global value chains.

Our analysis also indicates that the relationship between local and foreign firms is undergoing a transformation. While the presence of Japanese firms has historically been a crucial factor for new entrants, the growing capabilities of local firms suggest that they are becoming more integral to the supply chain dynamics. This trend points toward a more collaborative framework where local and foreign enterprises coalesce to enhance productivity and innovation within the Thai economy.

As the manufacturing sector and trade framework in Thailand advance in complexity, agglomerations, encompassing both forward and backward linkage effects such as supplier accessibility and market reach, alongside RVCs, have assumed a pivotal role in drawing Japanese enterprises to Thailand. According to the flying geese paradigm, although FDI is migrating towards less developed nations in search of low-cost labor, the influx of foreign capital, particularly from Japan, is intensifying in Thailand notwithstanding escalating wage rates; this phenomenon can be attributed to the growing significance of domestic supply and distribution networks over wage considerations. Moreover, the influence of local enterprises is also on the rise, as supply and distribution networks involving indigenous firms are being established concurrently with the evolution of Thai manufacturing. Additionally, networks with non-Japanese foreign firms and those external to the province are also proliferating, revealing a marked enhancement in the productivity of local firms, as well as a diminishing productivity disparity between local and foreign enterprises within this context.

Conversely, agglomeration and the progression of economies concurrently also give rise to mechanisms of dispersion. As wage rates ascend, labor-intensive sectors, products, and processes

[34] The port access index is a minor contributor.

are inclined to migrate to less developed nations or regions, and the excessive concentration of industries in Bangkok also serves as a catalyst for dispersion to alternative countries and regions.

Will the Thai economy persist in its trajectory of development in the forthcoming years, or is it poised to succumb to what is commonly referred to as the middle-income trap? Furthermore, the disruptions in supply chains and sales networks, coupled with the constraints on international expansion stemming from the ramifications of Covid-19, render the future markedly more ambiguous. Nevertheless, it is imperative for Thailand to enhance its industrial and trade frameworks by engaging not solely foreign enterprises but also domestic companies, while simultaneously expanding its supply chains and sales networks (or RVCs) across the Indochina Peninsula, which encompasses the CLMV nations. The insights derived from our study have significant implications for policymakers and stakeholders aiming to bolster Thailand's attractiveness as an investment destination. By fostering an environment that supports the development of local firms and enhancing the interconnectedness of supply and distribution networks, Thailand can further solidify its position as a key player in the regional and global economic landscape.

It has been posited that the flying geese theory has diminished in effectiveness as the division of labor progresses; however, with the advancement of labor division, there have emerged not only intra-district agglomerations but also intra-regional agglomerations that transcend national boundaries, culminating in the establishment of RVCs rather than GVCs (Baldwin and Okubo, 2013). In this framework, the transference of capital and technology from developed nations to their less developed counterparts is occurring, alongside a segmented development of flying geese at the product level. These phenomena align with the theory of FFG elaborated upon in Section 3; nevertheless, a systematic and comprehensive analysis at the regional level that encompasses a greater number of countries beyond a select few is warranted. Furthermore, the econometric analysis presented in this study is confined to a temporal scope of 15 years, and it would be advantageous to pursue analyses that extend beyond this timeframe, either prior to or subsequent to the current period.

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Data availability statement: Although some of the data that support the findings of this study are available online, some of it require a contract with the publisher.
Conflict of interests: The authors declare that they have no conflict of interest.
Declarations: They comply with ethical standards.

References

Adhikary, B. (2017). Factors Influencing Foreign Direct Investment in South Asia Economies. *South Asia Journal of Business Studies,* 6(1), 8-37

Akune, Y., & Tokunaga, S. (2007). Location Choice and Agglomeration Effect on Japanese Multinational Food Companies in East Asia and NAFTA/EU: Panel Data Analysis. *Journal of Applied Regional Science*, 12, 27-39. (in Japanese)

Akune, Y., & Tokunaga, S. (2012). Market Access, Supplier Access and Final Processed Food Location for Japanese Food Industry FDI in East Asia. *Studies in Regional Science*, 42, 287-304. (in Japanese)

Akune, Y., Tokunaga, S., & Shi, M. (2003). Location Choice of Japanese Food Industry in the East Asia. *Development Study,* 13(3), 1-9.

Almfraji, M., & Almsafir, M. (2014). Foreign Direct Investment and Economic Growth Literature Review from 1994 to 2012. *Procedia - Social and Behavioral Sciences,* 129, 206-213.

Amiti, M., & Javorcik, B. (2008). Trade Costs and Location of Foreign Firms in China. *Journal of Development Economics,* 85(1-2), 129-149.

Amiti, M., & Cameron, L. (2007). Economic Geography and Wages. *The Review of Economics and Statistics*, 89(1), 15-29.

