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Effects of Services Trade Restrictions on the Expansion of Servicification within Global Value Chains in Emerging and Developing Asian Economies

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Abstract

This study aims to assess the effects of services trade restrictions on the sluggish advancement of global value chains (GVCs) servicification in emerging and developing Asian economies, as the relationship between services trade restrictions and GVCs servicification is rarely examined. This study employs the recently published OECD Service Trade Restrictiveness Index (STRI) 2025 edition and the OECD Trade in Value Added (TiVA) 2023 edition to quantify the correlation between STRIs and five categories of business service inputs: trade, transport, information and communication (ICT), finance, and professional services, utilizing the structural gravity model and panel data analysis. The study identifies three principal findings. First, the advancement of GVCs servicification is notably sluggish in most emerging and developing Asian economies across five service categories. Second, the service trade restrictiveness adversely affects the performance of the GVCs servicification. The final aspect is the extent of negative effects against GVCs servicification attributed to the service trade restrictiveness, which ranges from 20% to 50%, excluding the professional category. The elimination or reduction of superfluous service trade regulations will advance the progression of GVC servicification in emerging and developing Asian economies.

Keywords: servicification; global value chains; services trade restrictions; Asian emerging and developing economies; structural gravity model.

JEL Classification Codes: F14, O53

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1.Introduction

Emerging economies in Asia saw significant economic expansion through industrialization, with many of them attaining middle-income status. In recent decades since the 1990s, the service-income nexus (services' share in GDP and real GDP per capita) and the manufacturing-income nexus (manufacturing's share in GDP and real GDP per capita) illustrate that the services-driven growth in Asia exceeds the manufacturing-led growth (Figure 1). The services sector has emerged as the predominant force in structural transformation during the 1990s, with its average contribution to GDP in Asia exceeding 50 percent currently. Nayyar et al. (2021) indicated that the contribution of services in industrialized nations is, on average, 75 percent of their GDP. Nonetheless, the expansion of services in emerging Asian economies also reflects their pivotal role in economic changes.

The services sector has emerged as a prominent focus for academics and policymakers in recent years. Academic research has demonstrated the macroeconomic interconnections among the services, income, and manufacturing sectors. Ndubuisi et al. (2023) demonstrated the significant acceleration of service contributions to income growth in developing Asia through cross-country studies. Services can be categorized into various sorts. Katouzian's (1970) approach delineates three subgroups: (i) new services[2], (ii) complementary services[3], and (iii) old services[4], to examine their evolution. The author discovered that the consumption of new services increasingly correlates with per capita income and leisure time, while complementary services are directly linked to industrial growth, the expansion of intermediate goods, the integration of domestic and international markets, and urbanization. The need for complementary services escalates with the rise of manufacturing production, indicating that these services are integral to the industrialization process. Owusu et al. (2020) categorized services into two primary groups: market services[5] and non-market services[6]. The relative significance of market services across all regions may serve as a new catalyst for economic growth alongside the expansion of the manufacturing sector. The authors disclosed that productivity growth in the market services industry is comparable to or exceeds that in

[2] It encompasses education, utilization of contemporary therapeutic and medical services, and various forms of entertainment (including vacation resorts, hotels, restaurants, cinemas, concerts, nightclubs, and similar establishments), along with more services (for further details, refer to Kaotuzian (1970)).
[3] Banking, finance, transportation, wholesale and retail trade.
[4] Domestic services such as housing care.
[5] Maintenance and repair, wholesale trade, retail trade, transport, post and telecommunications, financial intermediation, and business activities.
[6] Hotels and restaurants, public administration, education, health and other services, and private households.

manufacturing and other industries. Liao (2020) showed that distribution services[7] positively correlate with the manufacturing sector, subsequently followed by personal services[8], as per capita income increases in China.

In the context of the services sector's involvement in foreign transactions, its engagement in global value chains (GVCs) should not be overlooked. Despite potential disputes regarding the direct correlation between economic growth and participation in GVCs, the World Bank (2020) indicated that an increase of 1% in GVCs participation could enhance per capita income by over 1%. GVCs not only enhance connection across nations but also create opportunities, including increased employment, rising personal income, and reduced poverty in developing countries, as these nations undergo swift and effective transformations to engage in GVCs involvement. Moreover, GVCs provide an alternative avenue for development, alleviating the need for countries to commit themselves to accessing export markets and building import channels, including inputs, final goods, and after-sales services. The strategic significance of Asian economies' participation in GVCs is undeniable and essential for growing and expanding Asian economies, since Asia plays a pivotal role in the expansion of GVCs (Kimura 2006; Taguchi and Thet 2021; Alvarez et al. 2021).

Koopman et al. (2010 and 2014)[9] initiated their conceptual framework for tracing value-added and addressing double counting in GVCs. Subsequently, numerous empirical studies have quantified and examined the effects of GVCs across nations, utilizing value-added trade data developed by the OECD, WTO, and UNCTAD. Currently, the growing participation of service sectors in GVCs has been monitored (OECD et al. 2014) due to the structural transformations, termed "servicification," that GVCs have undergone in recent years.

Nano and Stolzenburg (2021) categorized the two essential kinds of servicification in GVCs as follows: (1) service sectors fulfill the requirements of non-service sector value chains, and (2) service sectors increasingly derive from their own value chains as the production processes of certain services resemble those of manufacturing products. Subsequently, a number of empirical research commenced quantifying the sources, motivations, and outcomes of servicification.

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[7] Wholesale, retailing, transportation and storage (complement of manufacturing goods).

[8] Hotels, restaurants, community, and personal services (substitution of home production).

[9] The GVC participation index introduced by Koopman et al. (2010) offers a conceptual framework for disaggregating a nation's total exports into value-added components by source, together with a novel bilateral database on value-added trade.

International tariff and non-tariff barriers are inevitable in real-world trade. In the realm of services trade, several trade restrictions persist irrespective of economic positions. These restrictions serve as barriers observable in various contexts, including the entry of foreign service providers, cross-border movement of individuals, and competition between foreign and domestic enterprises, all aimed at safeguarding domestic industries, ensuring product quality, and promoting consumer safety, among other reasons. Consequently, the servicification of GVCs is somewhat constrained by the practices of service trade restrictions. Due to restrictions on services trade, the impact on service trade and the servicification of GVCs is significantly adverse (Findlay and Roelfsema 2023, Huser and Mattoo 2017, and Nordås and Rouzet 2015).

The restrictions on services trade can be elucidated through the fragmentation theory paradigm established by Jones and Kierzkowski (1990). The interconnected production blocks within the integrated production process rely on various service links, including transportation, communication, professional services, and finance. Consequently, imposing greater restrictions on service trade undermines production efficiency and even diminishes the locational advantages of GVCs. In other words, service-link expenses may increase under more stringent service-restriction barriers, although the effects may vary among subsectors. Consequently, service trade restrictions can be viewed as a component of service-link costs that impede the advancement of GVCs servicification.

This study aims to assess the impact of service trade restrictions on the GVCs servicification in emerging and developing Asian economies. Consequently, emerging and developing Asian economies can recognize their negative impacts and the need to mitigate superfluous restrictions from a policy standpoint. The structural gravity trade model will be utilized with the panel trade data from the 2023 edition of Trade in Value Added (TiVA) and the 2025 edition of the Services Trade Restrictiveness Index (STRI).

2. Literature Reviews and Contributions

This section reviews the literature covering servicification in GVCs and its association with services trade restrictions. The literature of servicification in GVCs can be delineated into three key aspects: emerging patterns, causes, and effects.

Regarding the emerging patterns of servicification in GVCs, a significant and growing proportion of value-added services across nations was indicated (OECD, WTO, and World

Bank Group 2014; Johnson and Noguera 2017; Heuser and Mattoo 2017). This evolution is a remarkable trend in Asian economies as well (Baldwin et al., 2015; Thangavelu et al., 2018). Baldwin et al. (2015) identified that in Asia, the rise in GVCs participation is associated with the growth of foreign service value-added in a country's exports. Thangavelu et al. (2018) confirmed that the trend of servicification in Asia is characterized by a lower degree of domestic servicification and a higher degree of foreign servicification compared to OECD nations.

The potential causes of the servicification of GVCs were examined in four sources: reclassification, task-composition shift (linking services), task-composition shift (alterations in end goods), and task-relative price shift (Baldwin et al., 2015; Heuser and Mattoo, 2017).

1) Reclassification: Numerous services historically provided internally by manufacturing companies, and so categorized as manufacturing, have been outsourced at arm's length and reclassified as services.
2) Task-composition change (connecting services): the progression of GVCs necessitates the interconnections across geographically disparate production sites, incorporating service linkages such as telecommunications, transportation, and mailing, which enhance the value-added inherent in the final product.
3) Task-composition shift (alterations in final goods): it arises from modifications in the characteristics of the final manufactured products. For instance, numerous produced products have included more advanced services, such as the software utilized in automobiles.
4) Task-relative price shift: this arises from the allocation of tasks between the services and manufacturing sectors. The costs of service jobs have risen compared to those of manufacturing tasks, as manufacturing operations are more amenable to offshoring, which aims to lower relative prices.

Regarding the effects of servicification, the two aspects of macroeconomic performance, namely, productivity growth and export performances, were examined (Heuser and Mattoo, 2017). The expansion of producer services enhances the productivity of final goods and services while reducing the supply costs associated with producer services (Cheng and Xiao, 2021). Díaz-Mora et al. (2018) contended that the value-added from foreign services incorporated in manufacturing exports enhances export performance across all manufacturing sectors, especially in developing and emerging economies. Francois and Woerz (2008)

identified the substantial favorable impacts of increased business services inputs on heavy sectors, including machinery, motor vehicles, chemicals, and electronic equipment. Hing and Thangavelu (2024) established that servicification is positively correlated with productivity, facilitated by foreign ownership and participation in GVCs in Cambodia. The affirmative correlation between service input utilization and high-tech manufacturing exports, subsequently influencing total factor productivity (TFP) growth, is substantiated in India (Pattnayak and Chadha, 2022; Pant and Chakraborty, 2024).

