ACI Research Paper #17-2026

How Export Controls Reshape China's Outward FDI: Evidence and Trade Implications for Host Economies

Jingting LIU

Weilin LU

August 2026

Please cite this article as:

Liu, Jingting and Weilin Lu, "How Export Controls Reshape China's Outward FDI: Evidence and Trade Implications for Host Economies", Research Paper #17-2026, *Asia Competitiveness Institute Research Paper Series (August 2026).*

© 2026 by Jingting Liu, Weilin Lu and Asia Competitiveness Institute. All rights reserved. Short sections of text, not to exceed two paragraphs may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

How Export Controls Reshape China's Outward FDI: Evidence and Trade Implications for Host Economies*

Jingting Liu ‡ Weilin Lu †

August 2026

Abstract

We study how export controls imposed on China reshape its global investment patterns and host economies' trade and GVC linkages. We first document two stylized facts: China is increasingly exposed to export controls that disproportionately target its strategic industries, and, over the same period, Chinese outward FDI has become concentrated in the strategic sectors. Exploiting the staggered exposure of industries to these controls, we find that the value of Chinese outward FDI in affected industries more than doubles on average, driven by the intensive margin rather than new entry. For connector and ASEAN economies, the response concentrates at the extensive margin instead, with the likelihood of Chinese investment rising by 60 to 80 percent. In host economies, industries receiving export-control–induced Chinese FDI raise their imports of capital goods and production-critical inputs from China, consistent with production relocation by Chinese firms. We provide two pieces of evidence on the mechanism. First, this is not simply trade rerouting, as exports of these inputs to the US or the rest of the world do not rise simultaneously in industries receiving export-control-induced Chinese FDI. Second, the higher import of inputs from China appears only where Chinese investment is present, not in industries subject to the same controls but receiving no Chinese FDI. We find that Chinese FDI-receiving countries strengthen both forward and backward GVC linkages with China, especially ASEAN. Decomposing GVC linkages by host economies' firm ownership, we show the increasing GVC linkages with China are driven by foreign rather than local firms. The findings are robust to alternative estimators, balanced cohorts, and controlling for China's domestic structural shifts.

---

‡ Liu: Senior Lecturer at James Cook University Singapore. Address: 149 Sims Dr, Singapore 387380. Email: cindy.liu@jcu.edu.au. **Corresponding author.** Liu is also a research affiliate of the Asia Competitiveness Institute.

† Lu: Research Analyst at the Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore. Address: 469C Bukit Timah Rd, Singapore 259772. Email: wei-lin@nus.edu.sg.

* This research received no external financial support. The authors declare that they have no relevant or material financial interests related to this research.

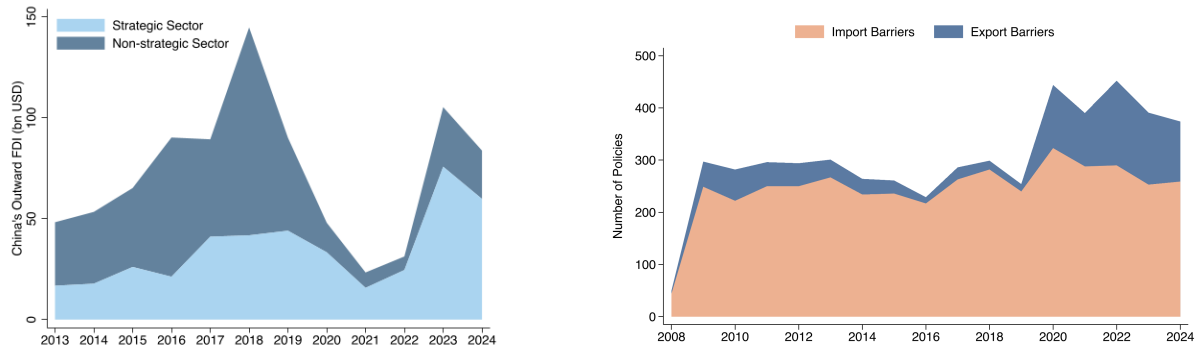
1 Introduction

Trade protectionism did not peak in 2018 in the wake of the US-China trade war. Instead, it expanded at an accelerated rate afterward. In 2018, 271 restrictive policies were newly erected, compared with only 124 liberalizing policies (St. Gallen Endowment for Prosperity through Trade, 2026). By 2022, the gap between restrictive and liberalizing policies had widened further: for every new liberalizing policy, four additional restrictive policies were implemented.

Trade-restrictive measures affecting China followed similar patterns as the supply chain involving China reconfigured through both trade (Alfaro and Chor, 2023; Freund et al., 2024; Fajgelbaum et al., 2024) and Chinese multinational enterprises (MNEs) increasingly entered foreign markets (Garred and Yuan, 2025; Wang et al., 2025), a trend widely documented in connection with the US-China trade war.

Yet a less-documented trend is that the increase in Chinese outward foreign direct investment (FDI) has become highly concentrated in strategic industries since 2022 (see Table 5 in Appendix A for a list of the industry codes), a pattern not observed during the height of US-China trade tensions (Fig. 1). This concentration coincided with the rise of export controls affecting China, which disproportionately targeted strategic industries.

FIGURE 1: Rise in China's Outward Investment and Export Restrictions Affecting China



(A) China's Outward FDI

(B) Export Controls Affecting China

Notes: Strategic sectors are defined at the ISIC Rev. 4 3-digit level, following Online Annex Table 4.1.5 of International Monetary Fund (2023). Using the 2-digit HS code strategic industry definition in Freund et al. (2024) lands us similar figures.

This paper explores whether the increase in export controls has given rise to a surge in Chinese outward FDI, and how the trade profiles and global value chain participation of the Chinese FDI-receiving industries in recipient countries subsequently change. Exploiting the first time an industry was subject to export controls imposed on China, we contrast Chinese outward FDI in affected and non-affected industries, using a staggered difference-in-differences estimator (Callaway and Sant'Anna,

2021). Second, we examine changes in the import and export structures of industries in host economies that both received Chinese FDI and were the same industries affected by export controls imposed on China. Third, we analyze the forward and backward linkages of these countries' FDI-receiving and export control-influenced industries with both China and the world.

We find that Chinese outward FDI from export-control-targeted industries increases by more than 2-fold on aggregate following the imposition of export controls. Much of this effect is driven by strategic industries and occurs at the intensive margin, indicating that destination-country industries with an existing presence of Chinese FDI attract additional Chinese investment after export controls are imposed. By contrast, connector economies and ASEAN countries—regions widely believed to have benefited from increasing geoeconomic fragmentation—experience stronger effects at the extensive margin, with the likelihood of Chinese investment increasing by between 60% and 80%. This indicates Chinese firms entering industries in which they had no prior investment presence after being exposed to export controls.

A more interesting question is whether and how the trade profiles of the host economies of Chinese outward FDI will subsequently change. We estimated shifts in host economies' trade patterns and their forward and backward linkages with both China and the world, comparing industries that received Chinese FDI and were subject to export controls imposed on China with those that were not. We find that host economies' imports of critical inputs from China rose significantly, while their share of capital goods imports increased as well, albeit with less precision. This effect is more prominent in connector countries and ASEAN economies. Meanwhile, there's no significant change in these countries' import and export structures with the world.

But do such shifts in host economies' trade profiles reflect Chinese firms relocating production away from China to the host countries following export controls imposed on China, or do they coincide with some trade-rerouting behavior, often triggered by import barriers such as tariffs? To answer this, we further estimated whether these countries experienced simultaneous increases in exports of critical inputs or in the share of capital goods exports, in tandem with the increase in their imports from China. In particular, we find no evidence of such a change in the structure of their exports to the US, alleviating concerns that these changes are due to other trade-rerouting motives.

Further looking into the mechanism, we ask whether the changes in these countries' import structures from China are indeed associated with Chinese FDI. To this end, we estimate the impact of export controls hitting China on other countries' imports of critical inputs in the same export-control-exposed industries, contrasting those country-industries that received Chinese FDI against those that did not. The results

from this exercise indicate that any shifts in these countries' profile of imports from China are associated with the presence of Chinese FDI.

Finally, we examine whether there are any changes to how these countries are embedded in the global value chain. By contrasting changes in value added originating from Chinese FDI recipient countries, embodied in the exports of the rest of the world and China, between industries subject to export controls imposed on China and those not, we find that these FDI host economies' forward linkages with both the world and China increased significantly, suggesting they are becoming more integrated suppliers to both China and the world. Meanwhile, we find a significant increase in value added originating from China, embodied in these FDI host economies' exports in export-control-targeted industries, following the policy shock, while value added from the rest of the world, embodied in their exports, did not increase. These indicate that these countries are increasingly sourcing from China but not necessarily from the world, and the effect is especially strong for connector and ASEAN countries. By segregating GVC linkages to those involving domestic and foreign firms in Chinese FDI host economies, we find that the strengthening of GVC linkages with China is concentrated on the foreign firms in these host economies, and this difference is particularly robust for backward linkages. Taken together, we find that Chinese FDI host economies are more embedded in Chinese supply chains, and these linkages work through foreign firms present in these host economies. To the extent that increased GVC linkages are associated with production and growth, any such benefit may accrue to foreign rather than domestic firms.

This paper relates to the growing literature on supply chain reshuffling due to the US-China trade war. This literature finds that, while there is notional bilateral trade decoupling between the US and China, the drop in China's share of US imports has been offset by increased imports from other countries often linked to China's supply chains (Jiang et al., 2023; Freund et al., 2024; Garred and Yuan, 2025; Alfaro and Chor, 2026). More broadly, this paper relates to the economic impact of tariffs (Fajgelbaum et al., 2020; Flaaen et al., 2020; Barattieri and Cacciatore, 2023) and reconfiguration of trade and FDI amid rising protectionism and geopolitical fragmentation (Aiyar et al., 2023; Gopinath et al., 2025). We deviate by focusing on export controls, a rising form of trade-restrictive measure on the export side, rather than tariffs, which are import barriers.

Several studies have also looked into the third-country effects of protectionist trade policies. In the context of the US-China trade war, Fajgelbaum et al. (2024) find that more than just trade reshuffling, new export opportunities were created for "bystander" countries. Cavalcanti et al. (2026) find that China's retaliatory tariffs on the US increased both Brazil's exports to China and employment. We complement these studies by examining the third-country trade implications of export controls on China.

Lastly, this paper speaks to the strand of literature on export controls specifically. Several studies examined how Chinese firms responded to US-imposed export controls within China, including resorting to domestic and alternative foreign suppliers (Crosignani et al., 2026) and indirectly affected firms ramping up innovation (He and Lyu, 2025). Closer to our work, Deseatnicov and Fukao (2024) find that Japanese multinational enterprises (MNEs) are increasingly relocating from China, driven by a reduction in the variety of imported intermediate inputs due to export controls. Motivated by a similar rationale, we instead examine Chinese firms' offshoring responses in the affected industries.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 studies the impact of the export controls on the offshoring activity of Chinese firms. Section 4 and 5 take a closer look at the subsequent trade and supply chain implications of the Chinese FDI recipient countries. In Section 6, we report the robustness analysis. Finally, Section 7 concludes.

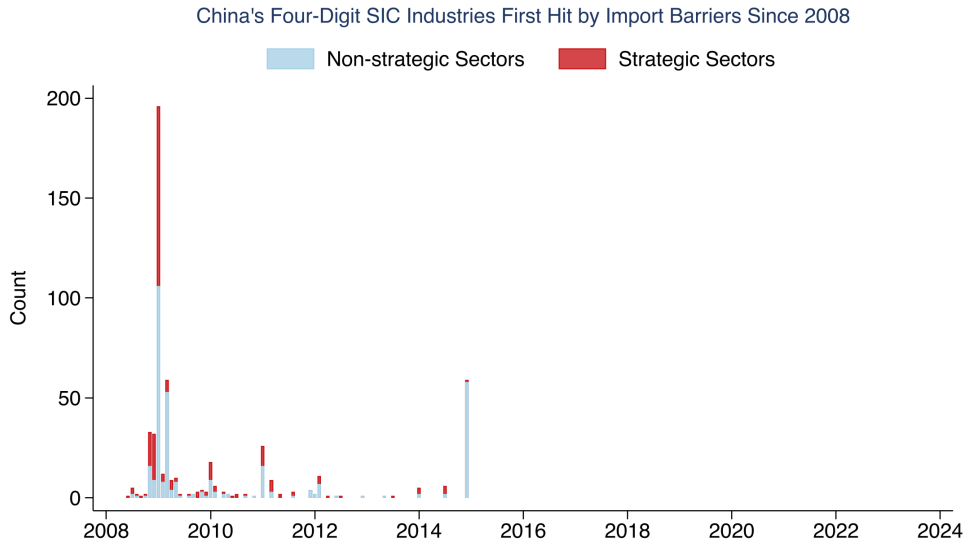
2 Data

This paper draws on data on trade protectionist measures from the Global Trade Alert (GTA) database, which has been a common source in several earlier studies on trade policy (Evenett et al., 2024; Ruta and Sztajerowska, 2025; Jakubik and Ruta, 2023; Jakubik et al., 2023). The GTA classifies measures into three categories: red, which clearly discriminate against foreign commercial interests; amber, which are likely to have discriminatory effects; and green, which liberalize trade or improve transparency. We filter the targeted (destination) country to be China. Following Evenett et al. (2024), we distinguish between import barriers and export barriers, and match the specific products affected at the six-digit Harmonized System (HS) level or 3-digit Central Product Classification (CPC) sector level to their respective Standard Industrial Classification (SIC) industry codes for later merging with foreign direct investment or OECD Trade in Value Added (TiVA) data.

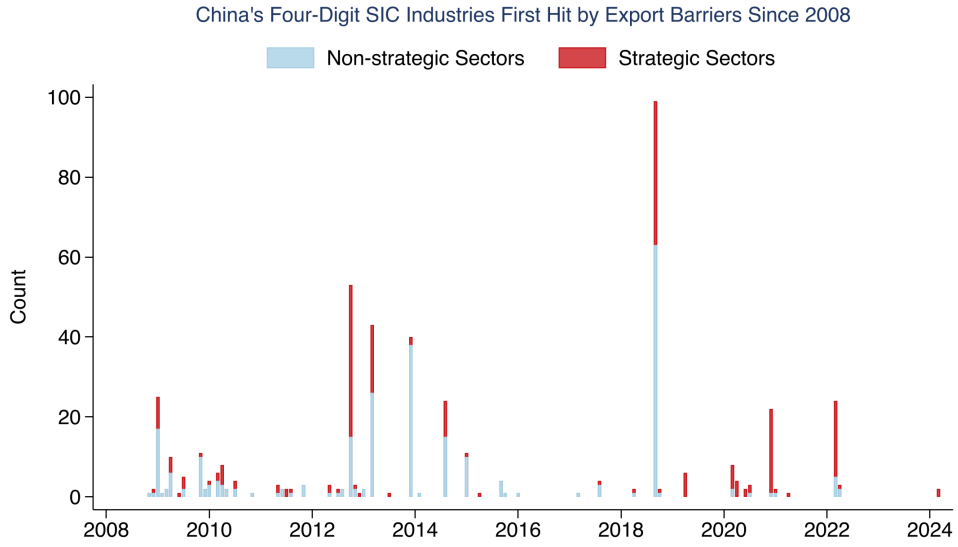
Figure 2 plots the distribution of the number of industries in China coded at the 4-digit SIC level first hit by an import barrier (panel 2a) or an export barrier (panel 2b) across all months from 2008 to 2024. While import barriers are not new, peaking around the post-global financial crisis (GFC) period, and do not discriminate between strategic and nonstrategic industries, the surge in export controls hitting China is more recent and increasingly targets strategic industries. Indeed, Table 6 in Appendix A shows that for trade war tariffs imposed by the US on China between 2018 and 2020, less than 50% of the affected products belong to strategic industries, whereas nearly 60% of products first imposed by an export control after 2018 were strategic, and the share rises to 75% after 2021. We further present the industries that

were first hit by an export control in Table 7 in Appendix A. Electronic Components and Accessories and Measuring and Controlling Devices are the top-hit sectors, which consist mostly of strategic industries.

FIGURE 2: Distribution of China's Four-Digit SIC Industries First Hit by Import and Export Barriers Since 2008



(A) Industries First Hit by Import Barriers



(B) Industries First Hit by Export Barriers

Notes: The date refers to the point in time when the 4-digit SIC industry was first affected by import barriers and export barriers, beginning in 2008, the earliest year covered by the Global Trade Alert (GTA) database.

For our purpose of estimating the impact of export barriers on Chinese outward FDI, we rely on Bureau van Dijk's Orbis Crossborder Investment (OCI) database for more granular FDI data than official sources, which encodes the industry of each FDI project at the 4-digit SIC level. The database provides

detailed information on the source country of each FDI project, which we filter to China, the destination country, and the project announcement date. Earlier studies on trade fragmentation and determinants of MNE internationalization decisions have similarly used OCI data (Zabetta et al., 2025; Estrin et al., 2018; Musteen et al., 2025; Schulze and Xin, 2025).