Anyanwu, J. (2012). Why Does Foreign Direct Investment Go Where It Goes? *Annals of Economics and Finance,* 13, 425-462.

Baldwin, R., & Okubo, T. (2014). Networked FDI: Sales and Sourcing Patterns of Japanese Foreign Affiliates. *World Economy*, 37(8), 1051-1080.

Bartik, T. (1985). Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States. *Journal of Business & Economic Statistics,* 3(1), 14-22.

Belderbos, R., & Carree, M. (2002). The Location of Japanese Investment in China: Agglomeration Effects, Keiretsu, and Firm Heterogeneity. *Journal of the Japanese and International Economics,* 16, 194-211.

Boermans, M., Roelfsema, H., & Zhang, Y. (2011). Regional Determinants of FDI in China: A Factor-based Approach. *Journal of Chinese Economic and Business Studies,* 9(1), 23-42.

Brainard, S. L. (1997). An empirical assessment of the proximity-concentration tradeoff between multinational sales and trade. *American Economic Review, 87*(4), 520–544.

Bretas, V., Alon, I., Paltrinieri, A., & Chawla, K. (2022). Bibliometric Review on FDI Attractiveness

Factors. *European Journal of International Management,* 17(2-3), 469-499.

Bronzini, R. (2007). FDI Inflows, Agglomeration and Host Country Firms' Size: Evidence from Italy. *Regional Studies,* 41(7), 963-978.

Bui, M., Miura, R., Saito, M., Shibata, Y., & Suenaga, K. (2022). Fragmented Flying Geese (FFG) and Intra-Regional Agglomeration: Towards a Model Explaining Location Shifting of Japanese Multinational Corporations and the Electric Value Chains of ASEAN Economies. *Economies,* 10(10), 238.

Bui, M. & Preechametta, A. (2019). Will Manufacturing Investors Go to Border Zones? The Case of Central Thailand. *International Journal of Emerging Markets*, 16(2), 323-346.

Carr, D. L., Markusen, J. R., & Maskus, K. E. (2001). Estimating the knowledge-capital model of the multinational enterprise. *American Economic Review, 91*(3), 693–708.

Carstensen, B., & Toubal, F. (2004). Foreign Direct Investment in Central and Eastern European Countries: A Dynamic Panel Analysis. *Journal of Comparative Economics,* 32(1), 3-22.

Casi, L., & Resmini, L. (2010). Evidence on the Determinants of Foreign Direct Investment: The Case of EU Regions. *Eastern Journal of European Studies,* 1(2), 93-118.

Chang, K.-I., Hayakawa, K., & Matsuura, T. (2014). Location Choice of Multinational Enterprises in China: Comparison between Japan and Taiwan. *Papers in Regional Science*, 93(3), 521-538.

Chang, S.-J., & Park, S. (2005). Types of Firms Generating Network Externalities and MNC's Co-location Decisions. *Strategic Management Journal,* 26(7), 595-615.

Cheng, S. (2007). Structure of Firm Location Choice: An Experiment of Japanese Greenfield Investment in China. *Asian Economic Journal,* 21(1), 47-73.

Cheng, S. (2008). Location Decision Variations of Japanese Investors in China. *The Review of Regional Studies,* 38(3), 395-415.

Cheng, S., & Stough, R. (2006). Location Decisions of Japanese New Manufacturing Plants in China: A Discrete-choice Analysis. *The Annals of Regional Science,* 40(2), 369-387.

Chidlow, A., Salciuviene, L., & Young, S. (2008). Regional Determinants of Inward FDI Distribution in Poland. *International Business Review,* 18(2), 119-133.

Choe, J. (2003). Do Foreign Direct Investment and Gross Domestic Investment Promote Economic Growth? *Review of Development Economics,* 7(1), 44-57.

Coughlin, C., Terza, J., & Arromdee, V. (1991). State Characteristics and the Location of Foreign Direct Investment Within the United States. *Review of Economics and Statistics,* 73(4), 675-683.

Debaere, P., Lee, J-H & Paik, M. (2010). Agglomeration, Backward and Forward Linkages: Evidence from South Korean Investment in China. *Canadian Journal of Economics*, 43(2), 520-546.

Douglas, W. (1992). Location Determinants of Japanese Startups in the United States. *Southern Economics Journal*, 58(3), 690-708.

Du, J., Lu, Y., & Tao, Z. (2008a). Economic Institutions and FDI Location Choice: Evidence from US Multinationals in China. *Journal of Comparative Economics,* 36(3), 412-429.

Du, J., Lu, Y., & Tao, Z. (2008b). FDI Location Choice: Agglomeration vs Institutions. *International Journal of Finance and Economics,* 13(1), 92-107.