We now turn to the literature pertaining to services trade restrictions. The detrimental effects of service trade restrictions have been substantiated from various perspectives: on overall costs comparable to tariffs (OECD, 2017), on service exports and export competitiveness (Nordås and Rouzet, 2015), on manufacturing exports (Su et al., 2020), on service trade flows (Chen, 2024; Gervais, 2018; Nordas and Rouzet, 2017), on food trade, including live animals and perishable goods (milk, eggs, and meat) (Zongo, 2021), and on bilateral greenfield foreign direct investment projects in business service sectors (Jungmittag and Marschinski, 2023). When considering the effects of services trade restrictions on GVCs, Findlay and Roelsema (2023) confirmed that the restrictions are harmful for backward participation in ASEAN members' GVCs. The authors also proposed that the future of ASEAN nations' GVCs will be significantly impacted by the liberalization of the services trade.

Based on the literature reviewed above, the majority of current research has addressed GVC servicification concerns and services trade restrictions independently, without combining them in a quantitative analysis. This study essentially establishes a quantitative contribution of services trade restrictions to the delayed process of the growth of GVC servicification in emerging Asian economies, using the most recent GVC data (OECD TiVA data from the 2023 edition) and STRI data (OECD STRI data from the 2025 edition), along with a structural gravity model,

3. Descriptive Analysis

This section illustrates the trends in GVC servicification and services trade restrictions in emerging Asian economies. Three income levels are represented in the sample countries: high, upper middle, and lower middle incomes. Japan, Korea, and Singapore are high-income countries, while China, India, Indonesia, Kazakhstan, Malaysia, the Philippines, Thailand, and Vietnam are lower- and upper-middle-income countries.

Koopman et al. (2010) conceptualized the GVC participation in terms of a vertical specialization chain as follows;

$$\text{GVC participation} = FV/E + IV/E \quad (1)$$

Where “FV”, “IV”, and “E” signify “foreign value-added embodied in gross exports”, “domestic value-added embodied as intermediate inputs in other countries’ gross exports”, and “gross exports”, respectively. FV/E represents downstream GVC participation corresponding to GVC backward participation (in the Buyer role), and IV/E denotes upstream GVC participation showing GVC forward participation (in the Seller role).

This study focuses on GVC "backward" participation to illustrate the GVCs servicification, specifically analyzing foreign value-added service inputs in gross exports, because this study targets emerging and developing Asian economies. They lack the capacity to produce certain advanced technological inputs, including information and communication technology, as well as expertise in professional services and knowledge. Consequently, their industrial process predominantly relies on services inputs from advanced economies. Thus, their function is more probable to be a downstream phase in the export activities within their GVC participations (Thangavelu et al. 2018).

The OECD provides the data for the following business sector services: wholesale and retail trade, and repair of motor vehicles and motorcycles (after this “trade”), transportation and storage (transport), information and communication (ICT), financial and insurance activities (finance), and professional, scientific and technical activities (Professional) (Table 1).

A comparison of the starting year 1995 and the concluding year 2020 in OECD TiVA 2023 for foreign value-added inputs in the specified five subsectors of business services, is illustrated in Figure 2, as a proportion of the gross exports of eleven sample nations. The average ratios of all service classes among sampled economies rose from 1995 to 2020: trade increased from 3.4% to 3.8%, transport from 1.9% to 2.0%, ICT from 0.6% to 1.1%, finance from 1.0% to 1.3%, and professional services from 1.0% to 1.4%.

In terms of individual sample economies, both Vietnam and India, classified as lower middle-income economies, exhibit increases across all categories; however, Vietnam demonstrates significant growth in trade, transport, ICT, and finance. In Indonesia, trade and professional categories experience a minor gain, while the remaining three categories exhibit a moderate decline. Regarding the Philippines, the four categories, excluding professional, are

declining. For upper-middle-income economies, China increases two categories, namely ICT and professional services, and Kazakhstan has growth in four categories with a slight decline in trade, whereas Malaysia shows a reduction across all categories. Thailand exhibits growth in four categories; nevertheless, the transport is experiencing a marginal decline. As for high-income economies, Japan, Korea, and Singapore excel in all categories. Thus, the majority of our sample for Asian economies implies that GVCs servicification has persisted in its growth.

The subsequent issue pertains to service trade restrictions, which impede the GVCs servicification. The Services Trade Restrictions Index (STRI) comprises “restrictions on foreign entry,” “restrictions to movement of people,” “other discriminatory measures,” “barriers to competition,” and “regulatory transparency”. The value ranges from 0 (total openness) to 1 (total restrictiveness), indicating that a greater STRI correlates with increased service trade restrictiveness. This study focuses on the overall STRI and consolidates the index from 22 industries into five categories of services, aligning with the OECD TiVA statistics.

Figure 3 illustrates the STRI for the years 2014 and 2024 over a sample of eleven nations. The mean STRI across sampled economies declines from 2014 to 2024: from 0.33 to 0.29 in trade, from 0.41 to 0.35 in transport, from 0.33 to 0.31 in ICT, from 0.34 to 0.32 in finance, and from 0.58 to 0.57 in professional. Significant reductions were observed in particular economies: India in transport, Indonesia in trade and ICT, Kazakhstan in transport, China in transport and finance, and the Philippines in transport. Nonetheless, STRI walls in most sample economies exceed the average STRI level in the trade, transport, ICT, and professional. In high-income economies such as Japan, Korea, and Singapore, the STRI is relatively lower, with the exception of Korea's professional.

The aforementioned observations have distinctly demonstrated the correlation between the decline in the STRI and the rise of GVCs servicification across the sampled economies. These facts necessitate further quantitative study to elucidate the significant contribution of STRI to the GVCs servicification in Asian sample economies.

4. Econometric Analysis

This section presents an econometric analysis by applying a structural gravity trade model to quantify the connection between servicification in GVCs and services trade restrictions in the sample economies.

4.1 Model Specification

This study applies the structural gravity model to examine the impacts of STRI on GVCs servicification by using a directional fixed effect (Equation 2) and an alternative model replacing the host economy's fixed effects with STRI (Equation 3). The model specification as follows:

$$lnfva\_xx_{ij,t} = \mu_{ij} + \pi_{i,t} + \delta_{j,t} + \varepsilon_{ij,t} \quad (2)$$

$$lnfva\_xx_{ij,t} = \mu_{ij} + \alpha * stri\_xx_{i,t} + \delta_{j,t} + \varepsilon_{ij,t} \quad (3)$$

Where "*i*" is a host economy receiving foreign value-added inputs of services for exports, and "*j*" is a partner economy offering value-added inputs of services to a host economy, and "*t*" stands for years. "*fva*" and "*stri*" denote foreign value-added inputs of services for exports and the STRI of a host economy, respectively. The subscript "*xx*" in "*fva*" of Equation 2 and in "*stri*" of Equation 3 represent five services categories in this study: trade (td), transport (tp), ICT (ic), finance (fn), and professional (pf). μ_{ij} is the pair time-invariant fixed effects between economies "*i*" and "*j*". π_i and δ_j are the time-variant fixed effects of economies, "*i*" and "*j*", respectively. "ε" is an error term. "α" is the estimated coefficient of Equation 3, and "*ln*" denotes a logarithm form for evading scaling problem in the estimation. Table 2, and Table 3 present the list of the variables and data sources, and their descriptive statistics.

The traditional gravity trade model elucidates bilateral trade flows based on the economic magnitude of two economies and the distance between them. Piermartini and Yotov (2016) contended that the traditional approach results in biased and inconsistent estimates. Consequently, they established a thorough and theoretically coherent econometric framework known as a structural model. They specifically offered six recommendations for developing a structural gravity model. The recommendations are: (i) utilize panel data to account for time-invariant bilateral trade costs; (ii) employ interval data to facilitate adjustments in trade flows; (iii) incorporate intra-national trade flows to maintain consistency with gravity theory and capture globalization's impact on international trade; (iv) apply directional time-varying fixed effects to manage unobservable multilateral resistances; (v) implement pair fixed effects to tackle time-invariant bilateral trade costs; and (vi) use the Poisson Pseudo Maximum Likelihood estimator (PPML) to resolve issues of heteroskedasticity and zero trade flows in trade data. Equation 2 adheres to four of the six recommendations: (i), (iii), (iv), and (v).

Regarding the recommendation (iii), this analysis incorporates the domestic value-added inputs of services in exports (fva_{ij}, $i = j$) to substantiate intra-national trade flows. Concerning the recommendation (ii), this study employs data aggregated over consecutive years instead of interval data due to restricted data availability for the sample period from 2014 to 2020. As for the recommendation (vi), this study uses the Poisson Quasi-Maximum Likelihood estimator (PQML) in place of PPML. This work aims to account for variances, over-dispersions, and under-dispersions in parameter estimation caused by factors such as omitted variables and data variability among samples (Roback and Legler, 2021). Moreover, PQML effectively addresses the issues of zero trade and heteroskedasticity, referred to as the addition problem, by equalizing the totals of actual and modeled values for any scale-invariant model, while also offering efficient solutions (Arvis and Shephard, 2011). This research additionally employs the ordinary least squares (OLS) estimator for a robustness verification.

4.2 Selection of Benchmark Countries

The choice of benchmark economies is based on the average STRI from 2014 to 2020, while GVC data is available only until 2020. The benchmark economies exhibiting the lowest STRI index differ by category in successive assessments. If economies pursue the STRI framework of benchmark economics by continuing the liberalization of services trade, it is presumed that their level of GVC servicification will improve.