To examine any subsequent changes to the trade profiles of FDI-receiving countries, we use annual bilateral trade data at the six-digit level of the Harmonized System (HS) product classification, obtained from CEPII-BACI (Gaulier and Zignago, 2010). We map trade data to their associated industries, coded according to the SIC, using the correlation table from the World Integrated Trade Solution (WITS). Finally, we classify each traded product by its relative position in the supply chain as a capital good, intermediate product, or final consumption product, based on the Broad Economic Categories (BEC) classification. The resulting dataset enables us to examine whether trade patterns diverge between industries targeted by export controls and those that are not. For example, a differential increase in the import shares of capital goods or intermediate inputs in targeted industries would serve as a stronger signal that export control–driven Chinese outward FDI is associated with production relocation to host countries than an increase in the import share of consumption goods.

We complement the analysis by constructing a trade volume index weighted by product centrality, a measure capturing the importance of a product as an input in production networks[1]. This allows us to test whether imports in industries receiving export control–driven Chinese FDI shift toward more production-critical goods, which will be consistent with strengthening domestic production capabilities (Fetzer et al., 2024). Finally, to understand the implications of export-control-driven Chinese outward FDI for receiving countries' global value chain (GVC) participation, we map OECD economic activities from the TiVA dataset to SIC industry codes to align TiVA data with both FDI and export controls. To disentangle the GVC linkages involving domestically-owned enterprises and foreign-invested enterprises in these host economies, we further draw on the OECD Activity of Multinational Enterprises (AMNE) database. Table 8 presents the summary statistics.

3 Export Controls and Chinese Firms' Direct Investment Abroad

We use a staggered difference-in-differences approach to examine: (i) whether the imposition of export barriers on China increased Chinese firms' direct investment abroad; (ii) if so, whether such increases are

[1]The centrality measure we use is the Integrated Global Product Centrality (IGPC) from (Fetzer et al., 2024). The IGPC measure provides a network-based measure of product importance that incorporates both trade intensity and supply-chain position. Conceptually, it parallels PageRank: products connected to highly central products receive higher scores, reflecting their systemic importance.

mainly accounted for by the strategic industries; and (iii) which countries received more Chinese outward FDI. The conventional TWFE estimator for staggered difference-in-differences may yield biased estimates when treatment effects are heterogeneous across groups or over time, as it implicitly uses already-treated units as controls for not-yet-treated units. This can distort the estimated average treatment effect when treatment timing varies across groups (De Chaisemartin and d'Haultfoeuille, 2020; Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021). To address these identification concerns, we adopt the approach of Callaway and Sant'Anna (2021) instead. Using this estimator, we compare each treatment cohort only to units that are never treated. Our identification relies on the parallel trends assumption: in the absence of export barriers, treated industries would have followed the same trajectory of outward FDI as never-treated industries.

Below we first estimate whether Chinese outward FDI differs between industries exposed to export controls and those that are not, following Callaway and Sant'Anna (2021). We define the treatment cohort $g_i = \min\{y : \text{industry } i \text{ is first subject to an export barrier targeting China in year } y\}$, with $g_i = 0$ for never-treated industries. We examine a five-year window before and after policy implementation for the event study:

$$ATT^{ES}(e) = \sum_{g} w(g,e)\, ATT(g, g+e), \qquad e \in \{-5,-4,-3,-2,-1,0,1,2,3,4,5\} \tag{1}$$

where

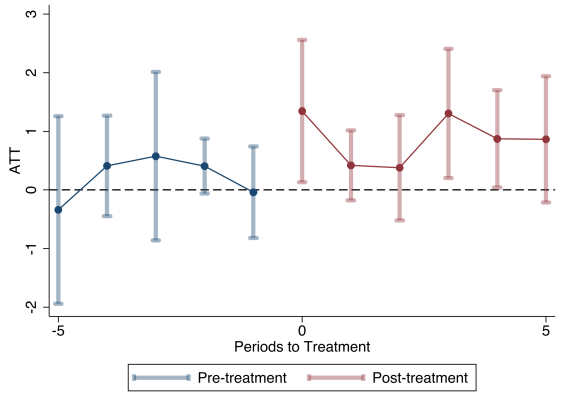
$$ATT(g,t) = E\left[Y_t(g) - Y_t(0) \mid G = g\right] \tag{2}$$

denotes the average treatment effect for units first treated in period g evaluated at calendar time t, identified under parallel trends by the difference-in-differences $ATT(g,t) = \mathbb{E}[\, Y_t - Y_{g-1} \mid G = g\,] - \mathbb{E}[\, Y_t - Y_{g-1} \mid G = 0\,]$, where $G = 0$ denotes never-treated industries and the weights $w(g,e)$ give each cohort's share among units observed e periods from treatment. We consider $Y_t = \log(FDI_t)$, $Y_t = \log(1 + FDI_t)$, and $Y_t = \mathbf{1}\{FDI_t > 0\}$ to examine the intensive-margin effects conditional on positive investment, the combined effects that incorporate zero investment observations, and the extensive margin, where we estimate the likelihood of having Chinese FDI. A positive, significant impact on the extensive margin may indicate the formation of new investment relationships due to export controls, where Chinese firms invest in destination-industries they had not previously entered.

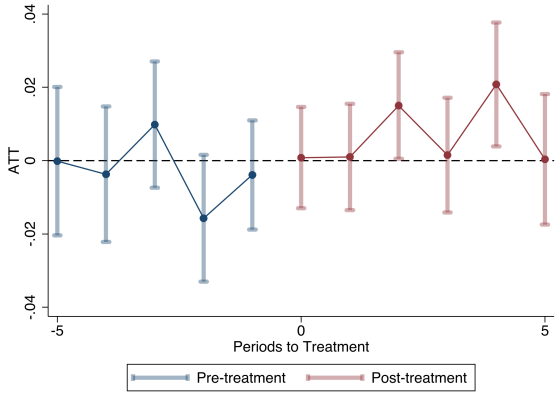
Figure 3a plots the dynamic treatment effects of export barriers on Chinese outward FDI at the intensive margin. Pre-treatment coefficients for the five years prior to treatment are statistically indistin-

guishable from zero, supporting the parallel trends assumption and suggesting that treated and control industries followed comparable trajectories before the imposition of export barriers. At the time of treatment (g), the estimated effect turns positive, indicating an immediate increase in Chinese FDI once an industry is first hit by export barriers. The effect remains elevated in subsequent years, with notable persistence at $g+3$ and $g+4$, where the estimates are again positive and statistically different from zero. Although confidence intervals widen in the later years, the overall pattern suggests that the imposition of export barriers induces not only an immediate but also a sustained increase in Chinese outward FDI, consistent with a durable relocation of investment rather than a short-lived adjustment.

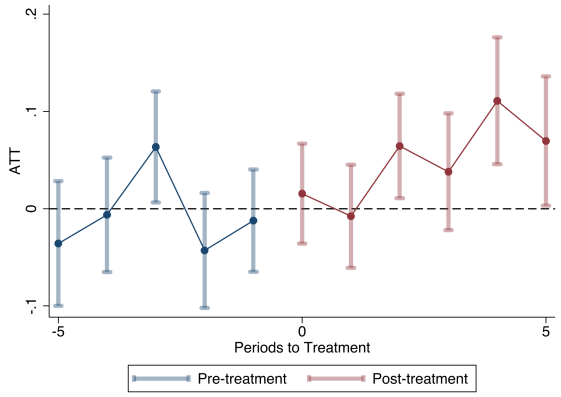
FIGURE 3: Export Controls and Chinese Outward FDI



(A) Intensive Margin: $\log(FDI)$



(B) Extensive Margin: $\mathbf{1}\{FDI > 0\}$



(C) Combined Effects: $\log(1+FDI)$

Notes: We plot the 95% confidence interval of the estimated average treatment effect on the treated following Callaway and Sant'Anna (2021). Robust standard errors are clustered at the destination–industry level.

Figure 3b shows the results for the extensive margin when $Y_t = \mathbf{1}\{FDI_t > 0\}$ is the outcome variable. The plot indicates that the likelihood of Chinese firms investing in an industry abroad is positive and rising over the post-treatment window, with an increase of about two percentage points by the fourth year. Figure 3c shows that estimating the model with a transformed dependent variable

$\log(1 + FDI)$, which accommodates the zero observations, likewise yields a positive impact of export controls on Chinese outward FDI.

We further examine the aggregate effect of export barriers on China's outward FDI across different subsamples, including FDI in strategic sectors, in connector economies, and in ASEAN countries–regions that are believed to have benefited the most from trade diversion. The aggregate effect is the cohort-size-weighted average of the post-treatment group-time effects,

$$ATT^{\text{agg}} = \sum_{g} \sum_{t \geq g} w_{g,t} \, ATT(g,t), \tag{3}$$

where $w_{g,t}$ is the share of treated observations in cohort g at time t.

Columns (1)–(3) in Table 1 show the aggregate post-treatment impact of export controls in the full sample. Column (1) reports the impact of the export controls on the intensive margin, focusing on changes in Chinese outward FDI in destination–industry cells where there are both pre-shock and post-shock flows. Column (2) uses $\log(1 + FDI)$ factoring in zero observations. Column (3) estimates the impact on the extensive margin, the differential change in likelihood of having FDI from China in the destination country and in the industry where China faced export controls. The coefficient in Column (1) is positive and statistically significant, suggesting that Chinese outward FDI increases by almost 120 % on average after being hit by export controls[2]. Column (2) shows a much smaller estimate factoring in the zero observations, suggesting much of the impact of export controls on inducing Chinese outward FDI is on the intensive rather than the extensive margin. This is confirmed by the estimate in Column (3), where the estimated impact of export controls on the extensive margin is close to zero and statistically insignificant.

Columns (4)–(6) show the results for strategic sectors. The estimates are very similar to those in Columns (1)–(3). This is unsurprising, since most FDI during the years when export controls were rising was strategic FDI. In other words, treated units in the full sample contain mostly strategic FDI.

Columns (7)–(8) of Table 1 show the aggregate estimates for connector economies, including Vietnam, Poland, Mexico, Morocco, and Indonesia. There is some evidence that Chinese outward FDI increases significantly on the extensive margin, meaning that Chinese firms entered industries they had not invested in before being hit by export controls. For connector countries, the likelihood of Chinese firms investing in an industry where they are hit by foreign-imposed export controls at home increases by

[2]We approximated the effect by $100[\exp(0.792) - 1] \approx 120.8\%$

approximately 3 percentage points, representing more than a 60% increase in the likelihood of Chinese investment.

Columns (9)–(10) present the results when we restrict the sample to ASEAN countries. The estimates are broadly similar for the connector country sample: The impact of export controls on Chinese outward FDI is positive and statistically significant on the extensive margin. For ASEAN countries, the likelihood of Chinese firms investing in an industry where China faces export controls increases by nearly 80% [3].

Overall, the results show that the aggregate FDI impact is driven by strategic FDI, and that Chinese firms increased investment in industries they had not previously entered in both connector and ASEAN countries. Figure 8 to Figure 10 plot the dynamic effects of export controls on Chinese outward FDI at the extensive margin for strategic industries, connector countries and ASEAN economies. The figures are broadly in line with aggregate results shown in Table 1, and demonstrate that parallel pre-trend assumptions generally hold. Using the extended two-way fixed effects model with interacted terms by Wooldridge (2025), Table 11 in Appendix C shows statistically significant larger impact of export controls on Chinese outward FDI in strategic sectors, in connector and ASEAN economies at the extensive margin, corroborating the results in Table 1.

TABLE 1: Aggregate effect of export barriers on China's outward greenfield FDI by subsample

	All			Strategic			Connector		ASEAN	
	(1) Intensive ln FDI	(2) Combined ln(1+FDI)	(3) Extensive **1**(FDI> 0)	(4) Intensive ln FDI	(5) Combined ln(1+FDI)	(6) Extensive **1**(FDI> 0)	(7) Combined ln(1+FDI)	(8) Extensive **1**(FDI> 0)	(9) Combined ln(1+FDI)	(10) Extensive **1**(FDI> 0)
ATT	0.792***	0.033*	-0.005	0.800***	0.046*	-0.003	0.214***	0.031**	0.177***	0.032***
	(0.261)	(0.019)	(0.005)	(0.274)	(0.026)	(0.006)	(0.055)	(0.013)	(0.040)	(0.009)
Pre-treatment share of having FDI			0.066			0.070		0.049		0.041
ATT as % of pre-treatment share			-7%			-4%		+62%		+78%
Treated units	229	2,654	2,654	204	1,808	1,808	327	327	515	515
Control units	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758
Observations	6,186	92,004	92,004	6,111	77,622	77,622	52,445	52,445	55,641	55,641

Notes: Aggregated average treatment effect on the treated (ATT) following Callaway and Sant'Anna (2021). Pre-treatment share of having FDI is the mean of **1**(FDI> 0) among the treated industries in their pre-treatment years; ATT as % of pre-treatment share presents the estimated differential increase in the share of industries receiving FDI among all treated industries relative to the change of the share among untreated industries as a percentage increase from the pre-treatment share (the estimated change in the entry probability relative to its pre-treatment level). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at destination country-industry level and shown in parentheses.

[3] We did not run the estimations at the intensive margin for connector and ASEAN countries due to lack of observations.

4 Trade Implications for Host Economies

In this section, we assess the trade implications of export control–induced Chinese outward FDI on host economies. To do so, we examine whether investment inflows into host economies are associated with systematic changes in the composition and sophistication of their imports at the industry level. We combine bilateral trade data at the six-digit Harmonized System (HS) level with industry concordances to construct measures of import structure for each destination country–industry–year observation. Products are classified into capital, intermediate, and consumption categories using the Broad Economic Categories (BEC) classification, allowing us to track shifts in the supply chain stage composition of imports.

We first analyze whether industries that receive Chinese FDI following export control shocks exhibit differential trends in the shares of capital and intermediate goods imports relative to consumption goods [4]. Increases in capital and intermediate import shares are consistent with production relocation, as they reflect rising demand for production inputs rather than final consumption. Conversely, increases in consumption goods shares would be consistent with host economies serving primarily as trade intermediaries or rerouting hubs rather than production sites. We estimate these compositional changes by showing the dynamic causal effects of the export controls on FDI-receiving industries, again following Callaway and Sant'Anna (2021), in five years prior and five years after the imposition of such measures.

To further capture changes in the quality and strategic content of imports, we construct a trade volume index weighted by product centrality, which is a score representing the importance of a product in the universe of product codes (Fetzer et al., 2024):

$$q^{\text{IGPC}}_{c,i,t} = \frac{\sum_{p \in i} \text{IGPC}_p \, q_{c,p,t}}{\sum_{p \in i} \text{IGPC}_p}, \tag{4}$$

where $q_{c,p,t}$ is country c's import volume of product p in year t, IGPC_p is the product centrality of p (Fetzer et al., 2024), and $p \in i$ are the products in industry i. $q^{\text{IGPC}}_{c,i,t}$ will be larger if country c imports a larger volume of products that are of higher product centrality score. This weighted measure then reflects the structural importance of imported goods within global production networks, assigning greater weight to inputs that occupy more central positions in supply chains. We then examine whether industries receiving export control–induced Chinese FDI experience differential increases in this index on average, also showing the dynamic causal effects since the first time when such a policy hit a given industry. To

[4] To be precise, we are examining the differential change in industries in host economies that both received Chinese FDI and are the same industries where China faced foreign-imposed export controls.

this end, we re-estimate Equation 1 and compute the aggregate effect according to Equation 3.

Table 2 presents the results. Column (1) reports estimates for all Chinese FDI recipient countries, while Columns (2) and (3) report estimates for ASEAN and connector economies, respectively. Panel A shows that changes in these countries' import composition from the world are largely muted: the BEC shares and the level of the centrality-weighted import volume index are all statistically insignificant. The exception is the logged centrality-weighted import index, which rises significantly for ASEAN (0.231) and connector economies (0.289), though not for the full sample. These results indicate that, in their Chinese FDI-receiving industries, connector and ASEAN economies increased their imports of production-critical inputs from the world.

Panel B turns to recipient countries' imports from China. Both the level of the centrality-weighted import volume index and its logged counterpart are positive and statistically significant across all three columns. In logged terms the effects are substantially larger than in Panel A (0.567 versus 0.033 for the full sample), indicating that the reorientation toward production-critical inputs is markedly more pronounced for imports sourced from China. The point estimate of the capital import share is likewise positive and larger than its Panel A counterpart for the full sample and connector economies, though imprecisely estimated. Taken together, these results are consistent with recipient countries shifting toward importing more production-critical inputs, particularly from China, in industries that both received Chinese FDI and in which China was subject to export controls.

Figure 4 plots the dynamic effects on centrality-weighted import volume index, whose aggregate effects are shown in Panel A and Panel B of Table 2. The figure shows statistically insignificant pre-treatment estimated coefficients, consistent with the parallel pre-trend assumption. More importantly, the figure shows that indeed, increases in critical inputs are statistically significant for imports from China (bottom panel) instead of world (top panel), and that the increases appear more persistent and prominent for connector and ASEAN countries.