Dunning, J. H. (1977). Trade, location of economic activity and the multinational enterprise: A search for an eclectic approach. In B. Ohlin, P. O. Hesselborn, & P. M. Wijkman (Eds.), *The international allocation of economic activity* (pp. 395–418). Macmillan.

Dunning, J. H. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies, 11*(1), 9–31.

Dunning, J. (1981). *International Production and the Multinational Enterprise.* Geroge Allen & Unwin.

Dunning, J. (1993). *Multinational Enterprises and the Global Corporation.* New York: Addison-Wesley.

Ellison, G. & Glaeser, E. (1997). Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach. *Journal of Political Economy*, 105, 889-927.

Fontagné, L., & Freudenberg, M. (1997). Intra-Industry Trade: Methodological Issues Reconsidered. CEPII Working Papers, 1997-01.

Fujita, M., Krugman, P., & Venables, A. (1999). *The Spatial Economy: Cities, Regions, and International Trade*, MIT Press.

Fujita, M., & Mori, T. (1996). The role of ports in the making of major cities: Self-agglomeration and hub-effect. *Journal of Development Economics, 49*(1), 93–120.

Fukao, K., & Yue, X. (1997). Location decisions of Japan's electric machinery firms. *Keio Journal of Economics,* 90(2), 209-237. (in Japanese)

Garetto, S, Pavcnik, N., Ramondo, N., Alviarez, V., Fan, J., Pandalai-Nayar, N., Limodio, N., Manelici, I., Morales, N., Dardati, E., Garcia-Lembergman, E., Gu, G., Hale, G., Hemous, D., Martin, R., Farrokhi, F., Pellegrina, H., Louis Vezina, L., Boudreau, L., Vasquez, J. (2025) "Foreign Direct Investment and Development" VoxDevLit, 13(1).

Greenaway, D., Hine, R., & Milner, C. (1995). Vertical and Horizontal Intra-Industry Trade: A Cross Industry Analysis for the United Kingdom. *Economic Journal*, 105(433), 1505-1518.

Grubel, H. G. & Lloyd, P. J. (1971). The Empirical Measurement of Intra-Industry Trade. *Economic Record*, 47(4), 494-517.

Guimaraes, P., Figueiredo, O., & Woodward, D. (2000). Agglomeration and the Location of Foreign Direct Investment in Portugal. *Journal of Urban Economics,* 47(1), 115-135.

Guimaraes, P., Rolfe, R., & Woodward, D. (1998). Regional Incentives and Industrial Location in Puerto Rico. *International Regional Science Review,* 21(2), 119-138.

Hanson, G. H. (1996). Localization economies, vertical organization, and trade. *American Economic Review, 86*(5), 1266–1278.

Hanson, G. H. (2001). Should countries promote foreign direct investment? *G-24 Discussion Paper No. 9.* United Nations Conference on Trade and Development.

Harris, C. (1954). The Market as a Factor in the Localization of Industry in the United States. *Annals*

of the Association of American Geographers, 44(4), 315-348.

Hausmann, R., Hidalgo, C., Bustos, S., Coscia, M., Simoes, A., & Yıldırım, M. (2013) *The Atlas of Economic Complexity: Mapping Paths to Prosperity*, MIT Press.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What You Export Matters. *Journal of Economic Growth*, 12, 1-25.

Head, K., & Mayer, T. (2004). Market Potential and the Location of Japanese Investment in the European Union. *Review of Economics and Statistics,* 86(4), 959-972.

Head, K. & Ries, J. (1996). Inter-city Competition for Foreign Direct Investment: Static and Dynamic Effects of China's Incentive Areas. *Journal of Urban Economics*, 40, 38-60.

Head, K., Ries, J., & Swenson, D. (1995). Agglomeration benefits and location choice: Evidence from Japanese manufacturing investment in the United States. *Journal of International Economics,* 38(3-4), 223-247.

Helpman, E. (1984). A simple theory of international trade with multinational corporations. *Journal of Political Economy, 92*(3), 451–471.

Hidalgo, C. A. (2021). Economic Complexity Theory and Applications. *Nature Reviews Physics*, 3, 92-113.

Hirschman, A. O. (1958). *The Strategy of Economic Development.* New Haven, Yale University Press.

Islam, M. S., & Beloucif, A. (2024). Determinants of Foreign Direct Investment: A Systematic Review of the Empirical Studies. *Foreign Trade Review*, 59, 309-337.

Javorcik, B. S. (2004). Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. *American Economic Review*, 94, 605-627.

JETRO. (2005). *JETRO's White Paper of Trade and Investment*. JETRO. (in Japanese)

Jin, S., & Tokunaga, S. (2006). Agglomeration Effects and Japanese Food Industry Investment in China - Evidence from the Cities -. *Studies in Regional Science,* 36(4), 899-908.