Among the eleven sampled economies, Japan and Singapore have been selected as common benchmark economies due to their STRIs across all categories reflecting the lowest values within the group. In the trade category of the STRI, China ranks second lowest, behind Japan, with the benchmarks being Japan, China, and Singapore. In the transport STRI, Malaysia ranks as the third lowest, with Japan, Malaysia, and Singapore serving as benchmarks. Concerning the ICT categories, the benchmarks are Japan, India, and Singapore, highlighting India's substantial reformations in ICT services. For the finance category, Japan, Korea, and Singapore are selected as benchmarks because of their low STRIs. In the professional category, Japan, Kazakhstan, and Singapore serve as benchmarks due to Kazakhstan's significant liberalization in this area.

In the subsequent estimation, the fixed effects of the host economies show their extents of the GVC servicification compared to those in benchmark economies. The extent of GVC servicification is influenced by service trade restrictions in host economies, as these restrictions

represent significant service-link costs for the host economies. Consequently, the STRI constitutes a significant component in the fixed effects of host economies. Thus, Equation 3 substitutes the fixed effects of host economies with their STRIs, enabling the quantification of the STRIs' contributions to the fixed effects, The quantitative contributions of service trade restrictions on GVC servicification can be calculated using the estimated fixed effects and STRI coefficients (that are anticipated to be significantly negative).

4.3 Sample Data and Property

The data for value-added service inputs in exports and the services trade restrictiveness are sourced from the Trade in Value Added (TiVA) 2023 edition and the Services Trade Restrictiveness Index (STRI) 2025 edition, respectively, as supplied by the OECD. In relation to the sample economies and timeframe, according to data availability, we have selected eleven host economies that receive value-added service inputs in exports. Regarding the partner economies supplying service inputs (including domestic value-added from the host country), Table 4 presents the top ten selected partners. It indicates that over 80% of the total service inputs in the host economies are represented. The OECD-TiVA data is available for the period 1995-2020, while the OECD-STRI data is accessible for the period 2014-2024. The sample period utilized for this estimation spans from 2014 to 2020, representing the largest data length available. A panel data configuration spanning seven years, comprising host and partner economies (7*11*10 = 770), is established for estimation purposes.

Before performing panel estimation, we first examine the stationary property of the created panel data of "*lnfva*" and "*stri*" by using the panel unit root tests—the individual unit root test and the common unit root test. These are the Levin, Lin, and Chu test (Levin et al., 2002) as a common unit root test, and the Fisher-ADF and Fisher-PP tests (Choi, 2001; Maddala and Wu, 1999) and the Im, Pesaran, and Shin test (Im et al., 2003) as individual unit root tests. The assumption in the common unit root test prescribes that there is a common unit root processes that deviate across cross-section. For the individual unit root test, the individual unit root processes vary across cross-section. The panel unit root test is derived from the null hypothesis that a level of panel data has a unit root by incorporating "intercept" in the test equations. Table 5 shows that the results of the common unit root test rule out the existence of a unit root at the conventionally significance level for all variables. Regarding the individual unit root tests, the majority of the unit root test results reject the null hypothesis. Thus, this

study assumes that there is no serious issue with unit roots in the panel data, allowing us to use the panel data in levels for succeeding estimations.

4.4 Estimation Outcomes and discussions

Table 6 displays the estimate results of the gravity trade model: the OLS estimation results are found in columns (i) and (iii), while the PQML estimation results are presented in columns (ii) and (iv) as a log-link function. Columns (i) and (ii) relate to Equation 2, whereas columns (iii) and (iv) pertain to Equation 3 across five kinds of service inputs. The estimation outcomes for Equations 2 and 3 indicate that both OLS and PQML estimators yield comparable and statistically significant results. In light of the recommendations from Arvis and Shephard (2011) and Piermartini and Yotov (2016), the following explanation places greater emphasis on the PQLM estimation results in columns (ii) and (iv) for Equations 2 and 3.

Focusing on the fixed effects in host economies in column (ii), they are significantly negative across all five categories, though in the trade category they include insignificant effects in the restricted sample years. The significantly negative fixed effects suggest that the host economies lag behind the GVCs servicification compared to the benchmark economies. Turning to the effects of STRI in column (iv), they are significantly negative. It implies that the existence of services trade restrictiveness impedes advancement in the GVCs servicification. Both estimation results compel us to examine the quantitative contributions of STRI to the sluggish advancement of the GVCs servicification.

Table 7 presents the quantitative analyses of STRI's contributions to the fixed effects of host economies. The host economies included in each category of Table 7 are those exhibiting significantly negative fixed effects in both OLS and PQML estimations presented in Table 6. Column (a) indicates the host economies" fixed effects on the period average presented in column (ii). Column (b) displays the period-averaged STRIs of the host economies. Column (c) computes the deviations of the host economies' STRIs from the benchmarks. Column (d) calculates the product of the deviations of STRIs in column (c) and the estimated STRIs coefficients in column (iv) in Table 6. Column (e) calculates the ratio of the STRI effects in column (d) to host economies' fixed effects in column (a), so quantifying the contributions of services trade restrictions' effects to the underdevelopment of GVCs servicification in the host economies.

The average contribution ratio is 0.518 in the trade category, 0.467 in transport, 0.202 in ICT, and 0.441 in finance. Thus, the negative contribution ratio is around 20-50% (excluding professional) and it implies that services trade restrictions should be alleviated or eliminated to promote the advancement of GVCs servicification. The findings of this study in the relationship between services trade restrictions and involvement in GVCs align with the earlier research conducted by Findlay and Roelfsema (2023). However, this study's significance is in quantifying the contribution ratio for five categories of services inputs. This quantitative finding also confirmed "ICT" as the most accessible category among five, with the professional category yielding the largest contribution.

In the professional category, the contribution ratio of services trade restriction effect is quantified at 1.505, representing the greatest value among the services categories. This is due to the inclusion of the outlier, specifically, the highest STRI level in Korea. In the professional category, Korea exerts complete control (i.e., STRI equals "1") over foreign service inputs in accounting, bookkeeping auditing, and tax consultancy activities. The OECD (2025) advised that Korea should have facilitated options for enterprises and consumers, since a high STRI or a complete prohibition on foreign inputs imposes additional costs on exporters.

The policy implication of the findings is that the liberalization in services trade would enhance the servicification in GVCs, allowing foreign services inputs to enrich manufacturing and services exports. . It helps to increase the market competitiveness and income growth of developing and growing Asian economies (Kaotuzian, 1970; Liao, 2020; Ndubuisi et al., 2023; and Owusu et al., 2020).

5. Conclusion

This study quantified the contribution of services trade restrictions on the stagnation of GVCs servicification in emerging and developing Asian economies. This study employs the recently published OECD-STRI and the OECD-TiVA database, to quantify the correlation between STRIs and five categories of business service inputs: trade, transport, ICT, finance, and professional services, utilizing the structural gravity model and panel data analysis. The study identifies three principal findings. First, the advancement of GVCs servicification is notably sluggish in most emerging and developing Asian economies across five service categories. Second, the service trade restrictiveness adversely affects the performance of the GVCs servicification. The final aspect is the extent of negative effects against GVCs

servicification attributed to the service trade restrictiveness, which ranges from 20% to 50%, excluding the professional category. The elimination or reduction of superfluous service trade regulations will advance the progression of GVC servicification in emerging and developing Asian economies.

This study has the following limitations. The categorization of business services into five groups may inaccurately assess the effects of the STRI. For instance, in 2020, the STRI for the professional category is 0.898, with an average of 0.795 in accounting and bookkeeping activities, and 1.000 in legal activities. To ascertain the authentic STRI effect, the study should examine the STRI effects on the subcategory foundation. Secondly, this study did not address regulatory discrepancies that can generate issues related to service-link costs, corporate operational expenses, and obstacles to GVCs servicification. Cieślik and Ghodsi (2024) confirmed that increased regulatory divergence is inversely related to the magnitude of multinational operations and cross-border investment prospects at the firm level. The OECD (2017) found that regulatory heterogeneity in the service sectors, as indicated by variations in the OECD-STRI, might incur costs comparable to tariffs ranging from 20% to 75%. Stone and Lejárraga (2018) proposed enhancing institutional connectedness through regulatory management strategies, regulatory coherence, and regulatory coordination among economies to foster the development of GVCs. Miroudot and Cadestin (2017) proposed that domestic reforms and the alleviation of barriers in partner nations can enhance the services sectors and activities dependent on service inputs.