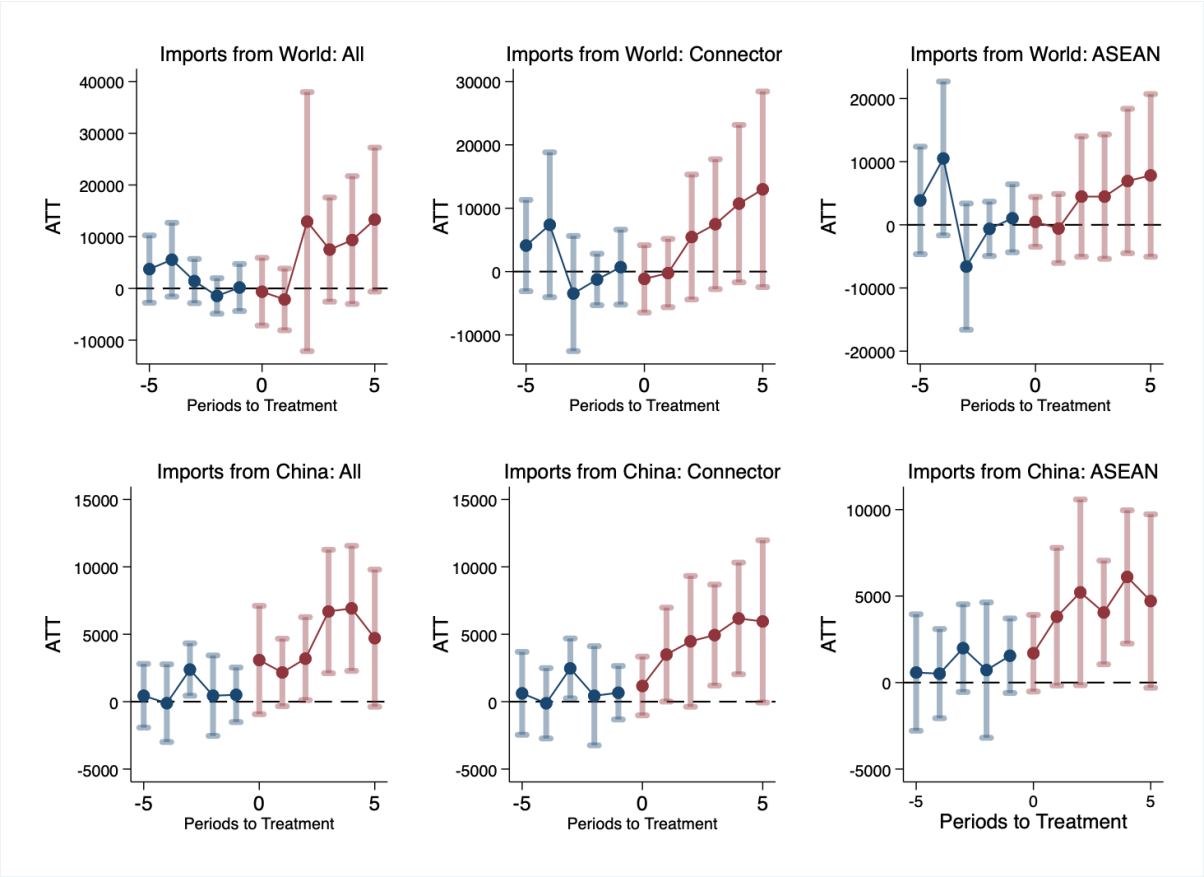
Figure 11 to Figure 12 in Appendix B plot the dynamic effects of export controls imposed on China on the trade shares across BEC categories of economies receiving Chinese FDI reported in Panel A and Panel B of Table 2. Again, pre-treatment coefficients are close to zero and statistically insignificant across outcomes, supporting the parallel-trends assumption. Figure 12 also shows host economies' share of capital goods import from China increases, albeit imprecisely estimated. Table 12 in Appendix C re-estimates the impact on host-economy trade composition following Wooldridge (2025) and obtains similar results to Table 2.

TABLE 2: Aggregate effect of export controls on host-economy trade composition by economy

	(1) All	(2) Connector	(3) ASEAN
Panel A: Imports from the World			
Capital import share	0.0022 (0.0021)	0.0028 (0.0067)	-0.0008 (0.0061)
Intermediate import share	-0.0022 (0.0030)	-0.0050 (0.0063)	-0.0123 (0.0110)
Consumption import share	0.0006 (0.0021)	0.0043 (0.0038)	0.0098 (0.0079)
Centrality-weighted import volume index	8442.8 (5727.1)	6179.7 (4641.9)	4434.3 (3891.3)
Log centrality-weighted import index	0.0329 (0.1119)	0.2890** (0.1136)	0.2312* (0.1322)
Panel B: Imports from China			
Capital import share	0.0039 (0.0036)	0.0094 (0.0101)	-0.0046 (0.0068)
Intermediate import share	-0.0014 (0.0045)	-0.0029 (0.0058)	-0.0135 (0.0112)
Consumption import share	-0.0001 (0.0036)	0.0061** (0.0031)	0.0152* (0.0084)
Centrality-weighted import volume index	4822.1** (2276.6)	5177.7** (2061.4)	5347.1*** (1895.0)
Log centrality-weighted import index	0.5670*** (0.1454)	0.8613*** (0.1912)	0.8539*** (0.2078)
Panel C: Exports to the World			
Capital export share	0.0013 (0.0026)	-0.0161** (0.0068)	0.0006 (0.0105)
Intermediate export share	-0.0011 (0.0033)	0.0102 (0.0064)	-0.0053 (0.0142)
Consumption export share	-0.0009 (0.0023)	0.0048 (0.0050)	0.0016 (0.0045)
Centrality-weighted export volume index	45810.2 (46003.2)	5208.7 (7116.9)	8199.8 (7732.4)
Log centrality-weighted export index	-0.006 (0.276)	0.384 (0.279)	0.467 (0.298)
Panel D: Exports to the US			
Capital export share	-0.0036 (0.0044)	-0.0073 (0.0139)	-0.0114 (0.0164)
Intermediate export share	-0.0004 (0.0058)	-0.0092 (0.0108)	-0.0058 (0.0159)
Consumption export share	0.0038 (0.0035)	0.0134 (0.0094)	0.0123 (0.0095)
Centrality-weighted export volume index	1029.0 (1025.4)	6717.0 (5541.1)	8151.5 (6183.5)
Log centrality-weighted export index	-0.994 (0.359)***	-0.419 (0.466)	0.038 (0.513)
Treated units	215	40	35
Control units	26	26	26

Notes: Aggregated average treatment effect on the treated (ATT) following Callaway and Sant'Anna (2021), with standard errors in parentheses. Treatment is the year an industry coded in US-SIC is first exposed to an export control imposed on China. To construct the outcomes, we match the HS product codes in host economies' trade statistics to their corresponding US-SIC industry codes and, for each industry, compute trade shares by production stage according to Broad Economic Categories and a product-centrality-weighted trade-volume index. The centrality score is from Fetzer et al. (2024). We restrict the merged sample to industries that receive Chinese FDI flows. Column (1) reports estimates for all countries in the estimation sample; columns (2) and (3) restrict to treated country-industries to be within connector economies (MEX, POL, MAR, VNM, IDN) and the ASEAN-10 countries, while the control group is the never-treated industries (where China was never exposed to export controls) of all countries. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

FIGURE 4: Dynamic Treatment Effects on Centrality-Weighted Import Volume Index



Notes: Dynamic effects of export controls on the centrality-weighted import volume indices of Chinese FDI-receiving economies estimated following Callaway and Sant'Anna (2021). We plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination-industry level.

4.1 Mechanism

To further shed light on the underlying mechanism, we examine how export patterns of host economies evolve following export control–induced Chinese outward FDI. Primarily, we are interested in whether our results of increasing imports of critical inputs could be capturing effects of other trade policies that cause Chinese firms to invest abroad for trade rerouting purposes. If the observed responses primarily reflect trade rerouting by Chinese firms, we would expect to see a corresponding increase in the export share of capital goods alongside the increase in the import share, as well as an increase in centrality-weighted exports alongside the increase in centrality-weighted imports. In particular, these export shifts should be more pronounced toward the United States.

Panels C and D of Table 2 show that estimated changes in host economies' exports to the world are largely small and statistically insignificant. Their exports to the US likewise show no increase on any of the measures, including the capital-goods export share and centrality-weighted exports; if anything, the

centrality-weighted (log) export index declines significantly. These patterns are inconsistent with trade rerouting.

Additionally, we examine whether the shifts in host economies' import structure following China's exposure to export controls are actually driven by Chinese firms' investments. We re-estimate the impact of export controls on host economies' imports from China, where the treatment dummy for each cohort is interacted with another indicator of whether the host economy's industry had sustained Chinese FDI around the shock. Following Wooldridge (2025), we run the following estimation:

$$Y_{it} = \eta_{g_i} + \lambda_t + \phi\,\mathrm{FDI}_i + \sum_{g}\sum_{s\geq g} \mathbf{1}\{g_i = g,\ t = s\}\left(\beta_{gs} + \delta_{gs}\,\mathrm{FDI}_i\right) + \varepsilon_{it}, \tag{5}$$

where i indexes a destination×industry pair, g_i again is the dummy variable for each industry's export-control cohort, indexed by the first year it is subject to export controls targeting China, s denotes calendar time, η_{g_i} and λ_t are cohort and year fixed effects, and $\mathrm{FDI}_i = 1$ for industries that sustained Chinese FDI around the shock, meaning there is both Chinese FDI before and after the shock. The cohort-time treatment effects are β_{gs} for non-FDI industries and $\beta_{gs} + \delta_{gs}$ for FDI industries.

The results are presented in Table 3. Column (1) reports the estimates for FDI-receiving industries, the aggregated effect of $\beta_{gs} + \delta_{gs}$. Column (2) reports the results for industries that received no Chinese FDI in the host economies, the aggregated effect of β_{gs}, where the industries were also subject to export controls imposed on China. Column (3) reports the estimated difference between the two, the aggregated effect of δ_{gs}. Compared with non-FDI industries, FDI-receiving industries increased their capital goods import share and imported more central inputs after China's exposure to export controls, and these differences are statistically significant.

Combined, the results presented in this section suggest that our estimated changes in the trade profiles of Chinese-FDI host economies are largely not a result of picking up other non-export control policies that may cause trade rerouting, and that the changes are associated with the presence of Chinese FDI.

5 Effects on GVC Linkages

In this section, we examine how host economies' integration into global value chains evolves over time following export controls affecting Chinese FDI–receiving industries. We consider four measures: forward linkage to the world, forward linkage to China, backward linkage from the world, and backward linkage from China.

TABLE 3: Effect of export controls on host-economy trade composition, comparing FDI-receiving industries and non-FDI-receiving industries

	(1) FDI industries	(2) Non-FDI industries	(3) Difference (1)−(2)
Imports from China			
Capital import share	0.0779* (0.0422)	-0.0097 (0.0064)	0.0876** (0.0446)
Intermediate import share	-0.0258 (0.0232)	0.0040 (0.0071)	-0.0298 (0.0246)
Consumption import share	-0.0197 (0.0374)	0.0032 (0.0080)	-0.0229 (0.0397)
Centrality-weighted import volume index	11297.5*** (2927.2)	339.3 (282.1)	10958.2*** (3065.3)
Log centrality-weighted import index	1.5938*** (0.2186)	0.1983*** (0.0623)	1.3955*** (0.2291)
Units	72	659	

Notes: Estimated using extended two-way FE regression following Wooldridge (2025), with the treatment ATTs interacted with an indicator for industries receiving Chinese FDI. Specifically, each estimate is from a regression $Y_{it} = \eta_{g_i} + \lambda_t + \phi\,\mathrm{FDI}_i + \sum_g \sum_{s \geq g} \mathbf{1}\{g_i = g,\, t = s\}(\beta_{gs} + \delta_{gs}\,\mathrm{FDI}_i) + \varepsilon_{it}$, where i indexes a destination×industry pair, g_i is the export-control cohort, s indexes calendar time, $s \geq g$ indexes calendar time from the cohort's first-treatment period g onward, η_{g_i} and λ_t are cohort and year effects, and $\mathrm{FDI}_i = 1$ for Chinese-FDI-receiving destination-industry pairs, so ϕ is the Chinese FDI-receiving industry fixed effect. The cohort-time effects β_{gs} are for the baseline non-FDI destination-industries and $\beta_{gs} + \delta_{gs}$ are for the FDI destination-industries. Both are aggregated over post-treatment cells ($s \geq g$) into columns (1) and (2), with column (3) being the difference of the aggregated effects. Standard errors are clustered by destination×industry in parentheses. We restrict the sample to industries whose HS product codes span at least two BEC categories so there is within-industry variation in BEC shares (otherwise it will always be 1). We use the not-yet-treated observations as the control group, as there are no HS codes spanning at least two BEC categories that are never treated. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We begin by mapping US SIC industry codes to OECD economic activities used in the TiVA dataset. The treatment year is defined as the first year in which the corresponding OECD activity in China is exposed to export controls. Forward and backward linkages with the world are drawn from standard TiVA indicators, namely the domestic value-added share of foreign gross exports (FL-W$_{c,i}$ = EXGR_DVAFXSH$_{c,i}$) and the foreign value-added share of gross exports (BL-W$_{c,i}$ = EXGR_FVASH$_{c,i}$). We additionally construct China-specific measures. Specifically, we construct forward linkage with China as value added of a country c embodied in the total gross export of industry i of China, as a share of country c's gross exports; likewise, backward linkage from China is constructed as value added from China as a share of country c's gross exports in industry i:

$$\text{(6)} \qquad \text{FL-CHN}_{c,i} = \frac{\text{EXGRVA}_{c,_\text{T},\text{CHN},i}}{\text{EXGR}_{c,_\text{T},W}} \times 100, \qquad \text{BL-CHN}_{c,i} = \frac{\text{EXGRVA}_{\text{CHN},_\text{T},c,i}}{\text{EXGR}_{c,i,W}} \times 100,$$

where EXGRVA is value added embodied in gross exports, EXGR is gross exports, _T denotes all industries, and W denotes the world.

Figure 5 presents the dynamic effects of export controls targeting China on the global value chain (GVC) linkages of industries in host economies receiving Chinese outward FDI. We distinguish between

forward and backward linkages, and between linkages with the world and with China.

We find that, first, forward linkages to the world increase steadily following treatment, with positive and persistent effects emerging after two to three periods. In contrast, forward linkages to China also increase in the immediate post-treatment periods, but the increase dissipates before forward linkages to China return to baseline levels. A similar pattern is observed for backward linkages from China, which rise modestly on impact but revert and decline after several periods.

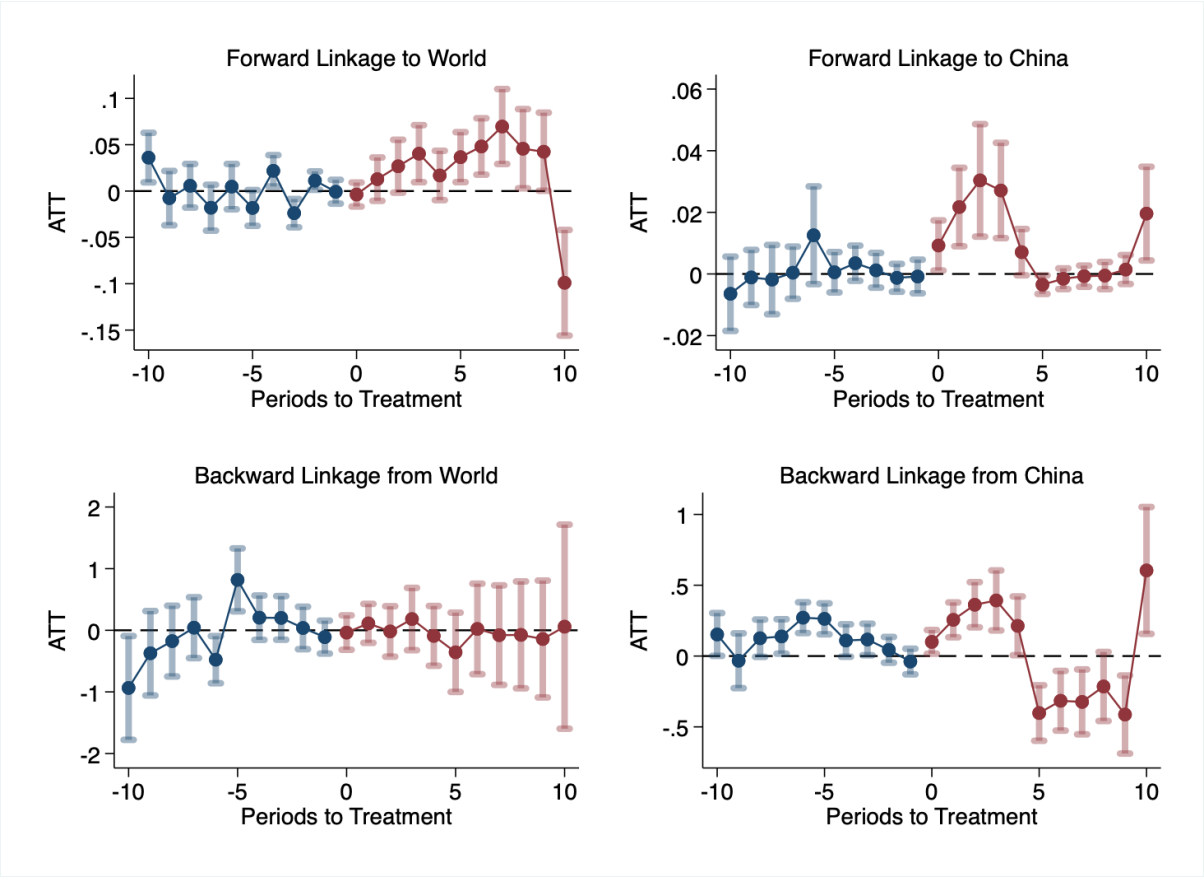
Overall, these results are consistent with strengthening of linkages with China, with simultaneous increasing forward GVC participation with the world, at least in the short run. Meanwhile, Figure 15 in Appendix B shows that the domestic value-added share of exports exhibits no significant changes in industries receiving Chinese FDI following the imposition of export controls on China.