Jin, S., & Tokunaga, S. (2007). Location of Japanese Investment in China's Food Industry. *The China Review,* 7, 129-138.

Jordaan, J. (2008). State Characteristics and the Locational Choice of Foreign Direct Investment: Evidence from Regional FDI in Mexico. *Growth and Change,* 39(3), 389-413.

Kang, S., & Lee, H. (2004). Location Choice of Multinational Companies in China: Korean and Japanese Companies. *KEIP Working Paper 04-13*.

Kim, J., & Aguilera, R. (2016). Foreign Location Choice: Review and Extensions. *International Journal of Management Reviews,* 18, 133-159.

Kohpaiboon, A., (2009). Imports-as-Market Discipline Hypothesis: Evidence from the Thai Manufacturing Sector, Edited by Chin Hee Hahn and Dionisius Narjoko, Causes and Consequences of Globalization in EAST ASIA: What Do the Micro Data Analyses Show?, ERIA Research Project Report 2009, No. 2, Ch.9, 268-312.

Kojima, K. (2003). *The Flying Geese Theory of Economic Development*, Vol.1, Bunshindo. (in

Japanese)

Kotabe, M. (1993). The Promotional Roles of the State Government and Japanese Manufacturing Direct Investment in the United States. *Journal of Business Research,* 27(2), 131-146.

Krugman, P. (1991a). *Geography and Trade.* Cambridge, MA: MIT Press.

Krugman, P. (1991b). Increasing Returns and Economic Geography. *Journal of Political Economy,* 99(3), 483-499.

Krugman, P., & Venables, A. J. (1995). Globalization and the inequality of nations. *Quarterly Journal of Economics, 110*(4), 857–880.

Leamer, E. E. (1997). Access to Western Markets and Eastern Effort. in Salvatore Zecchini, ed., *Lessons from the Economic Transition, Central and Eastern Europe in the 1990s*, Dordrecht: Kluwer Academic Publishers, ch.3, 503-526.

Liu, X., Lovely, M., & Ondrich, J. (2010). The Location Decisions of Foreign Investors in China: Untangling the Effect of Wages Using a Control Function Approach. *The Review of Economics and Statistics*, 92(1), 160-166.

Lu, J., & Tokunaga, S. (2008). Market Potential and Location Choice for the Japanese Food Industry in East Asia: An Approach of New Economic Geography. *Studies in Regional Science,* 38(1), 109-119.

Lu, J., & Tokunaga, S. (2009). Supplier Access and the Location Choice of Japanese Food Industry FDI in East Asia. *Letters in Spatial And Resource Sciences,* 2(1), 1-10.

Markusen, J. R. (1984). Multinationals, multi-plant economies, and the gains from trade. *Journal of International Economics, 16*(3–4), 205–226.

Markusen, J. R., & Venables, A. J. (1998). Multinational firms and the new trade theory. *Journal of International Economics, 46*(2), 183–203.

McFadden, D. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In P. Zarembka (Ed.), *Frontiers in Econometrics.* New York: Academic Press.

McFadden, D. (1984). Economic Analysis of Qualitative Response Models. In Z. Griliches, & M. Intriligator (Eds.), *Handbook of Econometrics* (2 ed., pp. 664-670). Amsterdam: Elsevier.

Ministry of Industry (2017). Thailand 4.0 – the Next revolution. The Ministry Annual Report Fiscal Year 2017.

Mukim, M., & Nunnenkamp, P. (2012). The Location Choice of Foreign Investors: A District Level Analysis in India. *The World Economy,* 35(7), 886-918.

Ng, L., & Tuan, C. (2003). Location decisions of manufacturing FDI in China: Implications of China's WTO Accession. *Journal of Asian Economics,* 14(1), 51-72.

Nielsen, B., Asmussen, C., & Weatherall, C. (2017). The Location Choice of Foreign Direct Investments: Empirical Evidence and Methodological Challenges. *Journal of World Business,* 52, 62-82.

Norman, G., & Woodward, D. (1988). The Location of Foreign Direct Investment in the United States: Patterns and Determinants. *International Regional Science Review,* 11(2), 137-154.

Ozawa, T. (2016). *The Evolution of the World Economy: The 'Flying-Geese' Theory of Multinational Corporations and Structural Transformation.* Cheltenham: Edward Elgar.

Redding, S., & Venables, A. (2004). Economic Geography and International Inequality. *Journal of International Economics*, 62, 53-82.

Roy, A., & Van den Berg, H. (2006). Foreign Direct Investment and Economic Growth: A Time-Series Approach. *Global Economy Journal,* 6(1), 1-21.