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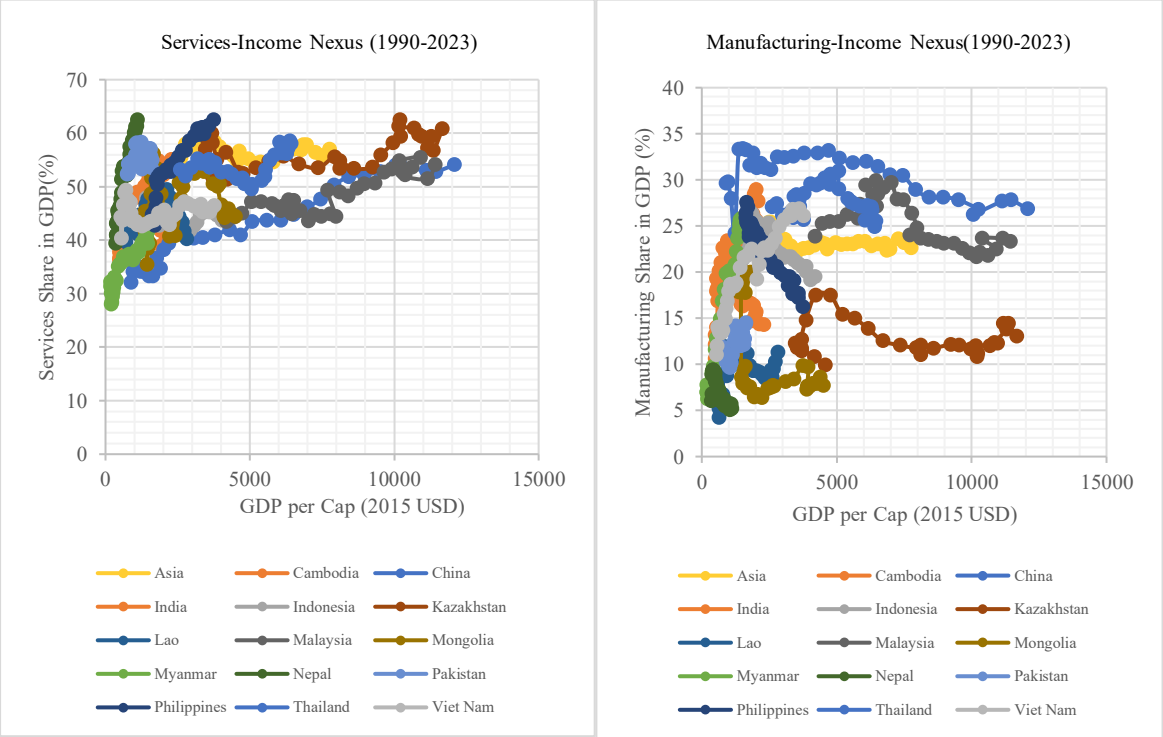
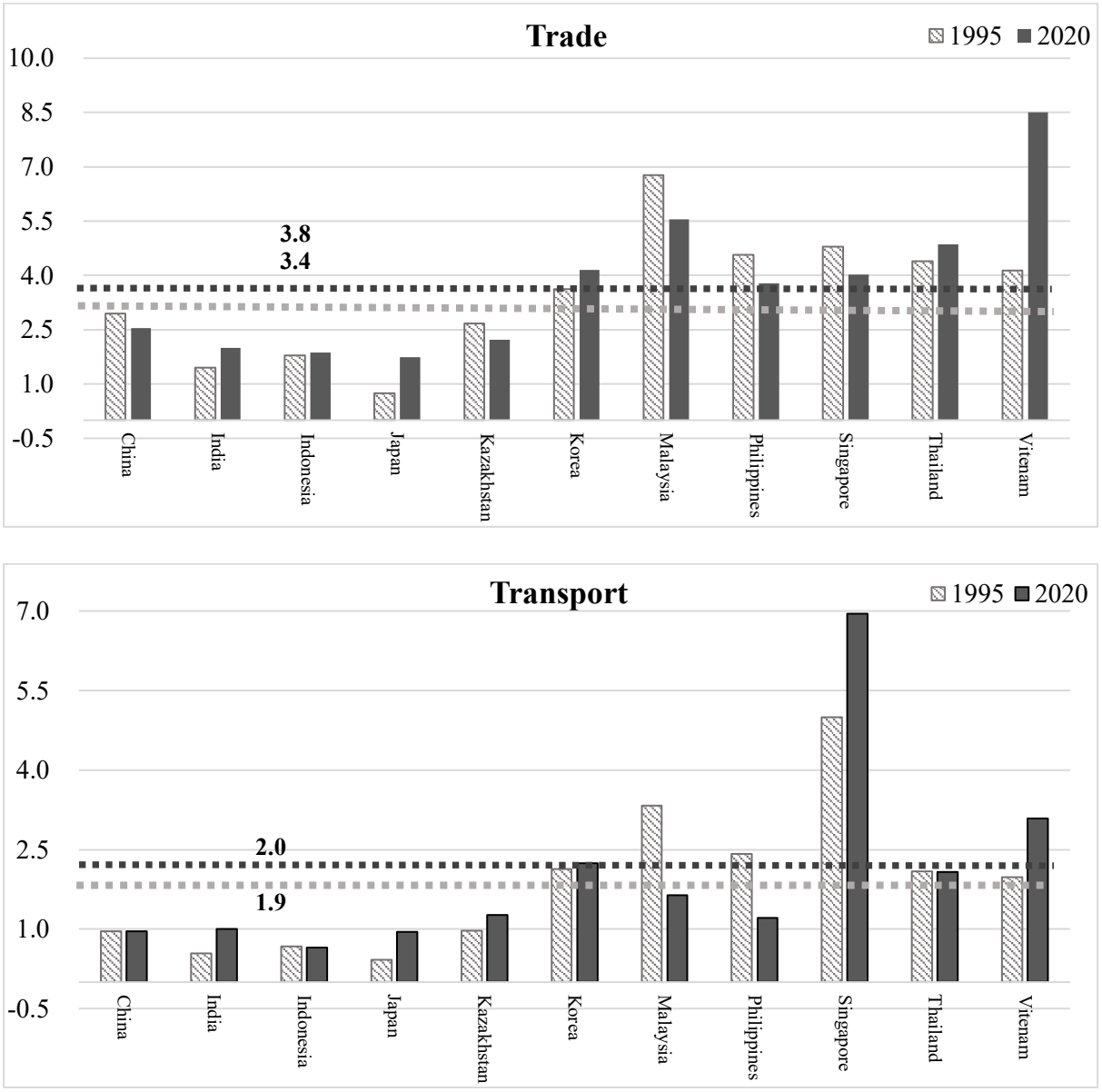
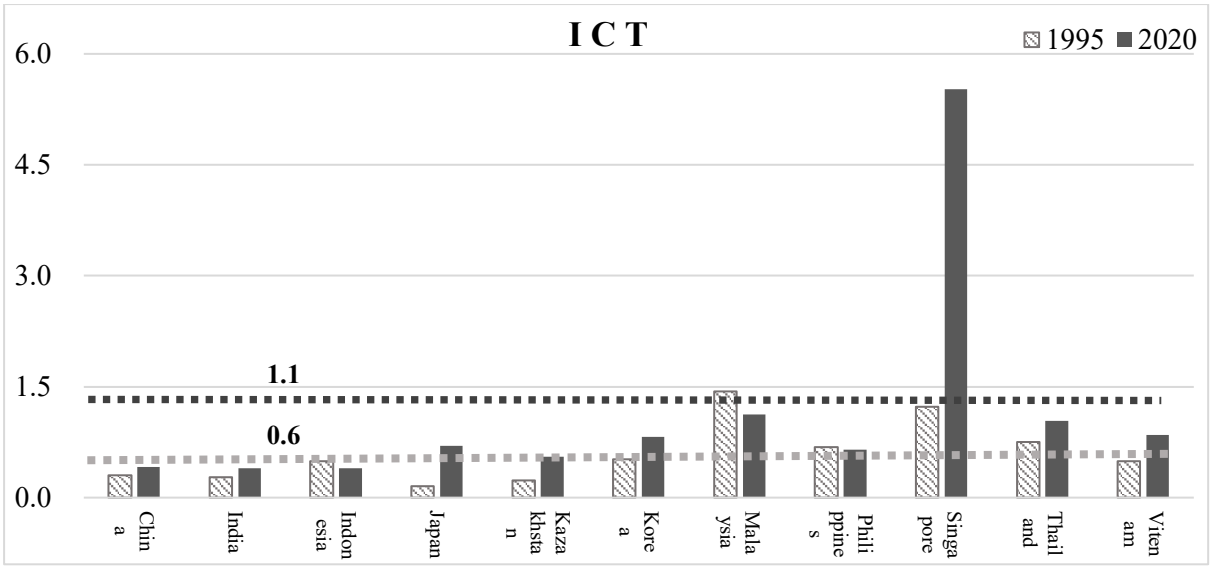
Figure 1 Services-Income Nexus and Manufacturing-Income Nexus in Selected Asia