Regional heterogeneity exists, however. Figure 6 shows that for connector countries, both forward and backward linkages with China increase, albeit the dynamic effects of forward linkage to China is imprecisely estimated. In contrast to the average results in Figure 5, both the forward and backward linkages with the world do not increase in Chinese FDI-receiving countries post-export controls imposed on China.

Further, Figure 7 shows that for ASEAN, the region that's both geographically close to China and believed to have benefited from the recent trade tensions, the estimated increase in both forward and backward linkages with China are persistent and statistically significant, while their forward and backward linkages with the world remain much more muted and even decline in some cases (backward linkage from world).

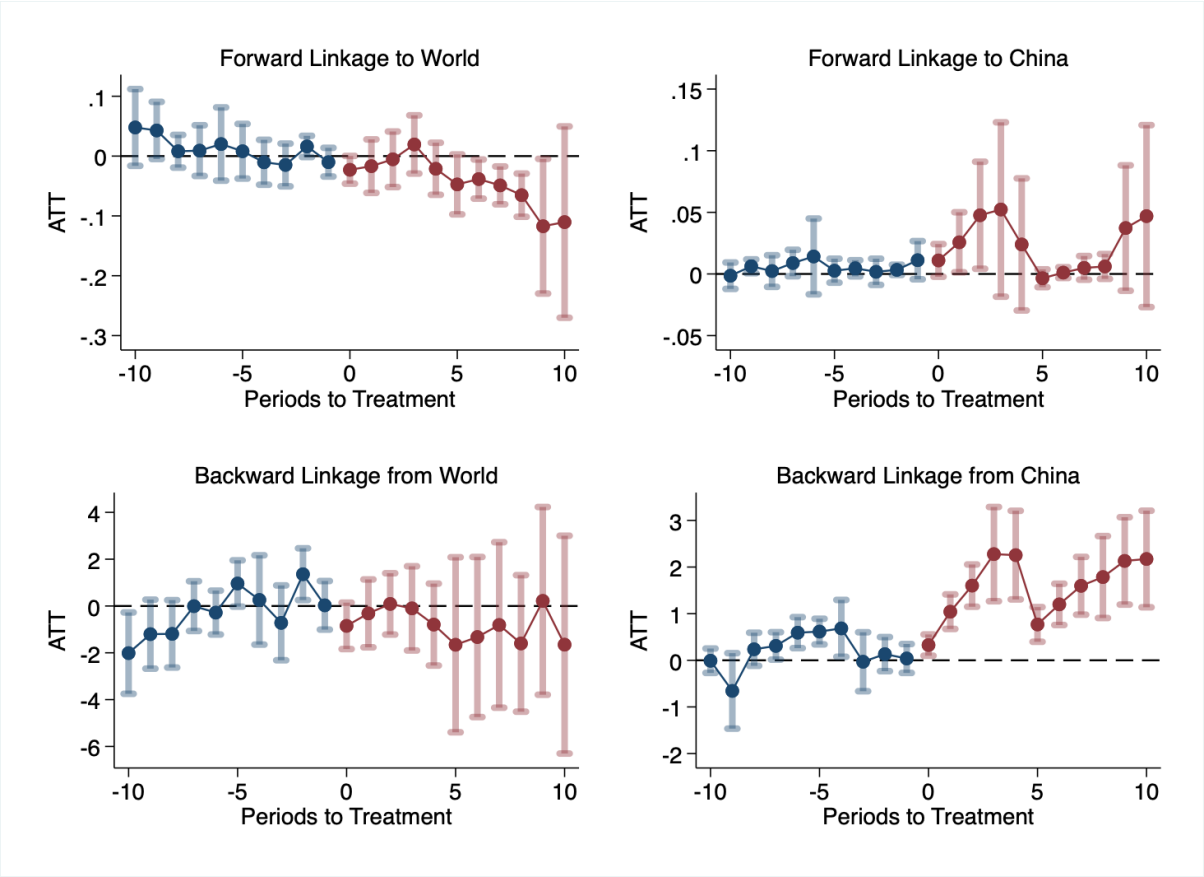
Taken together, the findings in this section indicate that compared to other Chinese FDI-receiving countries following export controls, ASEAN countries have become more deeply integrated with China-centered supply chains in Chinese FDI-receiving industries after China was exposed to export control shocks.

FIGURE 5: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Countries



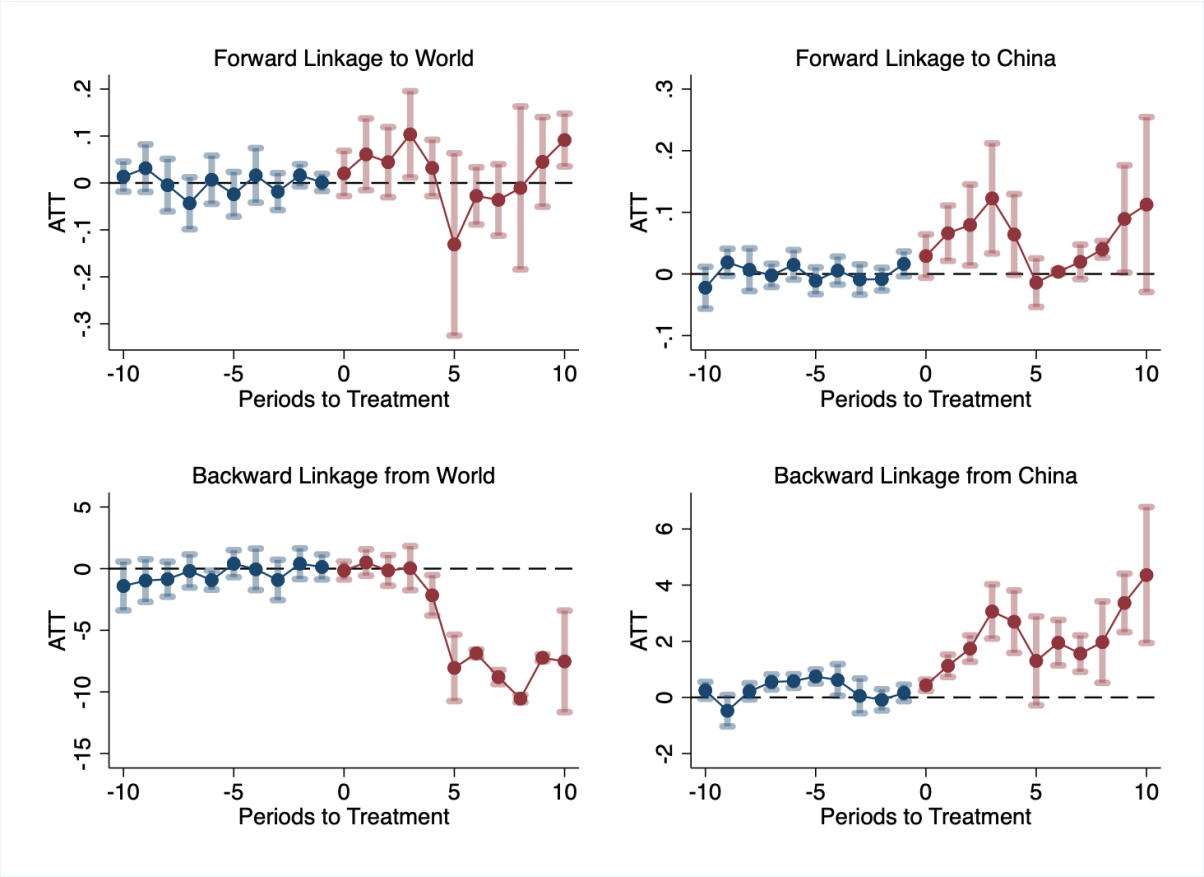
Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Standard errors are clustered at the destination-industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT).

FIGURE 6: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Connector Countries



Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Standard errors are clustered at the destination-industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT).

FIGURE 7: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving ASEAN Countries



Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Standard errors are clustered at the destination-industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT).

5.1 GVC Linkages by Ownership

Finally, we ask whether the increasing GVC linkages with China are concentrated in foreign-invested enterprises (FIEs) or domestically-owned enterprises (DOEs) in the Chinese-FDI-receiving countries. To this end, we use the Activity of Multinational Enterprises (AMNE) dataset from the OECD, which allows us to decompose the value added created by FIEs and DOEs, as well as the value added imported by FIEs and DOEs located in a country. We construct four measures: (1) the share of country c's FIE-created value added exported to China; (2) the share of country c's DOE-created value added exported to China; (3) the value added imported from China as a share of the total value added in inputs used by FIEs in country c; and (4) the value added imported from China as a share of the total value added in inputs used by DOEs in country c. The first two capture the forward production linkage with China, whereas the latter two measure the backward production linkage with China. Formally, for ownership

type $o \in \{\text{FIE}, \text{DOE}\}$ in industry i of host country c,

$$\text{FWD}^{o}_{c,i} = \frac{V^{o}_{c,i\to\text{CHN}}}{V^{o}_{c,i}}, \qquad \text{BWD}^{o}_{c,i} = \frac{M^{o}_{\text{CHN}\to c,i}}{M^{o}_{c,i}}, \tag{7}$$

where $V^{o}_{c,i}$ is the value added created by firms with ownership type o and $V^{o}_{c,i\to\text{CHN}}$ is the part embodied in its exports to China, while $M^{o}_{c,i}$ is the total value added in firms of ownership type o's inputs and $M^{o}_{\text{CHN}\to c,i}$ the part sourced from China.

We employ two estimators, applied to both the forward and backward measures. In the first, following Wooldridge (2025), we estimate the heterogeneous impact of export controls on the FIE and DOE linkages with China, whereby we interact an FIE indicator with the export-control treatment indicator for when an industry is first subject to export controls imposed by other countries on China. The difference between the estimated impacts on FIE and DOE linkages then shows whether the increasing linkages with China are concentrated in foreign firms or local firms:

$$Y_{it} = \eta_{g_i} + \lambda_t + \phi\,\text{FIE}_i + \sum_{g}\sum_{s\geq g} \mathbf{1}\{g_i = g,\ t = s\}\left(\beta_{gs} + \delta_{gs}\,\text{FIE}_i\right) + \varepsilon_{it}, \tag{8}$$

where Y_{it} is either forward or backward linkage measure of a host destination×industry×ownership type unit, and $\text{FIE}_i = 1$ for GVC linkages involving foreign-invested firms and 0 for the domestically-owned firms. Again, g_i is the export-control cohort, s indexes calendar time, and η_{g_i} and λ_t are cohort and year fixed effects. The estimated cohort-time effect on host economies' GVC linkages with China is then β_{gs} for DOEs and $\beta_{gs} + \delta_{gs}$ for FIEs. We report their aggregate effects ATT_{DOE} and ATT_{FIE} in Columns 2 and 3 of Table 4, and the aggregate difference between FIE and DOE in Column 4.

In the second estimator, following Callaway and Sant'Anna (2021), we estimate the difference in a host economy's GVC linkage with China between FIE and DOE firms directly via an event study on the FIE-minus-DOE differenced GVC variables, $(\text{FWD}^{\text{FIE}}_{c,i} - \text{FWD}^{\text{DOE}}_{c,i})$ and $(\text{BWD}^{\text{FIE}}_{c,i} - \text{BWD}^{\text{DOE}}_{c,i})$, so that using a single regression we can test whether this gap increases in Chinese FDI industries where China faced export controls, and we subsequently test the joint significance of its pre-treatment coefficients. For these estimations, we restrict the estimation sample to balanced cohorts with three pre- and post-shock event windows to avoid the estimates being contaminated by artificial cohort composition effects. Table 4 Column 5 shows the aggregate effect for the difference in both FWD and BWD, while Column 6 shows the joint pre-trend test results. The pre-trend p-value is obtained from a joint Wald test of the pre-treatment coefficients, $W = \hat{\boldsymbol{\beta}}'_{\text{pre}}\,\widehat{\mathbf{V}}^{-1}_{\text{pre}}\,\hat{\boldsymbol{\beta}}_{\text{pre}} \sim \chi^2(k)$, where $\hat{\boldsymbol{\beta}}_{\text{pre}}$ are the k estimated leads and $\widehat{\mathbf{V}}_{\text{pre}}$ their covariance. Thus, a large p-value lends support for no evidence against parallel trends.

TABLE 4: Export controls and GVC linkages with China by firm ownership linkages

			FIE−DOE		
Destination panel	ATT_{FIE}	ATT_{DOE}	ETWFE	CSDID	Pre-trend p
Panel A: Value added imported from China as share of total inputs by FIE or DOE (BWD)					
World	0.0042***	-0.0030***	0.0072***	0.0002	0.462
Connector	0.0194***	0.0055***	0.0139***	0.0025***	0.265
ASEAN	0.0205***	0.0040*	0.0164***	0.0020***	0.259
Panel B: Value added exported to China as share of total value added exported by FIE or DOE (FWD)					
World	0.0007	-0.0020***	0.0027***	-0.0002*	0.000
Connector	0.0004	-0.0014	0.0018***	0.0001	0.068
ASEAN	0.0010	-0.0046	0.0056**	-0.0002	0.033

Notes: Panel A presents the impact of export controls on value added created by Chinese domestically-owned firms embodied in host firms, as a share of the value added in inputs to host FIEs (ATT_{FIE}) and DOEs (ATT_{DOE}). We consider this as the host economies' backward exposure to Chinese value added. Panel B presents the impact of export controls on host countries' FIE or DOE value added used by Chinese domestically-owned firms, as a share of the total value added generated by host FIEs or DOEs. We consider this as the host economies' forward production exposure to China. In Columns 1 - 3, we report the aggregate effect for FIEs and DOEs in host economies, and their difference following Wooldridge (2025) ETWFE, where we use never-treated observations as the control and included cohort fixed effects. Standard errors are clustered at the destination×industry cell. In Column 4, we report the difference between FIE and DOE backward or forward linkages with China estimated directly following Callaway and Sant'Anna (2021)(basically we run a single regression on the FIE−DOE difference). The pre-trend p is the joint Wald test of pre-treatment coefficients from the csdid difference event study. A large p-value would lend support to a flat pre-trend. We used balanced cohort sample with 3 pre- and 3 post-treatment periods, so every treated cohort would have 3 pre-treatment observations and 3 post-treatment observations. FIE denotes all foreign-invested host firms, not Chinese-owned specifically. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We now turn to the results reported in Table 4. Panel A shows that both FIEs and DOEs import a larger share of value added from China (except for DOEs in the world panel, on average), and this share rises significantly more for FIEs than for DOEs, given the statistically significant estimates of the FIE−DOE columns estimated using either extended two-way fixed-effects (ETWFE) or CSDID estimator. The pre-trends are generally flat. Export controls therefore causally increase host economies' backward production linkages from China, and this increase is more pronounced for FIEs. In Panel B, the results are less consistent: using ETWFE estimator of Wooldridge (2025), we find a larger increase in the forward linkage to China for FIEs than for DOEs, but using CSDID following Callaway and Sant'Anna (2021), the difference is not statistically significant, and the parallel pre-trend assumption is generally violated. Overall, we interpret these results as the strengthened production linkages with China work mainly through FIEs in the Chinese-FDI-receiving countries, and this is more pronounced for the backward linkage. To the extent that GVC integration is correlated with production and growth, the inflow of Chinese investment and the subsequent relocation of production may benefit foreign firms more than local firms.

6 Robustness Analysis

In this section, we describe the results of our robustness analysis. We conduct three sets of robustness checks: (1) robustness to alternative estimators; (2) robustness to a balanced-cohort sample; and (3) robustness to accounting for China's own structural shifts, including possible effects of its industrial upgrading.

6.1 Alternative Estimator

Most of the results presented so far are obtained via the Callaway and Sant'Anna (2021) estimator,[5] which are the aggregated effects of the underlying 2×2 difference-in-differences comparisons. We thus re-estimate all results using the extended two-way fixed-effects (ETWFE) estimator of Wooldridge (2025) and reproduce all the tables and figures presented so far, which are reported in Appendix C. Figure 16a and Figure 16b show that following the imposition of export controls on China, Chinese outward FDI increases both at the intensive and extensive margin. The estimated combined effects are also positive and exhibit a jump post-export control imposition (see Figure 16c). For ASEAN and connector economies, Chinese FDI significantly expands at the extensive margin while not for the world in general (Table

[5]The exception is Table 3 and Table 4.