Sattaphon, W., & Kiminami, A. (2005). The Determinant Factor of Japanese Food Industry FDI in East Asia: Panel Econometrics Approach. *Journal Rural Economics Special Issue*, 418-424.

Smith, D., & Florida, R. (1994). Agglomeration and Industrial Location: An Econometric Analysis of Japanese-Affiliated Manufacturing Establishment in Automotive-Related Industries. *Journal of Urban Economics,* 36(1), 23-41.

Solomon, E. (2011). Foreign Direct Investment, Host Country Factors and Economic Growth. *Ensayos Revista de Economía,* 33(1), 41-70.

Song, T., & Cieslik, A. (2018). Determinants of City Choice of Foreign Direct Investment Into China: The Role of Specialisation, Diversification and Competition Externalities. *Tijdschrift voor economische en sociale geografie,* 109(3), 449-462.

Suenaga, K. (2010). Vertical Disintegration and Catch-up in the Semiconductor Industry. *Informatics*. 3 (2), 5-20.

Suenaga, K. (2018). Catching up and Innovation in the Asia Pacific: An Evolutionary Approach. In T. Clarke, & K. Lee (Eds.), *Innovation in the Asia Pacific: From Manufacturing to Knowledge Economies* (pp. 83-100). Berlin/Heidelberg: Springer.

Tang, S., Selvanathan, E., & Selvanathan, S. (2008). Foreign Direct Investment, Domestic Investment and Economic Growth in China: A Time Series Analysis. *The World Economy,* 31(10), 1292-1309.

The World Bank. (2020). *World Development Report: Trading for Development in the Age of Global Value Chains.* World Bank Group.

Tokunaga, S., & Akune, Y. (2003). Industrial Agglomeration and the Location of Foreign Direct Investment for Japanese Electronics Industry in East Asia. *Studies in Regional Science*, 33, 37-48. (in Japanese)

Tokunaga, S., Akune, Y., & Ikegawa, M. (2017). Complex Industrial Agglomeration, Supplier Access and Location of Japanese FDI: Case of Japanese Electronics Firms in East Asia. *Studies in Regional Science,* 47(2), 95-103.

Tokunaga, S., Akune, Y., Ikegawa, M., & Okiyama, M. (2015). Measures of the Agglomeration in Japanese Manufacturing Industries and Location of Japanese Manufacturers in East Asia. RIETI Policy Discussion Paper Series, 15-P-021, 1-116. (in Japanese)

Tokunaga, S., & Ikegawa, M. (2019). Global Supply Chain, Vertical and Horizontal Agglomerations, and Location of Final and Intermediate Goods Production Sites for Japanese MNFs in East Asia: Evidence from the Japanese Electronics and Automotive Industries. *Asia-Pacific*

Journal of Regional Science, 3, 911-953.

Tokunaga, S., & Ishii, R. (2000). An Empirical Analysis of Agglomeration effects and location choice of Japanese Electronics firm in East Asia. In H. Kohno, P. Nijkamp, & J. Poot, *Regional Cohesion and Competition in the Age of Globalization* (pp. 127-143). Edward Elgar Publishing.

Tokunaga, S., & Jin, S. (2007). An Empirical Analysis of Agglomeration Effects on the Location Choice of Japanese Electronics Firms in China Using Provincial Data. *Studies in Regional Science,* 37(1), 175-185.

Tokunaga, S., & Jin, S. (2011). Market Potential, Agglomeration and Location of Japanese Manufacturing in China. *Letters in Spatial and Resource Science,* 4, 9-19.

UNCTAD. (2023). *World Investment Report 2023.* United Nations.

Urata, S., & Kawai, H. (2000). The Determinants of the Location of Foreign Direct Investment by Japanese Small and Medium-sized Enterprises. *Small Business Economics,* 15, 79-103.

Wagner, U., & Timmins, C. (2009). Agglomeration Effects in Foreign Direct Investment and the Pollution Haven Hypothesis. *Environmental and Resource Economics,* 43, 231-256.

Wakasugi, R. (1997). Foreign Direct Investment of Japanese Firms: An Empirical Analysis of Market and Firm Specific Factor. *Keio Journal of Economics*, 90, 238-256. (in Japanese)

Wakasugi, R. (2005). The Effects of Chinese Regional Conditions on the Location Choice of Japanese Affiliates. *The Japanese Economic Review,* 56(4), 390-407.

Wattanadumrong, B., Collins, A., & Snell, M. (2010). Still Big in Bangkok? An Empirical Analysis of the Regional Distribution of Foreign Direct Investment in Thailand. *International Journal of the Economics of Business,* 17(3), 329-348.