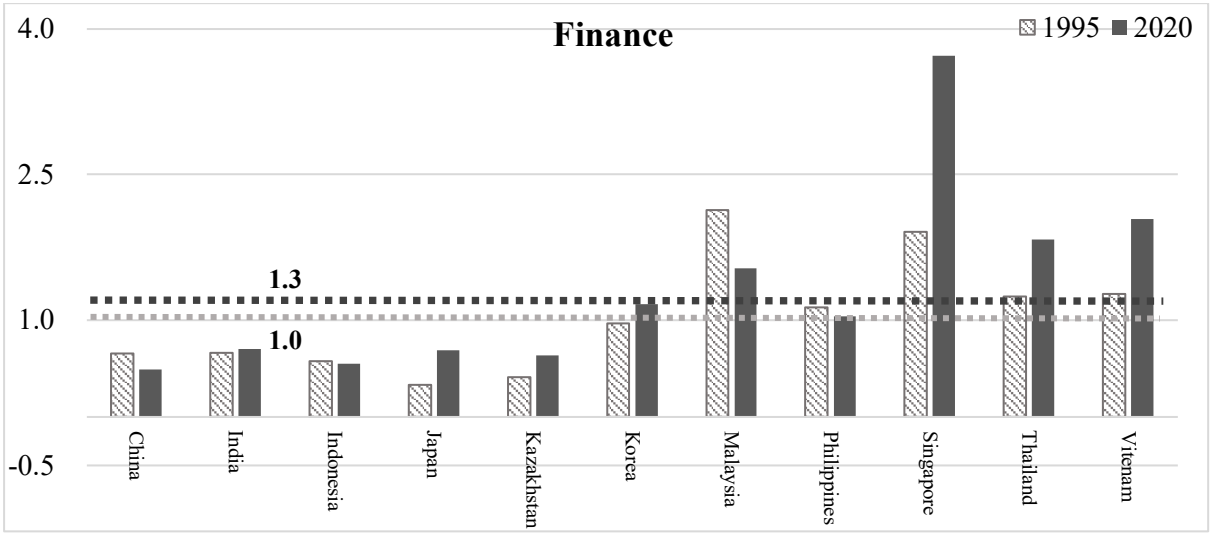


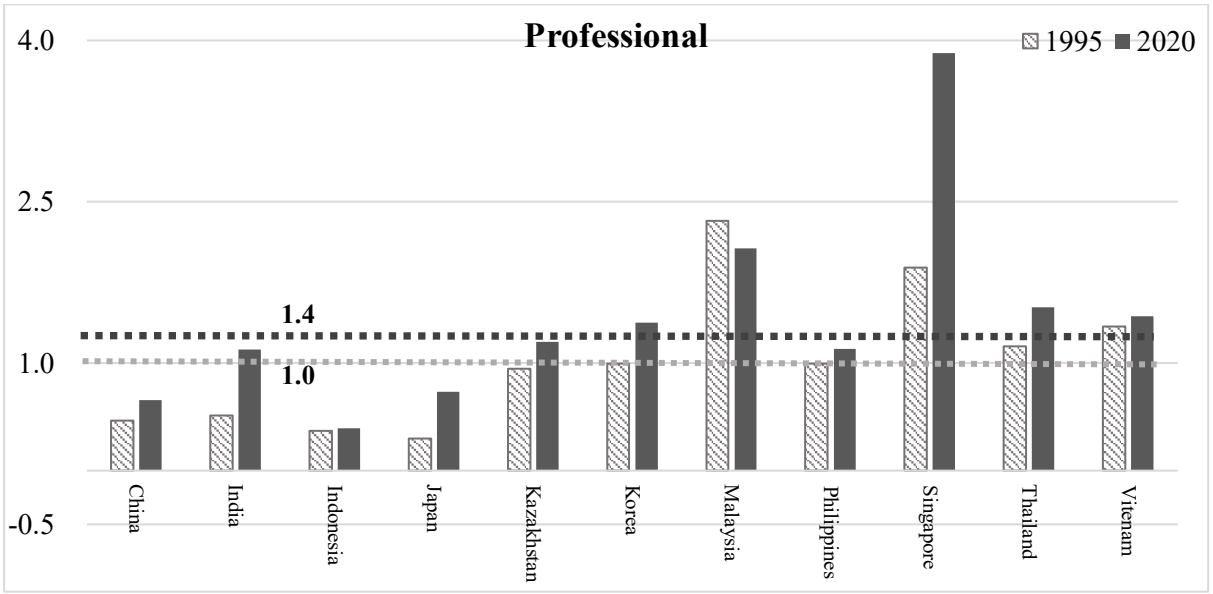
Source: UNCTAD 2025 database

Figure 2 Ratio of Foreign Value Added Inputs of Services to Gross Exports



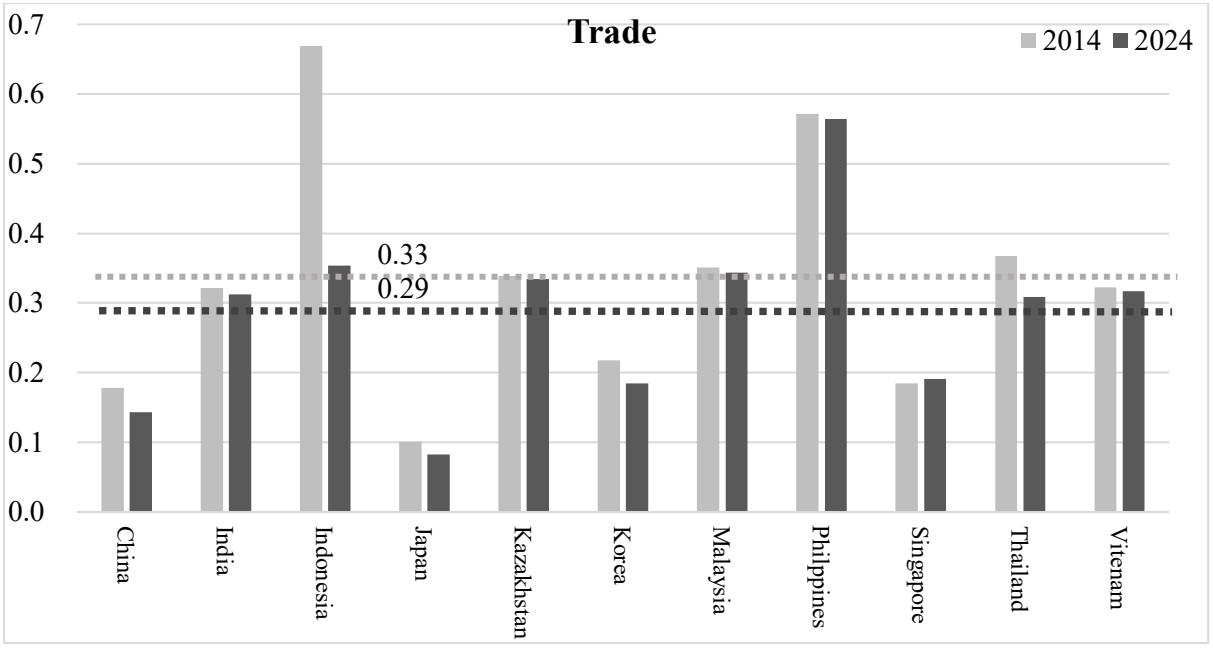


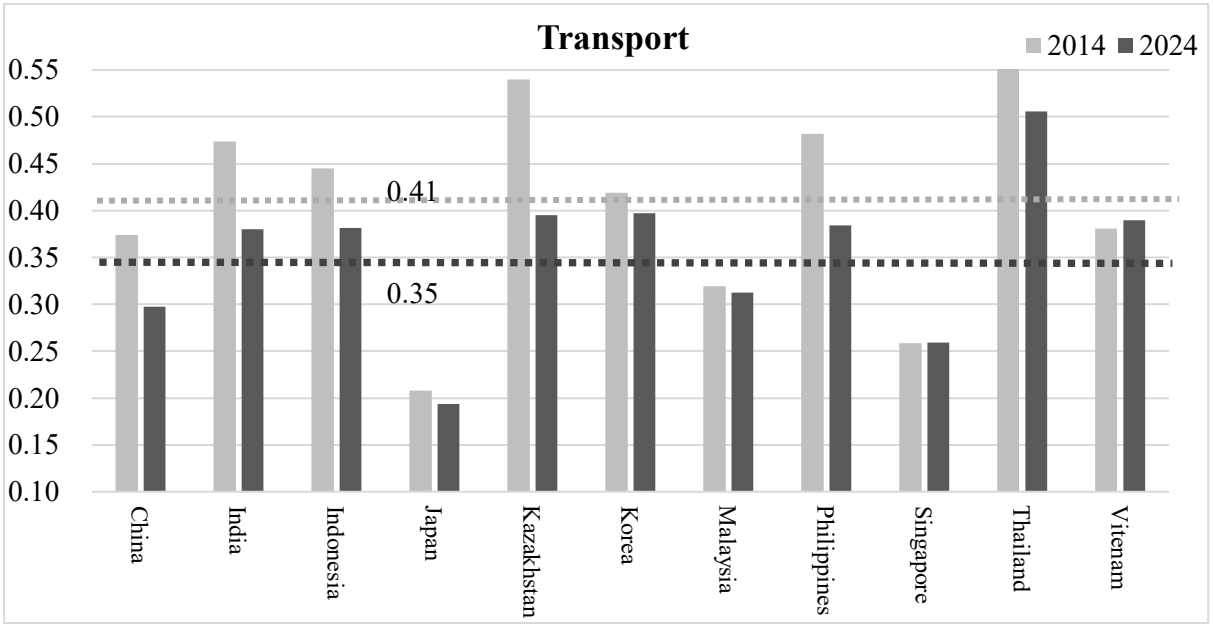


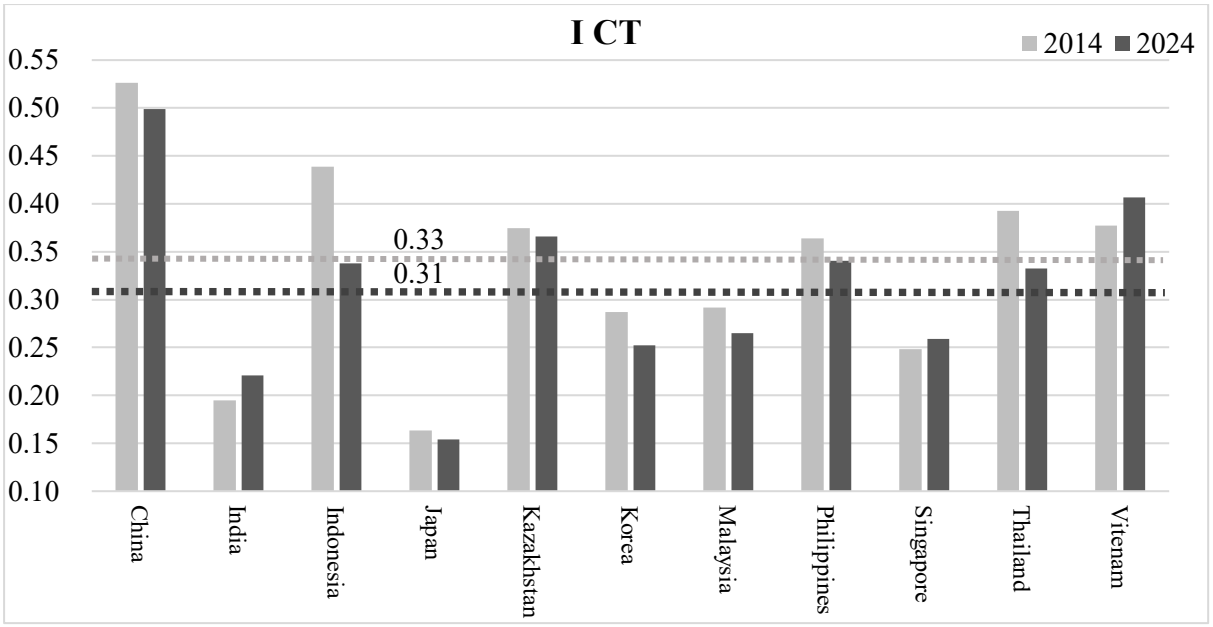


Sources: Authors' calculation based on the OECD TiVA 2023 database

Figure 3 Services Trade Restrictiveness Index






I CT
2014
2024
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.33
0.31
China
India
Indonesia
Japan
Kazakhstan
Korea
Malaysia
Philippines
Singapore
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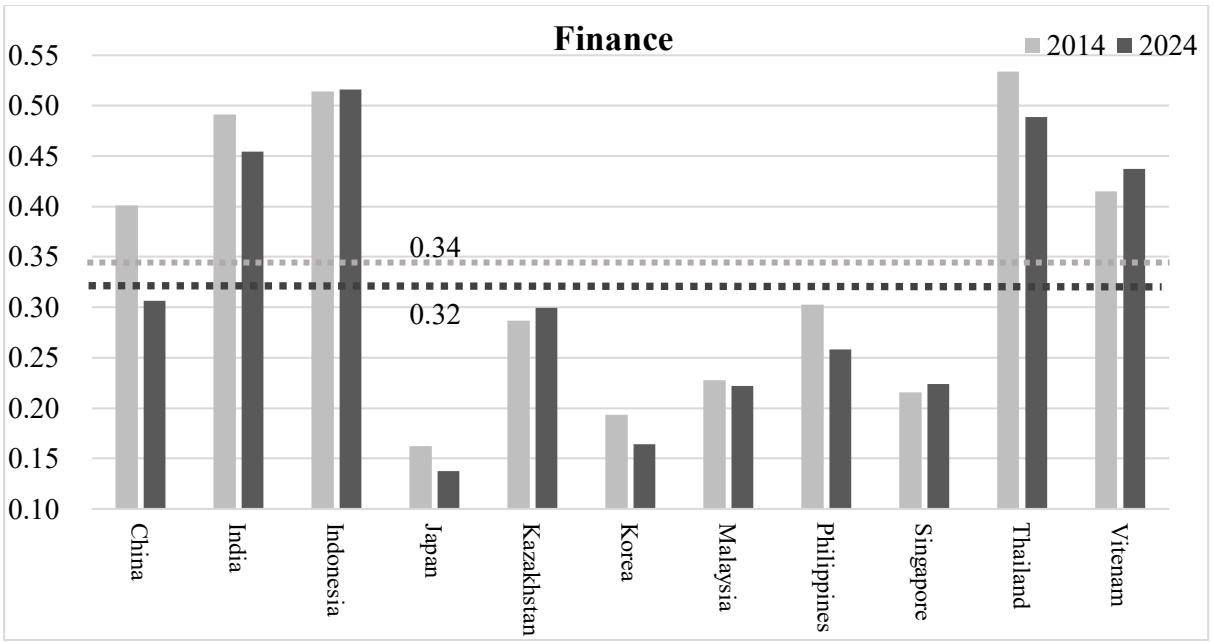
Finance
2014
2024
0.55
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0.20
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China
India
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Japan
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Philippines
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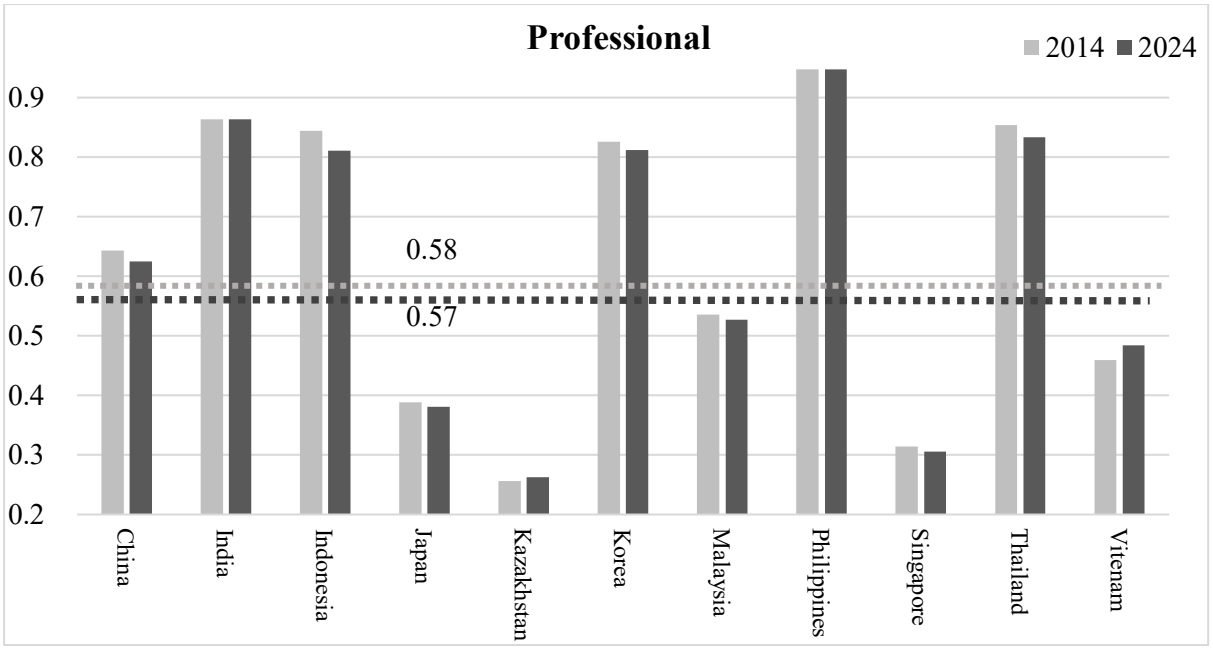

Sources: Authors' calculation based on the OECD STRI 2025 updated- database

Table 1 Categories in Business Sector Services

Sectors	(ACTIVITY) Economic activity
Wholesale and retail trade; repair of motor vehicles and motorcycles	· (G) Wholesale and retail trade; repair of motor vehicles and motorcycles
Transportation and storage	· (H) Transportation and storage
	· · (H49) Land transport and transport via pipelines
	· · · (H491) Transport via railways
	· · · · (H4912) Freight rail transport
	· · · (H492) Other land transport
	· · · · (H4923) Freight transport by road
	· · (H50) Water transport
	· · (H51) Air transport
	· · (H52) Warehousing and support activities for transportation
	· · · (H521) Warehousing and storage
	· · · (H522) Support activities for transportation
	· · · · (H5224) Cargo handling
Information and communication	· · (H53) Postal and courier activities
	· (J) Information and communication
	· · (J59) Motion picture, video and television programme production, sound recording and music publishing activities
	· · · (J591) Motion picture, video and television programme activities
	· · · (J592) Sound recording and music publishing activities
	· · (J60) Programming and broadcasting activities
	· · (J61) Telecommunications
	· · (J62_63) Computer programming, consultancy, and information service activities
Financial and Insurance activities	· (K) Financial and insurance activities
	· · (K64) Financial service activities, except insurance and pension funding
	· · (K65) Insurance, reinsurance and pension funding, except compulsory social security
Professional, scientific and technical activities	· (M) Professional, scientific and technical activities
	· · (M69) Legal and accounting activities
	· · · (M691) Legal activities
	· · · (M692) Accounting, bookkeeping and auditing activities; tax consultancy

Source: OECD STRI 2025 Edition