10 and Table 11). Table 12 again shows that imports of production-central inputs rise significantly more from China than from world, and exports to both the US and the world are not found to increase simultaneously. The dynamic effect plot in Figure 17 resembles Figure 4 in the main text. Finally, the plots of the dynamic effect of export controls on Chinese FDI-receiving countries' GVC linkages shown in Figure 18 - Figure 20 show the same export control impact on Chinese FDI-receiving countries' GVC linkages as those depicted in Figure 5 - Figure 7: rising forward and backward linkages with China, especially for ASEAN countries, whose forward linkage with the world also increases.

6.2 Balanced Cohorts

When estimating dynamic treatment effects, these estimates can be distorted by unbalanced cohorts. Some cohorts are treated earlier and are used to estimate treatment effects for longer event times. In contrast, some cohorts are treated later and may only be used to estimate treatment effects for a few event times. As a result, the estimated varying treatment effects over event time may not truly reflect changes in treatment effect over time. Instead, they may be an artifact of the different composition of cohorts used to aggregate the treatment effect. To address this concern, we re-estimate the dynamic treatment effects by restricting the estimation sample to treatment cohorts with a balanced number of event times pre- and post-export control imposition on China. We re-plot Figure 3 - Figure 7 in Appendix D. We obtain a similar set of results: Chinese investment overseas increases on average after being exposed to export controls, and the increase is mainly on the intensive margin for the world and on the extensive margin for ASEAN destination countries. Imports of critical inputs from China still increase significantly for the world and connector countries, although the effect is no longer statistically significant for ASEAN. Both forward and backward linkages with China increase in Chinese FDI-receiving industries after the imposition of export controls on China across panels.

6.3 Accounting for China's Structural Shifts

We documented the coincidence between Chinese outward FDI tilting toward the strategic industries and the rising number of export controls imposed on China targeting strategic industries in Figure 1. However, Chinese firms' pivot to strategic industries in their overseas investments may also reflect other structural shifts in Chinese industries, such as China's own industrial upgrading and domestic policy emphasis on high-tech and emerging green industries[6]. To alleviate the concern that our estimated impact

[6]U.S.-China Economic and Security Review Commission (2025) documents the increase in China's market share in the semiconductor, solar, and electric vehicle industries in relation to "Made in China 2025". Fang et al. (2025) documents the increase in China's industrial policies targeting high-skilled and emerging manufacturing industries.

of export controls on China's outward FDI, its exports of critical inputs to FDI destination countries, and its strengthening GVC linkages with those destination countries may also pick up the impact of China's domestic structural changes, we re-estimate all the main results in the paper by restricting the estimation sample to strategic industries only and identifying the impact of export controls hitting China from the staggered timing of their announcement, so that our control group consists of the not-yet-treated periods of the treated (export-control-imposed) industries and the never-treated strategic industries. The idea is that, if there is a common trend across strategic industries, either due to China's industrial upgrading or its domestic policy push, that trend is netted out when we compare only within strategic industries. Using two different strategic-industry classifications, following either IMF (2023) or Freund et al. (2024), we report in Table 13 and Table 14 the estimated aggregate treatment effects following either Callaway and Sant'Anna (2021) (Column 2) or Wooldridge (2025) (Column 3), together with the joint Wald test of the pre-trend coefficients (Column 4). Rows with a statistically significant treatment effect and no significant pre-trend are in bold. The results indicate that, among all outcome variables, the increases in Chinese outward FDI to the world, connector countries, and ASEAN countries still hold. Furthermore, export controls still have a positive and statistically significant impact on imports of production-central inputs from China by both connector and ASEAN countries. Finally, forward GVC linkages with China are still found to increase for connector and ASEAN countries as a result of export controls imposed on China in Chinese FDI-receiving industries.

7 Conclusion

Amid rising geopolitical tensions and the increasing use of export controls, this paper examines how trade barriers targeting China reshape firms' outward investment and host-country production structures. We document a surge in Chinese outward FDI alongside a sharp increase in trade restrictions, particularly in recent years, when export controls became more prevalent and concentrated in strategic industries.

Our results show that export controls caused Chinese outward FDI in affected industries to increase by more than 2-fold on average. This is mainly driven by the increase in outward FDI at the intensive margin. Meanwhile, when focusing on a subsample of connector countries or ASEAN countries – regions believed to have benefited from recent rising trade tensions, we find positive and statistically significant impact of export controls on Chinese outward FDI at the extensive margin: Firms invested in industries abroad where there was no prior investment presence.

Turning to host economies, we show that industries receiving export control–induced Chinese FDI

experienced shifts in their trade structure. These industries exhibit increases in capital and production-critical input imports from China. This is an effect that we find across all countries as well as for connector and ASEAN countries. In contrast we find no simultaneous increase of imports of production-critical inputs from the world.

We provide two pieces of evidence on the mechanism. First, we show that the estimated changes in Chinese FDI recipient countries' import profiles are not driven by other trade-rerouting effects, potentially due to import-barrier policies such as tariffs that might be concurrently in place. This is because we find no simultaneous increase in these countries' exports of critical inputs to either the world or to the US in industries where they received Chinese FDI and where China faced export controls. Second, we show that such a shift in the import structure is associated with having the presence of Chinese FDI in the given host economy-industry.

At the same time, on average, host economies become more integrated into global value chains, with strengthened forward linkages to the world. Notably, linkages with China appear to increase in the short run but decline over time.

Regional heterogeneity exists, however. In contrast to the aggregate results, for connector and ASEAN countries, their GVC linkages with China significantly increase in Chinese FDI-receiving industries affected by export controls imposed on China, while their GVC linkages with the world are much more muted or do not exhibit likewise increases. The strengthening effect of both forward and backward linkages with China is estimated to be especially persistent and statistically significant for ASEAN, indicating the region, being geographically close to China, is also being pulled closer to its supply chains.

Further, by decomposing Chinese FDI host countries' forward and backward production linkages with China into those associated with foreign firms and domestic firms of the host economy, we show that the strengthened linkages with China concentrate on the foreign-invested firms rather than the host countries' domestic firms. We argue that to the extent these linkages help promote production and growth, the benefits are likely to asymmetrically accrue more to the foreign firms, including Chinese firms, present in these other economies.

More broadly, our results highlight that trade restrictions in an era of fragmented globalization operate not only through trade flows but also through the reorganization of production. Understanding these adjustment margins is essential for evaluating the effectiveness and global consequences of modern trade policy.

References

Aiyar, S., Ilyina, A., Chen, J., Kangur, A., Trevino, J., Ebeke, C., Gudmundsson, T., Soderberg, G., Schulze, T., Kunaratskul, T., Ruta, M., Garcia-Saltos, R., and Rodriguez, S. (2023). Geo-Economic Fragmentation and the Future of Multilateralism. *Staff Discussion Notes*, 2023(001):1.

Alfaro, L. and Chor, D. (2023). Global supply chains: The looming "great reallocation". Nber working papers 31661, National Bureau of Economic Research.

Alfaro, L. and Chor, D. (2026). An Anatomy of the Great Reallocation in US Supply Chain Trade. *NBER Working Paper 34490*.

Barattieri, A. and Cacciatore, M. (2023). Self-Harming Trade Policy? Protectionism and Production Networks. *American Economic Journal: Macroeconomics*, 15(2):97–128.

Callaway, B. and Sant'Anna, P. H. C. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2):200–230.

Cavalcanti, T., Ogeda, P., and Ornelas, E. (2026). The US-China trade war creates jobs (elsewhere). *Journal of International Economics*, 161:104249.

Crosignani, M., Han, L., Macchiavelli, M., and Silva, A. F. (2026). Securing technological leadership? The cost of export controls on firms. *Journal of Financial Economics*, 175:104192.

De Chaisemartin, C. and d'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American economic review*, 110(9):2964–2996.

Deseatnicov, I. and Fukao, K. (2024). U.S. Export Controls and the Restructuring of Global Values Chains: An analysis of Japanese multinationals' exits from China. *RIETI Discussion Paper Series 24-E-082*.

Estrin, S., Meyer, K. E., and Pelletier, A. (2018). Emerging economy mnes: how does home country munificence matter? *Journal of World Business*, 53(4):514–528.

Evenett, S., Jakubik, A., Martín, F., and Ruta, M. (2024). The return of industrial policy in data. IMF Working Paper WP/24/1, International Monetary Fund. Also published in *The World Economy*, 47(7): 2762–2788.

Fajgelbaum, P., Goldberg, P., Kennedy, P., Khandelwal, A., and Taglioni, D. (2024). The US-China Trade War and Global Reallocations. *American Economic Review: Insights*, 6(2):295–312.

Fajgelbaum, P. D., Goldberg, P. K., Kennedy, P. J., and Khandelwal, A. K. (2020). The Return to Protectionism. *The Quarterly Journal of Economics*, 135(1):1–55.

Fang, H., Li, M., and Lu, G. (2025). Decoding China's industrial policies. Working Paper 33814, National Bureau of Economic Research, Cambridge, MA.

Fetzer, T., Lambert, P. J., Feld, B., and Garg, P. (2024). Ai-generated production networks: Measurement and applications to global trade. Technical report, Working Paper.

Flaaen, A., Hortaçsu, A., and Tintelnot, F. (2020). The Production Relocation and Price Effects of US Trade Policy: The Case of Washing Machines. *American Economic Review*, 110(7):2103–2127.

Freund, C., Mattoo, A., Mulabdic, A., and Ruta, M. (2024). Is US trade policy reshaping global supply chains? *Journal of International Economics*, 152:104011.

Garred, J. and Yuan, S. (2025). Relocation from China (with Chinese characteristics). *Journal of Development Economics*, 176:103510.

Gaulier, G. and Zignago, S. (2010). Baci: International trade database at the product-level (the 1994–2007 version). *CEPII Working Paper*, (2010-23).

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, 225(2):254–277.

Gopinath, G., Gourinchas, P.-O., Presbitero, A. F., and Topalova, P. (2025). Changing global linkages: A new Cold War? *Journal of International Economics*, 153:104042.

He, Y. and Lyu, J. (2025). Export controls and innovation transfer within Chinese business groups: Evidence from the U.S. entity list. *Research Policy*, 54(9):105311.

IMF (2023). *World Economic Outlook: A Rocky Recovery*.

International Monetary Fund (2023). World economic outlook: A rocky recovery. Technical report, International Monetary Fund, Washington, DC.

Jakubik, A., Keck, A., and Piermartini, R. (2023). Trade policy implications of a changing world: Tariffs and import market power. IMF Working Paper WP/23/005, International Monetary Fund.

Jakubik, A. and Ruta, M. (2023). Trading with friends in uncertain times. IMF Working Paper WP/23/124, International Monetary Fund.

Jiang, L., Lu, Y., Song, H., and Zhang, G. (2023). Responses of exporters to trade protectionism: Inferences from the US-China trade war. *Journal of International Economics*, 140:103687.

Musteen, M., Liu, X., and Chakravarty, D. (2025). Abandonment of cross-border acquisitions: The role of target country context. *Journal of World Business*, 60(4):101638.

Ruta, M. and Sztajerowska, M. (2025). Shifting advantages: Do subsidies shape cross-border investment? IMF Working Paper WP/25/080, International Monetary Fund.

Schulze, T. and Xin, W. (2025). Demystifying trade patterns in a fragmenting world. IMF Working Paper 2025/129, International Monetary Fund. Accessed August 24, 2025.

St. Gallen Endowment for Prosperity through Trade (2026). Global Trade Alert Database.

Sun, L. and Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2):175–199.

U.S.-China Economic and Security Review Commission (2025). Made in China 2025: Evaluating China's performance. Staff report, U.S.-China Economic and Security Review Commission, Washington, DC.

Wang, Z., Wei, S.-J., Yu, X., and Zhu, K. (2025). Measuring FDI and Trade-Related Interdependence Across Countries: The Case of the United States and China. *NBER Working Paper 34226*.

Wooldridge, J. M. (2025). Two-way fixed effects, the two-way mundlak regression, and difference-in-differences estimators. *Empirical Economics*, 69(5):2545–2587.

Zabetta, C., Massimiliano, Miguelez, E., Lissoni, F., and Hegarty, S. (2025). Foreign-origin managers and fdi location choice. *Journal of International Business Studies*, 56(2):194–202.

Appendices

A Additional Tables

TABLE 5: Strategic sectors included in the main regression analysis.

ISIC Rev. 4	Strategic sector
072	Mining of non-ferrous metal ores
091	Support activities for petroleum and natural gas extraction
191	Manufacture of coke oven products
201	Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms
210	Manufacture of pharmaceuticals, medicinal chemical and botanical products
239	Manufacture of non-metallic mineral products n.e.c.
261	Manufacture of electronic components and boards
264	Manufacture of consumer electronics
265	Manufacture of measuring, testing, navigating and control equipment; watches and clocks
272	Manufacture of batteries and accumulators
275	Manufacture of domestic appliances
281	Manufacture of general-purpose machinery
291	Manufacture of motor vehicles

Notes: Strategic sectors are defined at the ISIC Rev. 4 3-digit (group) level, following Online Annex Table 4.1.5 of International Monetary Fund (2023), and mapped to the US Standard Industrial Classification (SIC) for the industry-level analysis.

TABLE 6: Strategic share of Chinese industries targeted by US trade-war tariffs vs export controls

Instrument	Industries	Strategic	% Strategic
Tariffs (imposed after 2018)	441	212	48.1
Export controls (first imposed after 2018)	180	103	57.2
Export controls (first imposed after 2021)	32	24	75.0

Notes: The table tabulates the number of industries at 4-digit US-SIC level that are subject to tariffs or export controls. Here tariffs refer to US tariffs on China obtained from the Global Tariff Database whose applied rate rose above the January-2018 baseline through September-2025, converted to SIC. For export controls we tabulate number of SIC industries whose first export-barrier hit on China falls in 2018 and later (second row), or 2021 and later (third row). "Strategic" industry classification follows the strategic-sector list in Table 5. The last columns shows percentage of all industries hit by the respective instruments that are strategic.

TABLE 7: China's strategic industries first hit by export barriers after July 2018.

SIC (3 digit)	First	Total
367 Electronic Components and Accessories	8	8
382 Measuring and Controlling Devices	7	8
363 Household Appliances	5	6
308 Miscellaneous Plastics Products, NEC	4	9
356 General Industrial Machinery and Equipment	4	9
353 Construction, Mining, and Materials Handling Machinery and Equipment	4	7
354 Metalworking Machinery and Equipment	4	7
326 Pottery and Related Products	4	5
369 Miscellaneous Electrical Machinery, Equipment, and Supplies	4	5
349 Miscellaneous Fabricated Metal Products	3	9
362 Electrical Industrial Apparatus	3	4
364 Electric Lighting and Wiring Equipment	3	3
366 Communications Equipment	3	3
329 Miscellaneous Nonmetallic Mineral Products	2	6
359 Miscellaneous Industrial and Commercial Machinery	2	5
289 Miscellaneous Chemical Products	2	4
358 Refrigeration and Service Industry Machinery	2	4
371 Motor Vehicles and Motor Vehicle Equipment	2	4
399 Miscellaneous Manufacturing Industries	2	4
346 Metal Forgings and Stampings	2	3
372 Aircraft and Parts	2	3
391 Jewelry, Silverware, and Plated Ware	2	3
341 Metal Cans and Shipping Containers	2	2
342 Cutlery, Handtools, and General Hardware	2	2
361 Electric Transmission and Distribution Equipment	2	2

Notes: This table includes only those 3-digit SIC industry groups for which at least two 4-digit strategic SIC industries were first targeted. "First" denotes the number of strategic 4-digit SIC industries initially targeted within each group, and "Total" denotes the total number of 4-digit SIC industries classified as strategic within that group.