Yamawaki, H. (1993). Location Decisions of Japanese Multinational Firms in European Manufacturing Industries. In K. Hughs (Ed.), *European Competitiveness.* Cambridge: Cambridge University Press.

Yeung, W.-C., & Coe, N. (2015). Toward a Dynamic Theory of Global Production Networks. *Economic Geography,* 91, 29-58.

Zhang, K. (2001). What Attracts Foreign Multinational Corporations to China? *Contemporary Economic Policy,* 19, 336-346.

Appendix

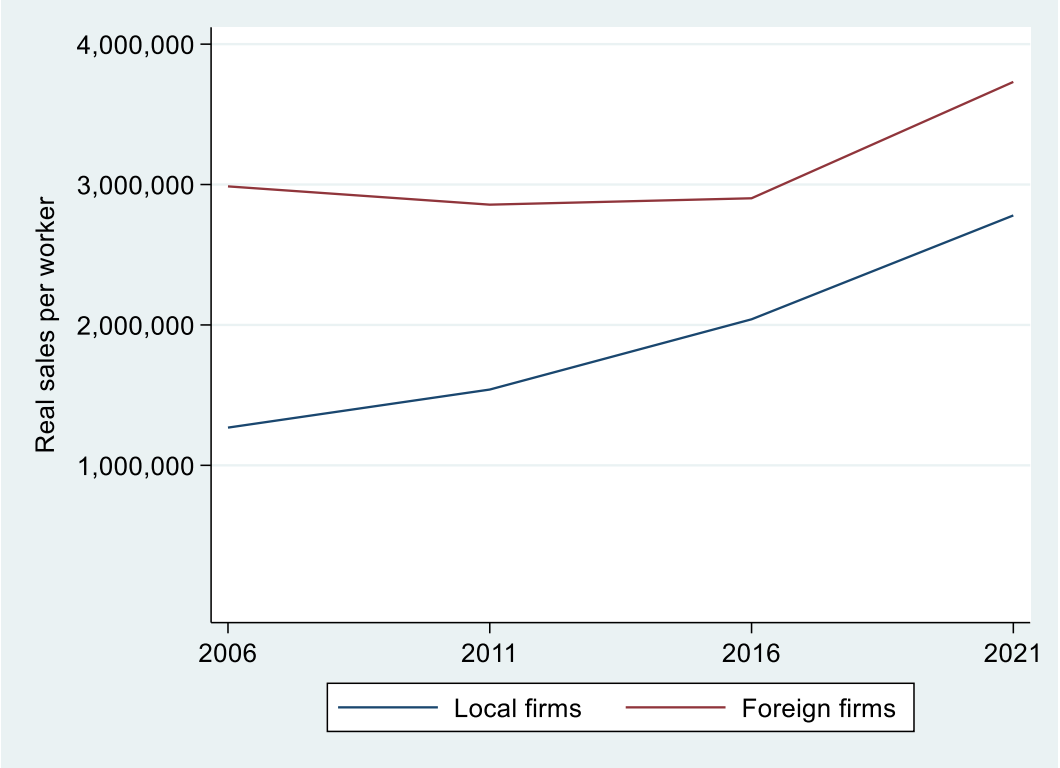


Figure A1. Real sales per worker in the manufacturing industry.

Note: Since there is no need to take into account differences in industry codes, data from 2006 is also included.

Source: Thai National Statistical Office, *Thai Industrial Census*, 2007, 2012, 2017, 2022.