Table 2 List of variables and Data Sources

Variables	Description	Sources
fva_td	FVA: Wholesale and retail trade; repair of motor vehicles and motorcycles	OECD TiVA 2023
fva_tp	FVA: Transportation and storage	
fva_ic	FVA: Information and communication	
fva_fn	FVA: Financial and insurance activities	
fva_pf	FVA: Professional, scientific and technical activities	
stri_td	STRI: Wholesale and retail trade; repair of motor vehicles and motorcycles	OECD STRI 2025
stri_tp	STRI: Transportation and storage	
stri_ic	STRI: Information and communication	
stri_fn	STRI: Financial and insurance activities	
stri_pf	STRI: Professional, scientific and technical activities	

Source: Authors' creation

Note: FVA is foreign value added, and STRI is services trade restrictiveness index. The unit of FVA is millions of US dollars, and that of STRI is the value from "0" to "1".

Table 3 Descriptive Analysis

Variables	Obs.	Median	Std. Dev.	Min.	Max
ln fva_td	770	6.313	1.844	2.413	12.622
ln fva_tp	770	5.703	1.823	1.677	11.744
ln fva_ic	770	4.982	1.829	1.376	11.372
ln fva_fn	770	5.291	1.842	1.270	11.780
ln fva_pf	770	5.487	1.731	1.416	10.788
stri_td	770	0.312	0.178	0.000	0.669
stri_tp	770	0.381	0.148	0.000	0.555
stri_ic	770	0.292	0.137	0.000	0.567
stri_fn	770	0.283	0.160	0.000	0.534
stri_pf	770	0.485	0.285	0.000	0.897

Source: Authors' Description

Table 4 Top Ten Partner Economies for Value-added Inputs of Total Business Sector Services in Exports and Their Share (%) of Total Business Sector Services Inputs

Host Economies										
China	India	Indonesia	Japan	Kazakhstan	Korea	Malaysia	Philippines	Singapore	Thailand	Vietnam
Partner Economies										
Australia	China	Australia	Australia	China	Australia	Australia	China	China	China	China
0.6	1.4	0.5	0.5	1.8	1.2	1.0	3.7	4.8	5.8	17.1
China	France	China	China	France	China	China	Germany	Germany	Germany	Germany
84.2	0.3	2.8	1.9	0.4	5.8	6.4	0.5	1.7	1.1	1.5
France	Germany	Germany	Germany	Germany	Germany	Germany	India	Hong Kong	India	India
0.5	0.4	0.4	0.6	0.8	1.3	1.2	0.5	1.1	1.1	1.8
Germany	India	India	India	India	India	India	Japan	India	Japan	Japan
0.9	88.6	0.6	0.3	0.5	0.7	1.2	2.0	3.9	4.0	5.4
Japan	Ireland	Indonesia	Japan	Italy	Japan	Japan	Korea	Japan	Korea	Korea
1.9	0.3	86.0	88.6	0.5	2.9	3.9	1.1	5.1	1.1	7.4
Korea	Japan	Japan	Korea	Kazakhstan	Korea	Korea	Philippines	Korea	Singapore	Singapore
1.4	0.5	1.4	0.5	84.3	71.3	1.1	82.3	1.3	1.7	2.1
Russia	Korea	Korea	Russia	Korea	Russia	Malaysia	Singapore	Netherlands	Taiwan	Taiwan
0.4	0.3	0.6	0.3	0.9	0.9	65.0	1.2	1.2	0.8	3.0
Singapore	Singapore	Singapore	Singapore	Russia	Singapore	Singapore	Taiwan	Singapore	Thailand	Thailand
0.5	0.4	1.2	0.4	4.3	0.8	2.7	0.6	57.3	69.6	2.8
Taiwan	UK	Thailand	UK	UK	UK	Taiwan	UK	UK	UK	US
1.1	0.6	0.4	0.4	0.9	0.8	1.4	0.5	2.1	0.8	5.6
US	US	US	US	US	US	US	US	US	US	Vietnam
2.1	2.1	1.6	2.4	1.3	5.0	5.8	2.4	6.4	4.1	36.9
Total Share (%)										
93.5	94.8	95.4	95.8	95.7	90.7	89.9	94.8	84.9	90.2	83.5