TABLE 8: Summary Statistics

Variable	N	Mean	SD	p25	Median	p75	Min	Max
Panel A: Chinese outward FDI (USD mn, destination-industry-year)								
OFDI value	6,186	85.117	746.487	1.370	5.697	30.000	0.0000	38,000
ln(OFDI), intensive margin	5,179	2.482	1.891	1.078	2.358	3.899	-5.635	10.545
Any OFDI (0/1), extensive margin	6,186	0.8372	0.3692	1.000	1.000	1.000	0.0000	1.000
Panel B: Host-economy imports								
Capital-goods import share (from World)	4,008	0.6791	0.4426	0.0000	1.000	1.000	0.0000	1.000
Intermediate import share (from World)	4,008	0.1446	0.3151	0.0000	0.0000	0.0444	0.0000	1.000
Consumption import share (from World)	4,008	0.1214	0.3014	0.0000	0.0000	0.0000	0.0000	1.000
Centrality-weighted import volume (from World)	4,097	37,059	118,523	1,321	6,170	25,399	0.0000	2,673,978
Capital-goods import share (from China)	3,917	0.6970	0.4372	0.0000	1.000	1.000	0.0000	1.000
Intermediate import share (from China)	3,917	0.1374	0.3101	0.0000	0.0000	0.0240	0.0000	1.000
Consumption import share (from China)	3,917	0.1231	0.3054	0.0000	0.0000	0.0000	0.0000	1.000
Centrality-weighted import volume (from China)	4,097	7,173	20,670	205.001	1,052	4,209	0.0000	417,254
Panel C: Host-economy exports								
Capital-goods export share (to World)	4,033	0.6718	0.4439	0.0000	1.000	1.000	0.0000	1.000
Intermediate export share (to World)	4,033	0.1486	0.3207	0.0000	0.0000	0.0440	0.0000	1.000
Consumption export share (to World)	4,033	0.1211	0.3066	0.0000	0.0000	0.0000	0.0000	1.000
Centrality-weighted export volume (to World)	4,097	61,744	531,916	277.532	2,987	20,147	0.0000	13,940,052
Capital-goods export share (to US)	3,283	0.7304	0.4181	0.4258	1.000	1.000	0.0000	1.000
Intermediate export share (to US)	3,283	0.1317	0.3041	0.0000	0.0000	0.0125	0.0000	1.000
Consumption export share (to US)	3,283	0.0965	0.2774	0.0000	0.0000	0.0000	0.0000	1.000
Centrality-weighted export volume (to US)	4,097	5,316	32,632	0.0346	33.717	583.914	0.0000	868,371
Panel D: GVC linkages (TiVA)								
Forward linkage to World	56,595	0.4235	0.7783	0.0380	0.2030	0.4990	0.0010	16.854
Forward linkage to China	57,750	0.0349	0.1593	0.0003	0.0035	0.0180	0.0000	7.618
Backward linkage from World	56,595	22.297	14.581	10.996	19.317	30.986	0.0000	110.541
Backward linkage from China	55,966	2.003	2.588	0.6210	1.153	2.273	0.0000	48.544
Panel E: GVC linkages by ownership (AMNE)								
Backward linkage from China, FIE	70,914	0.0180	0.0254	0.0046	0.0096	0.0205	0.0001	0.4457
Backward linkage from China, DOE	74,859	0.0141	0.0199	0.0036	0.0076	0.0160	0.0000	0.3645
Forward linkage to China, FIE	70,886	0.0178	0.0360	0.0024	0.0076	0.0195	0.0000	0.600
Forward linkage to China, DOE	74,828	0.0156	0.0340	0.0019	0.0064	0.0170	0.0000	0.580

Notes: Each panel summarizes its respective estimation sample, and hence the sample sizes differ accordingly. Panels B–C report the capital/intermediate/consumption composition of import (export) volumes and a product-centrality-weighted import (export) volume index. Panel D GVC linkages (OECD TiVA) are expressed as a percentage of gross exports. The reported forward linkages are mechanically smaller than backward linkages, as forward linkage measures a country's domestic value added embodied in other countries' exports, which represents a small share of its own exports. Meanwhile, backward linkage measures foreign value added in its own exports. Panel E reports summary statistics of linkages by ownership type (obtained from OECD AMNE), and they are expressed as shares of the relevant ownership type's value added. For forward linkages, we measure the share of value added created by either the domestic or foreign firms that is exported to China. For backward linkages, we measure the share of the value added embodied in either the domestic or foreign firms' inputs that is imported from China.

TABLE 9: Strategic industries according to Freund et al. (2024)

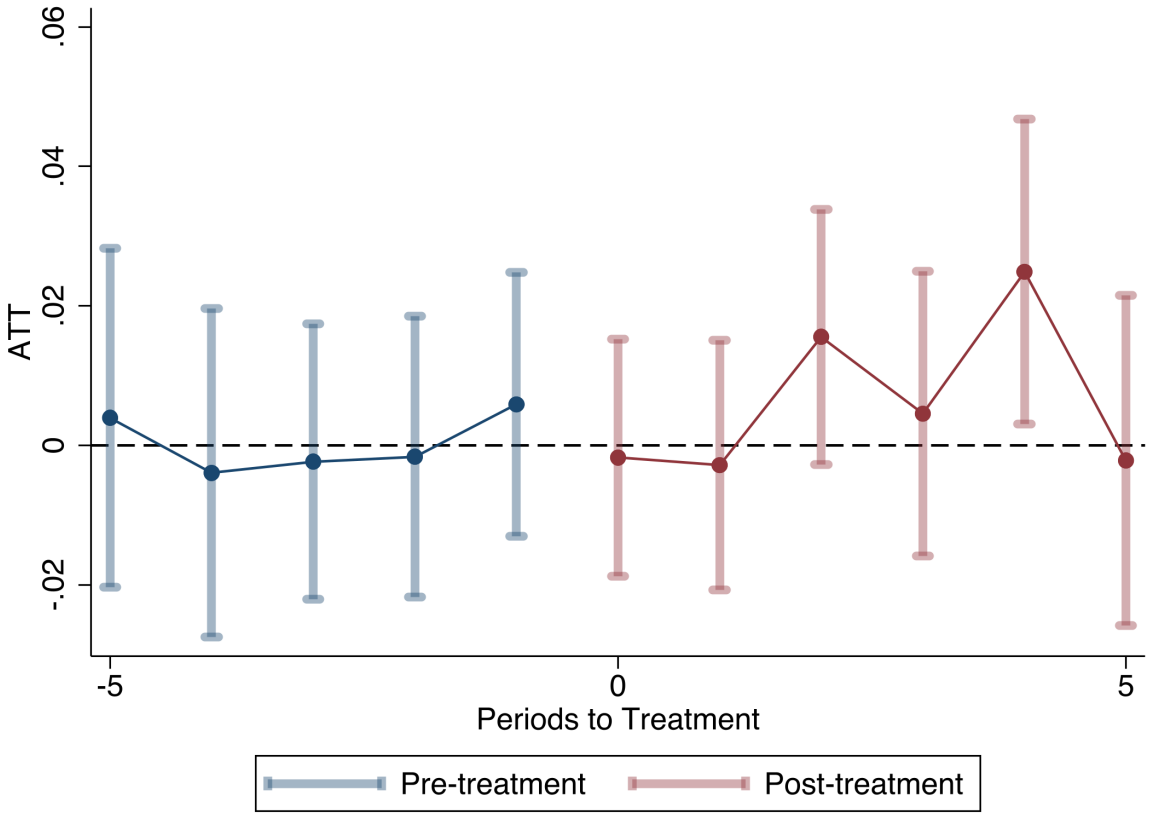
HS 2-digit chapter	Description
28	Inorganic chemicals; compounds of precious/rare-earth metals and radioactive elements
29	Organic chemicals
30	Pharmaceutical products
38	Miscellaneous chemical products
84	Nuclear reactors, boilers, machinery and mechanical appliances
85	Electrical machinery and equipment; electronics; sound and image recorders
87	Vehicles (other than railway/tramway rolling stock) and parts
88	Aircraft, spacecraft, and parts thereof
90	Optical, photographic, measuring, precision, medical and surgical instruments
93	Arms and ammunition; parts and accessories
98	Special classification provisions (HTS Chapter 98)

Notes: This table lists the Freund et al. (2024) strategic sectors, which comprises the eleven 2-digit HS chapters. The authors first obtain the "recognized high-technology fields" (biotechnology, life sciences, opto-electronics, information and communications, electronics, flexible manufacturing, advanced materials, aerospace, weapons, and nuclear technology) according to the US Census Bureau. Within each high-tech field, the authors retrieve the list of Advanced Technology Products (ATP) and identify the 2-digit HS sectors that correspond to these products. These HS chapters are later concorded to US-SIC industries for robustness estimation.

B Additional Figures

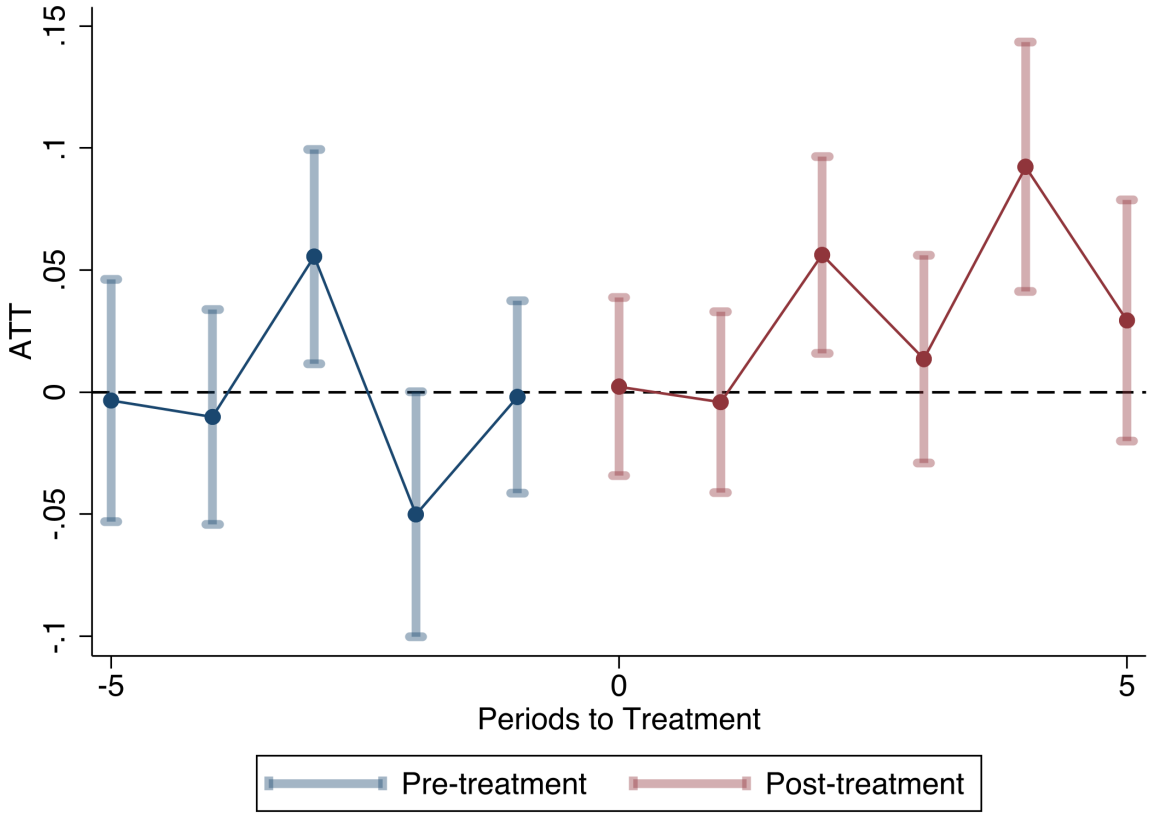
B.1 Impact on China's Outward FDI

FIGURE 8: Export Controls on Chinese Outward FDI: Strategic Industries **1**(FDI> 0)



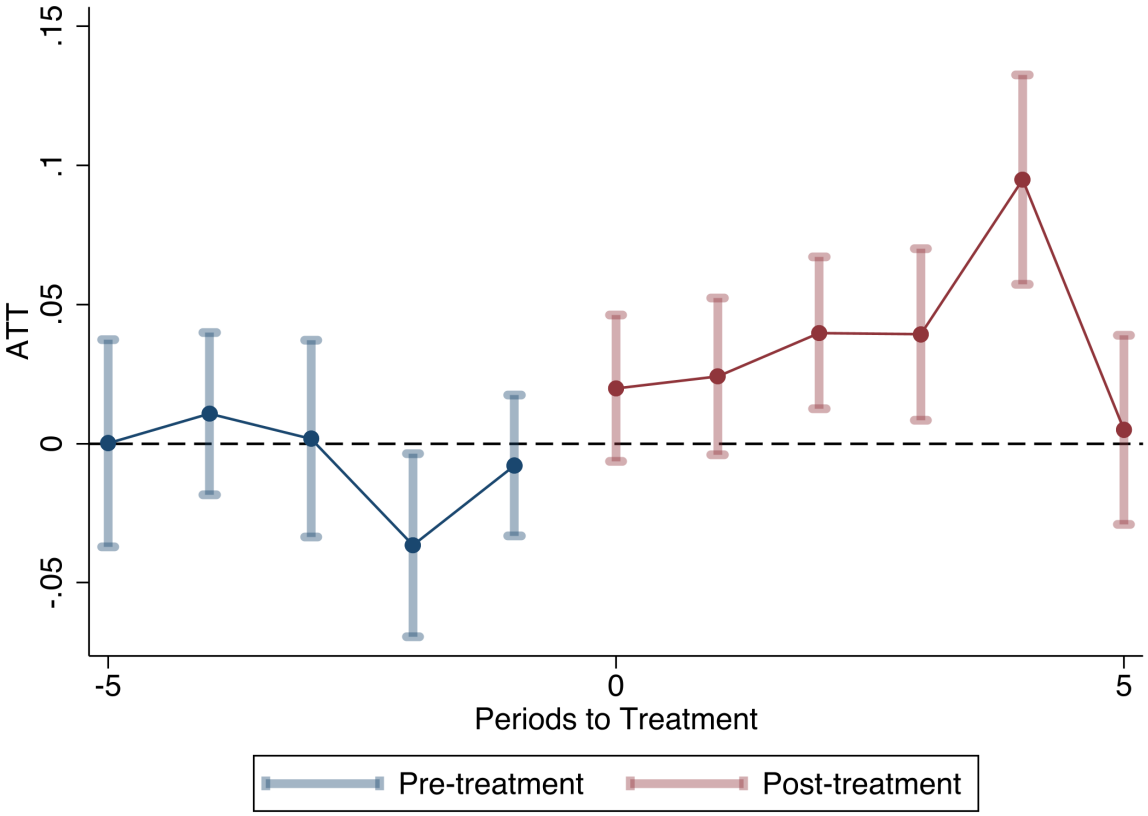
Notes: We plot the 95% confidence interval of the estimated average treatment effect on the treated following Callaway and Sant'Anna (2021). Robust standard errors are clustered at the destination–industry level.

FIGURE 9: Export Controls on Chinese Outward FDI: Connector Countries **1**(FDI> 0)



Notes: We plot the 95% confidence interval of the estimated average treatment effect on the treated following Callaway and Sant'Anna (2021). Robust standard errors are clustered at the destination–industry level.

FIGURE 10: Export Controls on Chinese Outward FDI: ASEAN Countries **1**(FDI> 0)



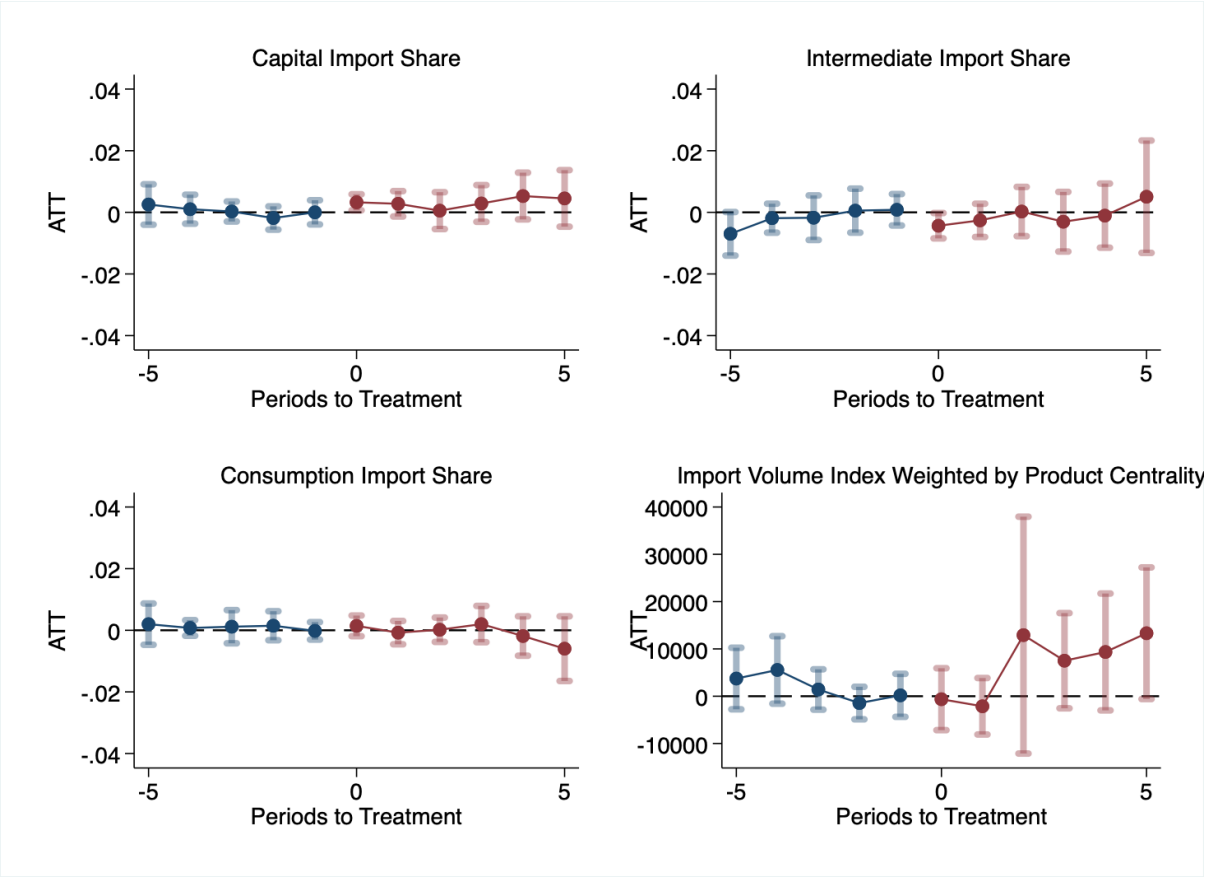
Notes: We plot the 95% confidence interval of the estimated average treatment effect on the treated following Callaway and Sant'Anna (2021). Robust standard errors are clustered at the destination–industry level.