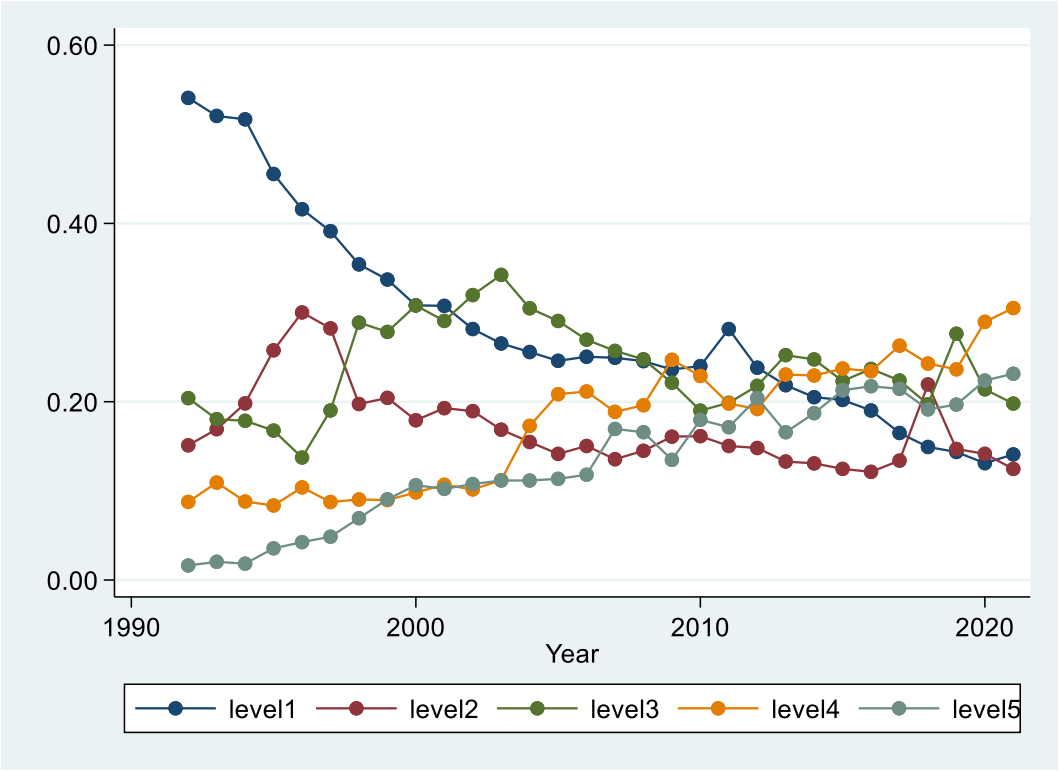


Figure A2. Trends in export goods from Thailand to Japan by PCI level

Source: UN Comtrade, SITC Rev.3

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lnrwages	3.545***	2.851***	2.632***	3.291***	2.555***	3.038***	2.829***	3.476***	2.648***	2.013***	2.911***	2.069***	2.881***
	(0.217)	(0.240)	(0.229)	(0.228)	(0.246)	(0.233)	(0.228)	(0.221)	(0.243)	(0.250)	(0.223)	(0.246)	(0.223)
lnrmw	2.520***	2.542***	2.930***	2.531***	2.569***	2.618***	2.802***	2.530***	2.689***	2.729***	2.940***	2.744***	3.012***
	(0.422)	(0.422)	(0.432)	(0.421)	(0.424)	(0.422)	(0.430)	(0.422)	(0.423)	(0.425)	(0.430)	(0.425)	(0.432)
lnrGRP	0.634***	0.481***	0.754***	0.519***	0.506***	0.447***	0.689***	0.585***	0.414***	0.238***	0.645***	0.243***	0.655***
	(0.0441)	(0.0490)	(0.0494)	(0.0496)	(0.0482)	(0.0514)	(0.0469)	(0.0526)	(0.0504)	(0.0545)	(0.0462)	(0.0541)	(0.0467)
lnPA	0.443***	0.0240	1.358***	0.220**	0.0282	0.100	1.201***	0.348***	0.147	-0.273***	1.313***	-0.348***	1.298***
	(0.0832)	(0.0971)	(0.120)	(0.0947)	(0.0934)	(0.0953)	(0.119)	(0.0997)	(0.0905)	(0.0965)	(0.124)	(0.102)	(0.119)
lnSA_I		0.406***											
		(0.0473)											
lnSA_O			-1.313***										
			(0.133)										
lnSA_IL				0.229***									
				(0.0440)									
lnSA_IF					0.369***								
					(0.0391)								
lnMA_I						0.389***							
						(0.0541)							
lnMA_O							-1.073***						
							(0.127)						
lnMA_IL								0.0905*					
								(0.0527)					
lnMA_IF									0.438***				
									(0.0451)				
lnSA_IJ										0.608***			
										(0.0522)			
lnSA_OJ											-1.151***		
											(0.130)		
lnMA_IJ												0.775***	
												(0.0580)	
lnMA_OJ													-1.159***
													(0.125)
Observations	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695	79,695
Pseudo R-squared	0.385	0.397	0.400	0.389	0.401	0.393	0.396	0.386	0.399	0.423	0.397	0.417	0.398

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A1. Estimation results (Analysis 2 based on ISIC Rev.3)