Source: Authors' estimation

Table 5 Panel Unit Roots Tests

	Levin, Lin, and Chu Test	Fisher-ADF Chi-square	Fisher-PP Chi-square	Im, Pesaran, and Shin W-stat
ln fva_td	-11.179***	266.967**	373.527***	-1.636*
ln fva_tp	-12.015***	262.863**	315.146***	-1.660**
ln fva_ic	-24.426***	365.491***	290.149***	-5.550***
ln fva_fn	-14.610***	318.287***	430.741***	-3.476***
ln fva_pf	-20.571***	308.040***	435.152***	-3.155***
stri_td	-9.672***	228.072***	140.251	-3.865***
stri_tp	-10.084***	116.367	237.123***	3.369
stri_ic	-8.377***	75.306	153.227**	2.844
stri_fn	-19.387***	229.288***	286.736***	-1.415*
stri_pf	-154.671***	183.517***	58.351	-32.513***

Source: Authors' estimation

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% level,respectively.

Table 6 Gravity Trade Model Estimation Results

(a) Trade (Benchmark: China, Japan and Singapore)

Model Estimation		(i)	(ii)	(iii)	(iv)
Equation		2	2	3	3
Methology		OLS	PQML	OLS	PQML
STRI_td				-4.269***	-3.295***
				(-14.177)	(-186.870)
India	2014	0.148	-0.100***		
	2015	0.039	-0.177***		
	2016	0.057	-0.166***		
	2017	0.156	-0.019		
	2018	0.276**	0.087***		
	2019	0.308***	0.140***		
	2020	0.282**	0.072***		
Indonesia	2014	-4.813***	-4.874***		
	2015	-5.002***	-4.961***		
	2016	-5.020***	-4.944***		
	2017	-4.871***	-4.820***		
	2018	-4.750***	-4.757***		
	2019	-4.891***	-4.796***		
	2020	-4.975***	-4.875***		
Kazakhstan	2014	-2.722***	-2.639***		
	2015	-3.234***	-3.023***		
	2016	-3.122***	-3.227***		
	2017	-3.102***	-3.025***		
	2018	-2.854***	-2.859***		
	2019	-2.736***	-2.865***		
	2020	-2.939***	-3.095***		
Korea	2014	1.067***	0.637***		
	2015	0.924***	0.506***		
	2016	0.902***	0.490***		
	2017	0.984***	0.564***		
	2018	1.012***	0.609***		
	2019	0.918***	0.512***		
	2020	0.972***	0.721***		
Philippines	2014	-1.610***	-1.417***		
	2015	-1.472***	-1.421***		
	2016	-1.395***	-1.391***		
	2017	-1.260***	-1.289***		
	2018	-1.193***	-1.236***		
	2019	-1.173***	-1.221***		
	2020	-1.210***	-1.335***		
Malaysia	2014	0.000	0.011		
	2015	-0.138	-0.124***		
	2016	-0.202	-0.167***		
	2017	-0.093	-0.089***		
	2018	0.015	0.004		
	2019	-0.026	-0.019		
	2020	-0.028	-0.107***		
Thailand	2014	-0.048	-0.125***		
	2015	-0.122	-0.153***		
	2016	-0.118	-0.126***		
	2017	-0.011	-0.026		
	2018	0.026	0.041**		
	2019	-0.039	0.048***		
	2020	-0.136	-0.099***		
Vietnam	2014	-0.639***	-0.538***		
	2015	-0.531***	-0.454***		
	2016	-0.377**	-0.349***		
	2017	-0.183	-0.198***		
	2018	-0.081	-0.092***		
	2019	0.006	-0.008		
	2020	0.103	0.067***		
i Fixed Effects		Yes	Yes	No	No
j Fixed Effects		Yes	Yes	Yes	Yes
i-j Fixed Effects		Yes	Yes	Yes	Yes

(b) Transport (Benchmark: Japan, Malaysia, and Singapore)

Model Estimation		(i)	(ii)	(iii)	(iv)
Equation		2	2	3	3
Methology		OLS	PQML	OLS	PQML
STRI_tp				-4.815***	-4.306***
				(-14.435)	(-141.137)
China	2014	-0.363*	-0.393***		
	2015	-0.316	-0.383***		
	2016	-0.423**	-0.482***		
	2017	-0.312	-0.379***		
	2018	-0.287	-0.281***		
	2019	-0.298	-0.262***		
	2020	-0.227	-0.233***		
India	2014	-1.009***	-1.313***		
	2015	-1.020***	-1.397***		
	2016	-1.048***	-1.383***		
	2017	-0.953***	-1.285***		
	2018	-0.808***	-1.229***		
	2019	-0.768***	-1.180***		
	2020	-0.848***	-1.250***		
Indonesia	2014	-2.809***	-3.985***		
	2015	-2.921***	-3.916***		
	2016	-2.962***	-3.878***		
	2017	-2.845***	-3.769***		
	2018	-2.717***	-3.715***		
	2019	-2.831***	-3.696***		
	2020	-2.957***	-4.015***		
Kazakhstan	2014	-2.738***	-2.903***		
	2015	-3.072***	-3.226***		
	2016	-3.055***	-3.439***		
	2017	-3.087***	-3.256***		
	2018	-2.834***	-3.029***		
	2019	-2.693***	-3.053***		
	2020	-2.914***	-3.277***		
Korea	2014	0.216	0.030**		
	2015	0.250	0.170***		
	2016	0.197	0.106***		
	2017	0.233	0.117***		
	2018	0.286	0.163***		
	2019	0.239	0.109***		
	2020	0.251	0.083***		
Philippines	2014	-2.319***	-2.516***		
	2015	-2.176***	-2.434***		
	2016	-2.093***	-2.369***		
	2017	-1.950***	-2.255***		
	2018	-1.875***	-2.158***		
	2019	-1.853***	-2.101***		
	2020	-1.956***	-2.253***		
Thailand	2014	-0.396*	-0.729***		
	2015	-0.401*	-0.704***		
	2016	-0.413*	-0.660***		
	2017	-0.330	-0.586***		
	2018	-0.254	-0.479***		
	2019	-0.291	-0.457***		
	2020	-0.477**	-0.802***		
Vietnam	2014	-0.909***	-1.015***		
	2015	-0.737***	-0.929***		
	2016	-0.592**	-0.863***		
	2017	-0.467**	-0.747***		
	2018	-0.361	-0.626***		
	2019	-0.268	-0.529***		
	2020	-0.183	-0.527***		
i Fixed Effects		Yes	Yes	No	No
j Fixed Effects		Yes	Yes	Yes	Yes
i-j Fixed Effects		Yes	Yes	Yes	Yes

(c) ICT (Benchmark: Japan, India, and Singapore)

Model Estimation		(i)	(ii)	(iii)	(iv)
Equation		2	2	3	3
Methology		OLS	PQML	OLS	PQML
STRI_ic				-2.010***	-1.911***
				(-4.384)	(-57.381)
China	2014	-0.369	-0.768***		
	2015	-0.382	-0.653***		
	2016	-0.408	-0.631***		
	2017	-0.269	-0.502***		
	2018	-0.194	-0.203***		
	2019	-0.227	-0.204***		
	2020	-0.175	-0.171***		
Indonesia	2014	-2.996***	-3.754***		
	2015	-3.096***	-3.805***		
	2016	-3.107***	-3.752***		
	2017	-3.000***	-3.635***		
	2018	-2.879***	-3.555***		
	2019	-3.002***	-3.553***		
	2020	-3.162***	-3.626***		
Kazakhstan	2014	-4.045***	-3.746***		
	2015	-4.390***	-4.161***		
	2016	-4.330***	-4.504***		
	2017	-4.376***	-4.357***		
	2018	-4.111***	-4.235***		
	2019	-4.097***	-4.308***		
	2020	-4.292***	-4.572***		
Korea	2014	0.132	-0.310***		
	2015	-0.012	-0.431***		
	2016	-0.036	-0.429***		
	2017	0.087	-0.373***		
	2018	0.145	-0.255***		
	2019	0.088	-0.258***		
	2020	0.076	-0.290***		
Philippines	2014	-3.566***	-3.353***		
	2015	-3.356***	-3.276***		
	2016	-3.276***	-3.231***		
	2017	-3.117***	-3.175***		
	2018	-3.011***	-3.140***		
	2019	-2.984***	-3.100***		
	2020	-3.129***	-3.258***		
Malaysia	2014	-1.764***	-1.731***		
	2015	-1.881***	-1.868***		
	2016	-1.876***	-1.875***		
	2017	-1.779***	-1.809***		
	2018	-1.680***	-1.729***		
	2019	-1.737***	-1.763***		
	2020	-1.935***	-2.043***		
Thailand	2014	-1.702***	-1.783***		
	2015	-1.729***	-1.770***		
	2016	-1.709***	-1.711***		
	2017	-1.640***	-1.645***		
	2018	-1.530***	-1.546***		
	2019	-1.600***	-1.538***		
	2020	-1.756***	-1.883***		
Vietnam	2014	-2.850***	-2.899***		
	2015	-2.701***	-2.778***		
	2016	-2.541***	-2.501***		
	2017	-2.386***	-2.387***		
	2018	-2.256***	-2.262***		
	2019	-2.222***	-2.193***		
	2020	-2.202***	-2.313***		
i Fixed Effects		Yes	Yes	No	No
j Fixed Effects		Yes	Yes	Yes	Yes
i-j Fixed Effects		Yes	Yes	Yes	yes