B.2 Trade Implications

We present the dynamic treatment effects for industries exposed to export controls relative to unaffected industries on host economies' import structure in Figure 11, estimated using an event-study specification with a five-year window before and after policy implementation. The top panels show effects on capital and intermediate import shares, the bottom left panel shows consumption import shares, and the bottom right panel shows the centrality-weighted import volume index. Pre-treatment coefficients are close to zero and statistically insignificant across outcomes, supporting the parallel trends assumption and the validity of our empirical design. Following policy implementation, capital import shares exhibit a positive shift, although not statistically significant at the 95% level, whereas intermediate and consumption import shares remain relatively stable and, if anything, show slight declines. Meanwhile, the centrality-weighted import index does not display a clear increase. Overall, the post-policy changes in FDI-receiving countries' import from the world on average are not statistically significant.

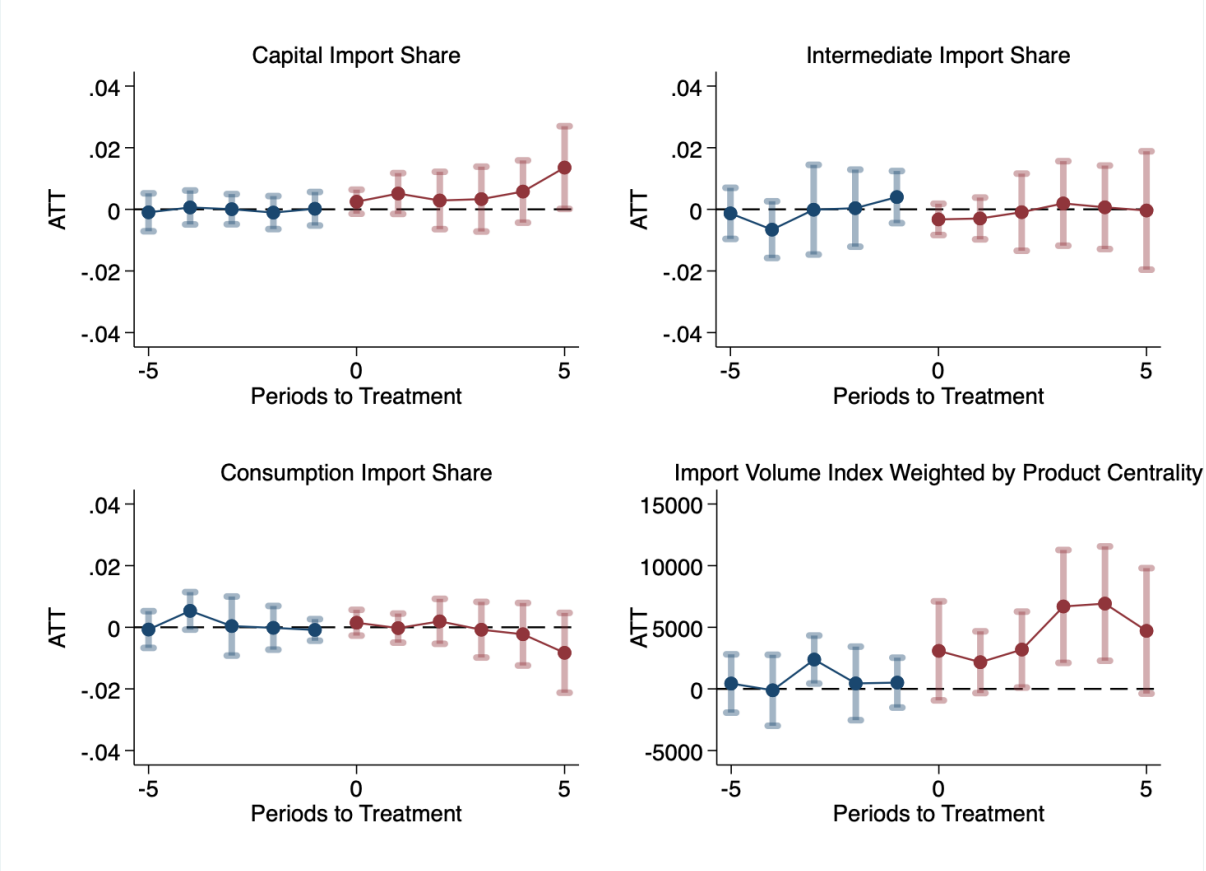
We then re-estimate changes in host economies' import structures, focusing only on imports from China, as shown in Figure 12. The main difference from the baseline results (Figure 11) is that, when restricting the sample to imports from China, we find a statistically significant increase in the centrality-weighted import index. This is consistent with the interpretation that export control–induced Chinese FDI in host economies is associated with changes in host-country import composition that are consistent with production reallocation.

FIGURE 11: Dynamic Treatment Effects on Imports from the World



Notes: Dynamic effects of export controls on the composition of imports from world in affected industries across Chinese outward FDI destination countries, estimated with Callaway and Sant'Anna (2021). We plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination–industry level.

FIGURE 12: Dynamic Treatment Effects on Imports from China



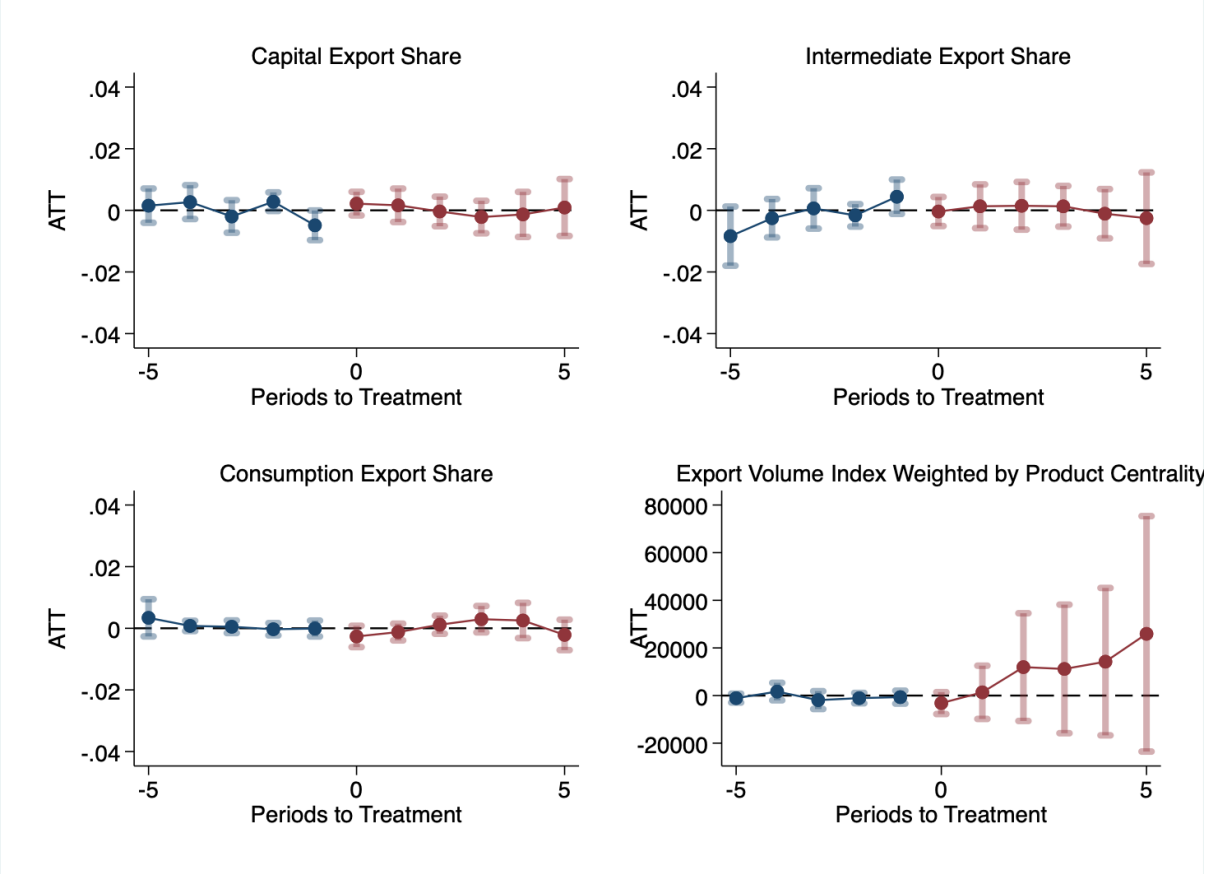
Notes: Dynamic effects of export controls on the composition of imports from China in affected industries across Chinese outward FDI destination countries, estimated with Callaway and Sant'Anna (2021). Our estimation is based on Section 5.6 and we plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination–industry level.

Figure 13 presents dynamic treatment effects on Chinese FDI-recipient countries' exports to the world after the respective industries in China are imposed export controls. Pre-treatment coefficients are close to zero, supporting the validity of the empirical design. Post-treatment (export control imposition on China), we find no statistically significant increase in the share of capital goods exports from Chinese FDI-receiving countries, suggesting limited evidence of trade rerouting through host economies in response to export controls. Instead, export shares across capital, intermediate, and consumption goods remain broadly stable.

Figure 14 examines exports to the United States by host economies receiving Chinese FDI following the announcement of export controls. The estimated effects are generally small and statistically insignificant across all export categories. These results provide little support for the hypothesis that host-country industries receiving investment from Chinese firms in sectors targeted by foreign-imposed export controls on China subsequently reoriented their exports toward the US market. This suggests that our earlier estimated increases in the capital goods import share and the centrality-weighted import

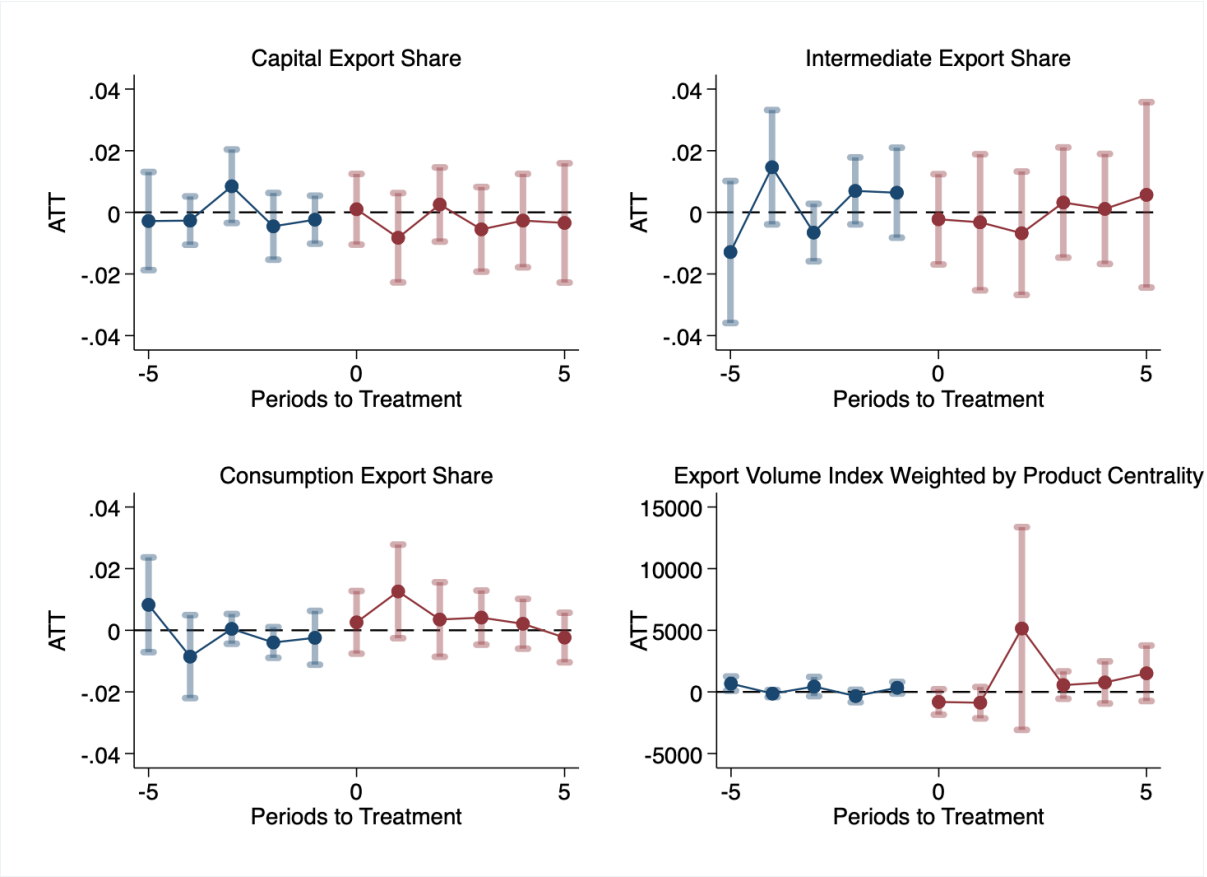
index for imports from China are unlikely to be capturing the effects of other policies that induced trade-rerouting FDI.

FIGURE 13: Dynamic Treatment Effects on Exports to the World



Notes: Dynamic effects of export controls on the composition of exports to the world in affected industries from Chinese outward FDI destination countries, estimated with Callaway and Sant'Anna (2021). Our estimation is based on Section 5.6 and we plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination–industry level.

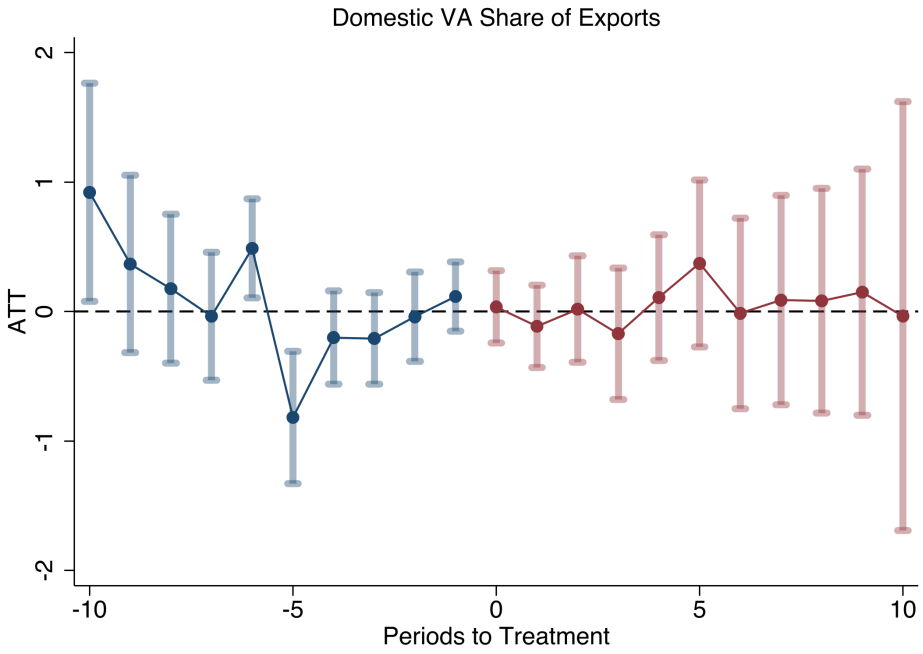
FIGURE 14: Dynamic Treatment Effects on Exports to the US



Notes: Dynamic effects of export controls on the composition of exports to the US in affected industries from Chinese outward FDI destination countries, estimated with Callaway and Sant'Anna (2021). Our estimation is based on Section 5.6 and we plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination–industry level.

B.3 GVC Implications

FIGURE 15: Dynamic Effects of Export Controls Targeting China on Domestic Value-Added Share of Exports in Chinese OFDI-Receiving Countries



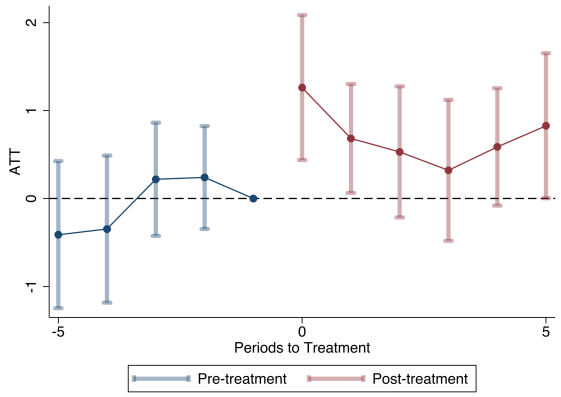
Notes: This figure reports dynamic treatment effects of export controls on the domestic value-added share of gross exports (EXGR_DVASH) for affected industries. Estimates are obtained using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Standard errors are clustered at the destination-industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT).