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lnrwages	1.996***	0.964***	1.719***	1.674***	0.523	1.240***	1.837***	1.837***	0.797**	0.559	1.863***	1.258***	1.820***
	(0.319)	(0.351)	(0.339)	(0.335)	(0.360)	(0.344)	(0.329)	(0.330)	(0.351)	(0.369)	(0.340)	(0.336)	(0.341)
lnrmw	-6.477***	-8.596***	-1.645	-7.977***	-7.006***	-8.327***	-3.120**	-7.326***	-7.621***	-6.963***	-0.292	-6.947***	-0.129
	(0.997)	(1.000)	(1.250)	(1.099)	(0.929)	(1.032)	(1.231)	(1.084)	(0.972)	(0.967)	(1.301)	(0.993)	(1.260)
lnrGRP	0.683***	0.388***	0.616***	0.557***	0.424***	0.469***	0.616***	0.621***	0.397***	0.0729	0.438***	0.225**	0.450***
	(0.0797)	(0.0897)	(0.0863)	(0.0884)	(0.0868)	(0.0874)	(0.0844)	(0.0855)	(0.0875)	(0.0946)	(0.0913)	(0.102)	(0.0907)
lnPA	1.463***	1.090***	2.241***	1.244***	1.151***	1.037***	1.938***	1.292***	1.119***	0.754***	2.499***	1.086***	2.492***
	(0.143)	(0.149)	(0.181)	(0.157)	(0.142)	(0.157)	(0.170)	(0.167)	(0.147)	(0.155)	(0.195)	(0.156)	(0.184)
lnSA_I		0.566***											
		(0.0818)											
lnSA_O			-1.690***										
			(0.251)										
lnSA_IL				0.262***									
				(0.0832)									
lnSA_IF					0.410***								
					(0.0558)								
lnMA_I						0.498***							
						(0.0864)							
lnMA_O							-1.091***						
							(0.223)						
lnMA_IL								0.159**					
								(0.0807)					
lnMA_IF									0.541***				
									(0.0689)				
lnSA_IJ										0.744***			
										(0.0797)			
lnSA_OJ											-1.923***		
											(0.248)		
lnMA_IJ												0.633***	
												(0.0928)	
lnMA_OJ													-2.030***
													(0.236)
Observations	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960	34,960
Pseudo R-squared	0.367	0.384	0.382	0.370	0.393	0.378	0.375	0.368	0.388	0.426	0.387	0.383	0.392

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2. Estimation results (Analysis 1: foreign capital standard is set at 50% or more)

VARIABLES	(1) Basic enter_y	(2) lnSA_I enter_y	(3) lnSA_O enter_y	(4) lnSA_IL enter_y	(5) lnSA_IF enter_y	(6) lnMA_I enter_y	(7) lnMA_O enter_y	(8) lnMA_IL enter_y	(9) lnMA_IF enter_y	(10) lnSA_IJ enter_y	(11) lnSA_OJ enter_y	(12) lnMA_IJ enter_y	(13) lnMA_OJ enter_y
lngdppw	0.103	-0.442**	-0.375	-0.0953	-0.649***	0.0183	-0.292	0.161	-0.284	-0.506**	-0.0213	-0.250	-0.0887
	(0.203)	(0.210)	(0.242)	(0.199)	(0.222)	(0.201)	(0.236)	(0.202)	(0.211)	(0.204)	(0.228)	(0.200)	(0.230)
lnrmw	12.21***	14.68***	11.35***	11.93***	16.29***	13.87***	7.968***	12.25***	16.71***	12.61***	12.07***	12.78***	12.07***
	(2.603)	(2.597)	(2.568)	(2.575)	(2.677)	(2.634)	(2.862)	(2.600)	(2.758)	(2.585)	(2.594)	(2.603)	(2.590)
lnrGRP	0.669***	0.611***	0.895***	0.546***	0.709***	0.415***	0.816***	0.476***	0.361***	0.312***	0.696***	0.196*	0.709***
	(0.0832)	(0.0912)	(0.107)	(0.0895)	(0.0902)	(0.101)	(0.0951)	(0.101)	(0.100)	(0.0984)	(0.0861)	(0.102)	(0.0860)
lnPA	1.347***	0.705***	1.882***	0.973***	0.728***	1.053***	1.881***	1.108***	1.082***	0.381**	1.523***	0.487**	1.594***
	(0.157)	(0.182)	(0.214)	(0.177)	(0.171)	(0.174)	(0.223)	(0.176)	(0.165)	(0.189)	(0.211)	(0.190)	(0.205)
lnSA_I		0.588***											
		(0.0839)											
lnSA_O			-0.920***										
			(0.261)										
lnSA_IL				0.401***									
				(0.0737)									
lnSA_IF					0.434***								
					(0.0682)								
lnMA_I						0.429***							
						(0.0988)							
lnMA_O							-0.818***						
							(0.248)						
lnMA_IL								0.290***					
								(0.0894)					
lnMA_IF									0.542***				
									(0.0950)				
lnSA_IJ										0.561***			
										(0.0772)			
lnSA_OJ											-0.262		
											(0.215)		
lnMA_IJ												0.742***	
												(0.0836)	
lnMA_OJ													-0.418*
													(0.230)
Observations	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025	25,025
Pseudo R-squared	0.398	0.422	0.403	0.411	0.420	0.406	0.403	0.403	0.413	0.438	0.399	0.441	0.399

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3. Estimation results (Analysis 3: Use lngdppw instead of lnrwages)