(d) Finance (Benchmark: Japan, Korea, and Singapore)

Model Estimation		(i)	(ii)	(iii)	(iv)
Equation		2	2	3	3
Methology		OLS	PQML	OLS	PQML
STRI_fn				-3.869***	-4.136***
				(-14.045)	(-136.238)
China	2014	-0.865***	-0.911***		
	2015	-0.937***	-0.821***		
	2016	-1.021***	-0.939***		
	2017	-0.942***	-0.918***		
	2018	-0.902***	-0.898***		
	2019	-0.917***	-0.924***		
	2020	-0.870***	-0.902***		
India	2014	-0.995***	-1.427***		
	2015	-1.068***	-1.491***		
	2016	-1.015***	-1.530***		
	2017	-0.935***	-1.430***		
	2018	-0.917***	-1.321***		
	2019	-0.964***	-1.278***		
	2020	-0.925***	-1.292***		
Indonesia	2014	-3.830***	-4.823***		
	2015	-3.915***	-4.824***		
	2016	-3.971***	-4.767***		
	2017	-3.860***	-4.610***		
	2018	-3.764***	-4.546***		
	2019	-3.874***	-4.596***		
	2020	-4.017***	-4.662***		
Kazakhstan	2014	-3.676***	-3.477***		
	2015	-4.072***	-3.846***		
	2016	-3.892***	-4.056***		
	2017	-4.023***	-3.902***		
	2018	-3.823***	-3.873***		
	2019	-3.726***	-3.903***		
	2020	-3.923***	-4.174***		
Philippines	2014	-3.091***	-2.941***		
	2015	-2.925***	-2.888***		
	2016	-2.850***	-2.844***		
	2017	-2.757***	-2.759***		
	2018	-2.678***	-2.721***		
	2019	-2.645***	-2.685***		
	2020	-2.777***	-2.891***		
Malaysia	2014	-1.340***	-1.370***		
	2015	-1.431***	-1.478***		
	2016	-1.509***	-1.490***		
	2017	-1.421***	-1.403***		
	2018	-1.314***	-1.308***		
	2019	-1.364***	-1.334***		
	2020	-1.479***	-1.507***		
Thailand	2014	-0.756***	-0.827***		
	2015	-0.760***	-0.804***		
	2016	-0.803***	-0.803***		
	2017	-0.741***	-0.721***		
	2018	-0.663***	-0.646***		
	2019	-0.688***	-0.640***		
	2020	-0.831***	-0.833***		
Vietnam	2014	-2.084***	-2.035***		
	2015	-1.929***	-1.897***		
	2016	-1.829***	-1.811***		
	2017	-1.710***	-1.720***		
	2018	-1.588***	-1.609***		
	2019	-1.524***	-1.533***		
	2020	-1.497***	-1.531***		
i Fixed Effects		Yes	Yes	No	No
j Fixed Effects		Yes	Yes	Yes	Yes
i-j Fixed Effects		Yes	Yes	Yes	yes

(e) Professional (Benchmark: Japan, Kazakhstan, and Singapore)

Model Estimation		(i)	(ii)	(iii)	(iv)
Equation		2	2	3	3
Methology		OLS	PQML	OLS	PQML
STRI_pf				-1.857***	-1.830***
				(-10.601)	(-115.263)
China	2014	0.253	0.400***		
	2015	0.312	0.431***		
	2016	0.237	0.336***		
	2017	0.339	0.404***		
	2018	0.341	0.500***		
	2019	0.365	0.504***		
	2020	0.417	0.539***		
India	2014	-0.324	-0.829***		
	2015	-0.191	-0.763***		
	2016	-0.166	-0.684***		
	2017	-0.070	-0.567***		
	2018	0.052	-0.466***		
	2019	0.114	-0.434***		
	2020	0.247	-0.355***		
Indonesia	2014	-3.327***	-5.266***		
	2015	-3.398***	-5.469***		
	2016	-3.457***	-5.558***		
	2017	-3.356***	-5.474***		
	2018	-3.233***	-5.330***		
	2019	-3.348***	-5.337***		
	2020	-3.516***	-5.603***		
Korea	2014	-0.187	-0.179***		
	2015	-0.174	-0.117***		
	2016	-0.243	-0.193***		
	2017	-0.175	-0.166***		
	2018	-0.186	-0.119***		
	2019	-0.197	-0.112***		
	2020	-0.242	-0.168***		
Philippines	2014	-1.424***	-2.619***		
	2015	-1.153***	-2.406***		
	2016	-1.072***	-2.276***		
	2017	-0.950***	-2.129***		
	2018	-0.866***	-1.997***		
	2019	-0.786***	-1.938***		
	2020	-0.902***	-2.063***		
Malaysia	2014	0.424	-0.652***		
	2015	0.360	-0.790***		
	2016	0.370	-0.801***		
	2017	0.489	-0.711***		
	2018	0.559*	-0.623***		
	2019	0.572*	-0.577***		
	2020	0.355	-0.833***		
Thailand	2014	0.322	-0.802***		
	2015	0.355	-0.813***		
	2016	0.361	-0.784***		
	2017	0.397	-0.778***		
	2018	0.480	-0.689***		
	2019	0.452	-0.698***		
	2020	0.267	-0.920***		
Vietnam	2014	-0.788**	-1.885***		
	2015	-0.558*	-1.749***		
	2016	-0.449	-1.592***		
	2017	-0.322	-1.482***		
	2018	-0.223	-1.375***		
	2019	-0.166	-1.310***		
	2020	-0.127	-1.317***		
i Fixed Effects		Yes	Yes	No	No
j Fixed Effects		Yes	Yes	Yes	Yes
i-j Fixed Effects		Yes	Yes	Yes	yes

Source: Authors' estimation

Note: *, **, and *** denote rejection of the null hypothesis at 90%, 95%, and 99% levels, respectively. The t-statistics are shown in parentheses.

Table 7 Contributions of Services Trade Restrictiveness

(a) Trade

Trade	Host Economies' Fixed Effects	STRI	STRI (b) - Benchmark STRI	(c) × -3.29511 [coefficient]	(d) / (a) Ave. 0.518
	(a)	(b)	(c)	(d)	(e)
Indonesia	-4.861***	0.647	0.492	-1.621	0.333
Kazakhstan	-2.962***	0.337	0.182	-0.599	0.202
Philippines	-1.330***	0.566	0.411	-1.356	1.019

(b) Transport

Transport	Host Economies' Fixed Effects	STRI	STRI (b) - Benchmark STRI	(c) × -4.306 [coefficient]	(d) / (a) Ave. 0.467
	(a)	(b)	(c)	(d)	(e)
China	-0.345***	0.366	0.077	-0.332	0.862
India	-1.291***	0.456	0.167	-0.720	0.547
Indonesia	-3.854***	0.404	0.114	-0.493	0.113
Kazakhstan	-3.169***	0.451	0.162	-0.696	0.190
Philippines	-2.298***	0.471	0.181	-0.781	0.280
Thailand	-0.631***	0.541	0.251	-1.082	0.965
Vietnam	-0.748***	0.379	0.089	-0.385	0.311

(c) ICT

ICT	Host Economies' Fixed Effects	STRI	STRI (b) - Benchmark STRI	(c) × -1.191 [coefficient]	(d) / (a) Avg 0.202
	(a)	(b)	(c)	(d)	(e)
China	-0.447***	0.545	0.343	-0.409	0.914
Indonesia	-3.669***	0.383	0.181	-0.216	0.059
Kazakhstan	-4.269***	0.368	0.165	-0.197	0.046
Korea	-0.335***	0.278	0.076	-0.091	0.271
Philippines	-3.219***	0.354	0.152	-0.181	0.056
Malaysia	-1.831***	0.290	0.088	-0.105	0.057
Thailand	-1.697***	0.374	0.172	-0.205	0.121
Vietnam	-2.476***	0.386	0.184	-0.219	0.088

(d) Finance

Finance	Host Economies' Fixed Effects	STRI	STRI (b) - Benchmark STRI	(c) × -4.136 [coefficient]	(d) / (a) Ave. 0.441
	(a)	(b)	(c)	(d)	(e)
China	-0.902***	0.388	0.208	-0.859	0.953
India	-1.396***	0.477	0.296	-1.224	0.877
Indonesia	-4.690***	0.516	0.335	-1.387	0.296
Kazakhstan	-3.890***	0.279	0.099	-0.408	0.105
Philippines	-2.818***	0.288	0.107	-0.442	0.157
Malaysia	-1.413***	0.227	0.046	-0.191	0.135
Thailand	-0.754***	0.521	0.340	-1.408	1.869
Vietnam	-1.734***	0.417	0.236	-0.977	0.564

(e) Professional

Professional	Host Economies' Fixed Effects	STRI	STRI (b) - Benchmark STRI	(c) × -1.829767 [coefficient]	(d) / (a) Ave. 1.505
	(a)	(b)	(c)	(d)	(e)
India	-0.585***	0.814	0.548	-1.003	1.713
Indonesia	-5.434***	0.784	0.519	-0.949	0.175
Korea	-0.151***	0.771	0.505	-0.924	6.134
Philippines	-2.204***	0.897	0.632	-1.156	0.524
Malaysia	-0.712***	0.484	0.218	-0.400	0.561
Thailand	-0.783***	0.800	0.534	-0.977	1.248
Vietnam	-1.530***	0.415	0.149	-0.2724	0.178

Sources: Authors' estimation