C Robustness Checks: Alternative Estimators

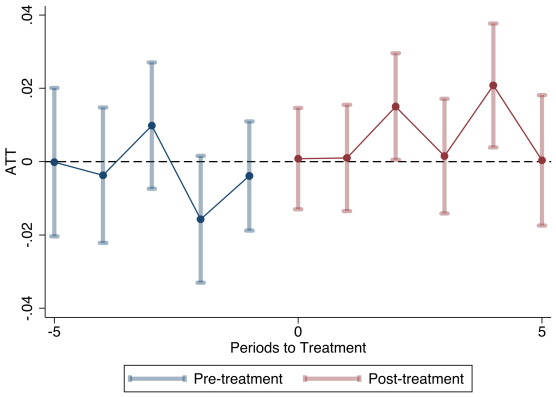
In this section, we assess the robustness of our main results using alternative estimators.

C.1 Effects on Chinese OFDI

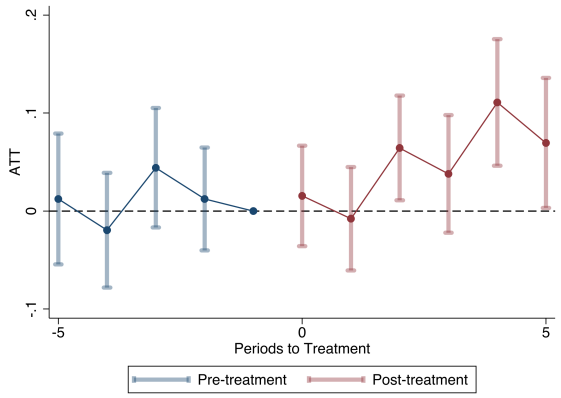
FIGURE 16: Export Controls and Chinese Outward FDI



(A) Intensive Margin: $\log(FDI)$



(B) Extensive Margin: $\mathbf{1}\{FDI > 0\}$



(C) Combined Effects: $\log(1 + FDI)$

Notes: Panels (a)–(c) report dynamic effects of export controls on Chinese outward FDI for affected industries, estimated using the Wooldridge (2025) difference-in-differences estimator. The outcome variables are $\log(FDI)$ in Panel (a), $\mathbf{1}\{FDI > 0\}$ in Panel (b), and $\log(1 + FDI)$ in Panel (c). The estimator is based on a pooled regression with cohort-time interaction terms using never-treated units as the comparison group. The specification is $Y_{it} = \alpha_i + \lambda_t + \sum_g \sum_{s \geq g} \beta_{gs} \mathbf{1}\{g_i = g, t = s\} + \varepsilon_{it}$, where α_i are destination–industry fixed effects and λ_t are year fixed effects. Plotted points are the event-time aggregates of β_{gs} at horizon $e = s - g$. Standard errors are clustered at the destination–industry level. The horizontal axis denotes periods relative to the first year of treatment, and the vertical axis reports the average treatment effect on the treated (ATT). Post-treatment markers are shown in maroon and pre-treatment markers in light navy. The dashed horizontal line denotes zero.

TABLE 10: Aggregate effect of export barriers on China's outward greenfield FDI by subsample

	All			Strategic			Connector		ASEAN	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Intensive	Combined	Extensive	Intensive	Combined	Extensive	Combined	Extensive	Combined	Extensive
	ln FDI	ln(1+FDI)	Any FDI	ln FDI	ln(1+FDI)	Any FDI	ln(1+FDI)	Any FDI	ln(1+FDI)	Any FDI
ATT	0.632***	0.033*	-0.005	0.600**	0.046*	-0.003	0.214***	0.031**	0.177***	0.032***
	(0.220)	(0.019)	(.)	(0.236)	(0.026)	(0.006)	(0.054)	(0.013)	(0.039)	(0.009)
Pre-treatment share of having FDI			0.066			0.070		0.049		0.041
ATT as % of pre-treatment share			-7%			-4%		+62%		+78%
Treated units	229	2,654	2,654	204	1,808	1,808	327	327	515	515
Control units	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758
Observations	6,186	92,004	92,004	6,111	77,622	77,622	52,445	52,445	55,641	55,641

Notes: Aggregated average treatment effect on the treated (ATT) following Wooldridge (2025). Pre-treatment share of having FDI is the mean of $\mathbf{1}$(FDI>0) among the treated industries in their pre-treatment years; ATT as % of pre-treatment share presents the estimated differential increase in the share of industries receiving FDI among all treated industries relative to the change of the share among untreated industries as a percentage increase from the pre-treatment share (the estimated change in the entry probability relative to its pre-treatment level). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Destination country-industry fixed effects and year fixed effects are included. Standard errors are clustered at destination country-industry groups and shown in parentheses.

TABLE 11: Heterogeneous effect of export barriers on China's outward greenfield FDI

	Strategic			Connector		ASEAN	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Intensive	Combined	Extensive	Combined	Extensive	Combined	Extensive
	ln FDI	ln(1+FDI)	Any FDI	ln(1+FDI)	Any FDI	ln(1+FDI)	Any FDI
ATT: subgroup	0.776***	0.059**	0.001	0.201***	0.022***	0.108***	0.006
	(0.207)	(0.023)	(0.006)	(0.037)	(0.008)	(0.028)	(0.006)
ATT: others	1.077***	-0.011	-0.014***	0.010	-0.008*	0.015	-0.007
	(0.215)	(0.019)	(0.006)	(0.019)	(0.005)	(0.019)	(0.005)
Marginal Effect	-0.302	0.070***	0.016***	0.191***	0.030***	0.093***	0.014***
(subgroup−others)	(0.260)	(0.022)	(0.006)	(0.035)	(0.007)	(0.023)	(0.005)
Treated (subgroup)	204	1,808	1,808	327	327	515	515
Treated (others)	25	846	846	2,327	2,327	2,139	2,139
Control units	2,758	2,758	2,758	2,758	2,758	2,758	2,758
Observations	6,186	92,004	92,004	92,004	92,004	92,004	92,004

Notes: Aggregated average treatment effect on the treated (ATT) following Wooldridge (2025). Each column is a single regression on the full sample. $Y_{it} = \eta_{g_i} + \lambda_t + \phi S_i + \sum_g \sum_{s \geq g} \mathbf{1}\{g_i = g, t = s\}(\beta_{gs} + \delta_{gs} S_i) + \varepsilon_{it}$, where i indexes a destination×industry pair, g_i is the export-control cohort, s indexes calendar time, η_{g_i} and λ_t are cohort and year fixed effects, $S_i = 1$ for the subgroup (strategic industries, connector, or ASEAN), and Y_{it} is the column's outcome ($\ln FDI_{it}$, $\ln(1 + FDI_{it})$, or $\mathbf{1}\{FDI_{it} > 0\}$). We use never-treated units as the control group. "ATT: subgroup" refers to the aggregated effects of $\beta_{gs} + \delta_{gs}$ over post-treatment cells ($s \geq g$). "ATT: others" refers to the aggregated effects of β_{gs} over post-treatment cells ($s \geq g$). "Marginal Effect" is the difference between the aggregated effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at destination country-industry groups and shown in parentheses.

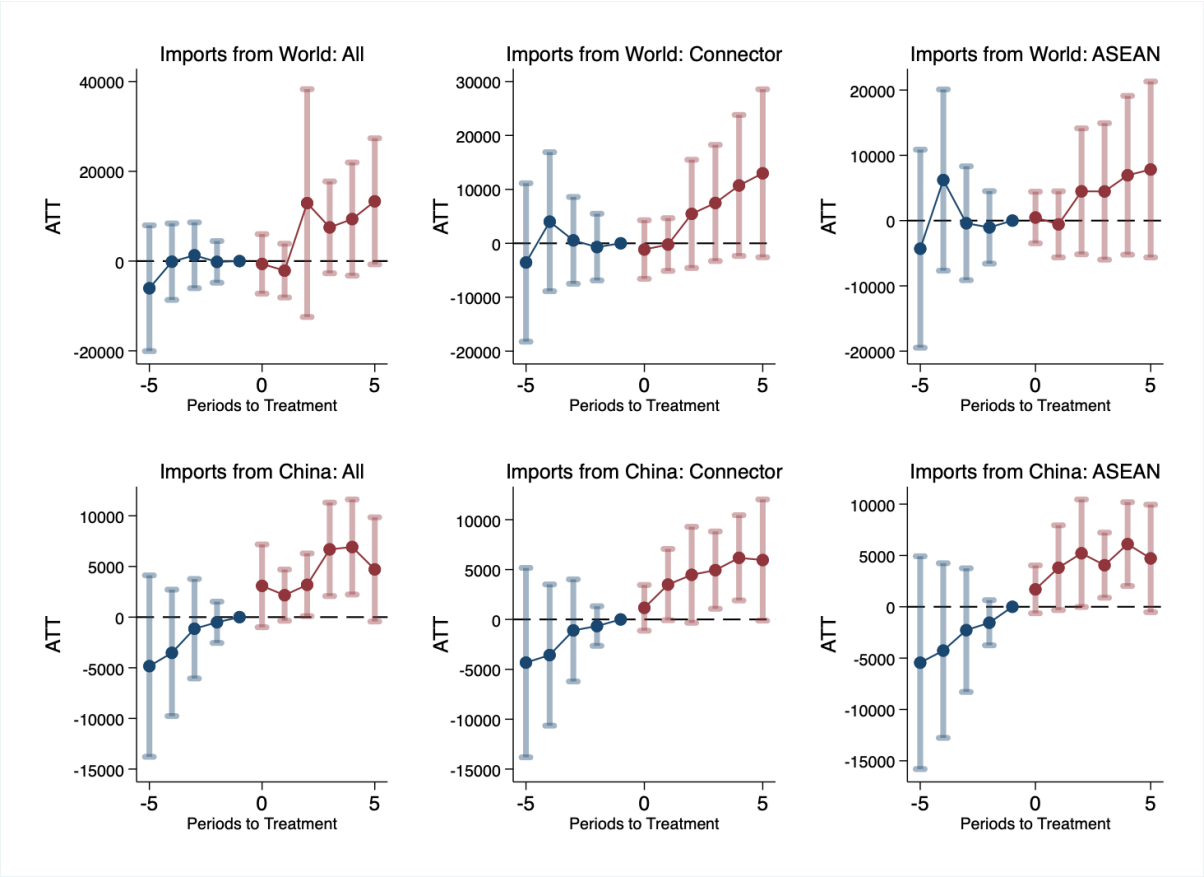
C.2 Effects on Host Economies' Trade Composition

TABLE 12: Aggregate effect of export controls on host-economy trade composition by economy

	(1) All	(2) Connector	(3) ASEAN
Panel A: Imports from the World			
Capital import share	0.0022†	0.0022†	-0.0008†
Intermediate import share	-0.0018†	-0.0038†	-0.0090†
Consumption import share	0.0006†	0.0036†	0.0096†
Centrality-weighted import volume index	8442.8 (5777.9)	6179.7 (4732.9)	4434.3 (4104.2)
Log centrality-weighted import index	0.0295 (0.0984)	0.2890** (0.1143)	0.2312** (0.1176)
Panel B: Imports from China			
Capital import share	0.0039†	0.0074†	-0.0045†
Intermediate import share	-0.0012†	-0.0022†	-0.0098†
Consumption import share	-0.0000†	0.0051†	0.0149†
Centrality-weighted import volume index	4822.1** (2318.9)	5177.7** (2155.2)	5347.1*** (1921.2)
Log centrality-weighted import index	0.5652*** (0.1486)	0.8613*** (0.1939)	0.8539*** (0.1874)
Panel C: Exports to the World			
Capital export share	0.0013†	-0.0126†	0.0006†
Intermediate export share	-0.0009†	0.0077†	-0.0039†
Consumption export share	-0.0008†	0.0040†	0.0016†
Centrality-weighted export volume index	45810.2 (33855.0)	5208.7 (7188.6)	8199.8 (7862.3)
Log centrality-weighted export index	0.0076 (0.2899)	0.3968 (0.3065)	0.4871 (0.3368)
Panel D: Exports to the US			
Capital export share	-0.0033†	-0.0057†	-0.0112†
Intermediate export share	-0.0003†	-0.0069†	-0.0042†
Consumption export share	0.0034†	0.0112†	0.0120†
Centrality-weighted export volume index	1029.0 (1032.2)	6717.0 (5427.7)	8151.5 (6102.2)
Log centrality-weighted export index	-1.151*** (0.402)	-0.562 (0.509)	-0.097 (0.553)
Treated units	215	40	35
Control units	26	26	26

Notes: Aggregated average treatment effect on the treated (ATT) following Wooldridge (2025) for each subsample. Outcomes are the BEC volume shares and the product-centrality-weighted trade-volume index shown in the corresponding figure subplots. Columns (2)–(3) restrict the treated group to connector economies (MEX, POL, MAR, VNM, IDN) and ASEAN-10, respectively, while keeping the full never-treated control pool. † denotes cases where point estimates are available but standard error is undefined. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

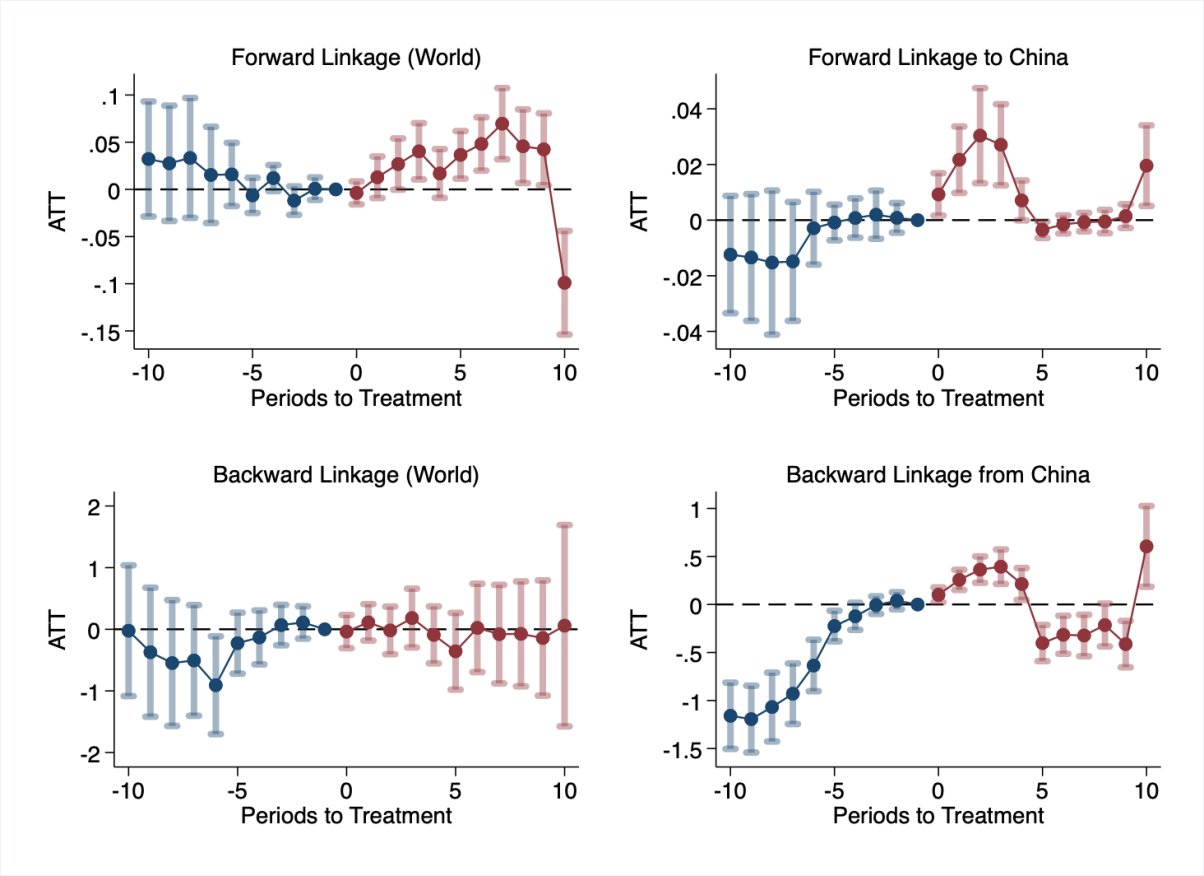
FIGURE 17: Dynamic Treatment Effects on Centrality-Weighted Import Volume Index



Notes: Dynamic effects of export controls on the centrality-weighted import volume indices of Chinese FDI-receiving economies, estimated using the Wooldridge (2025) difference-in-differences estimator. We plot the 95% confidence interval of the estimate. Robust standard errors are clustered at the destination-industry level.

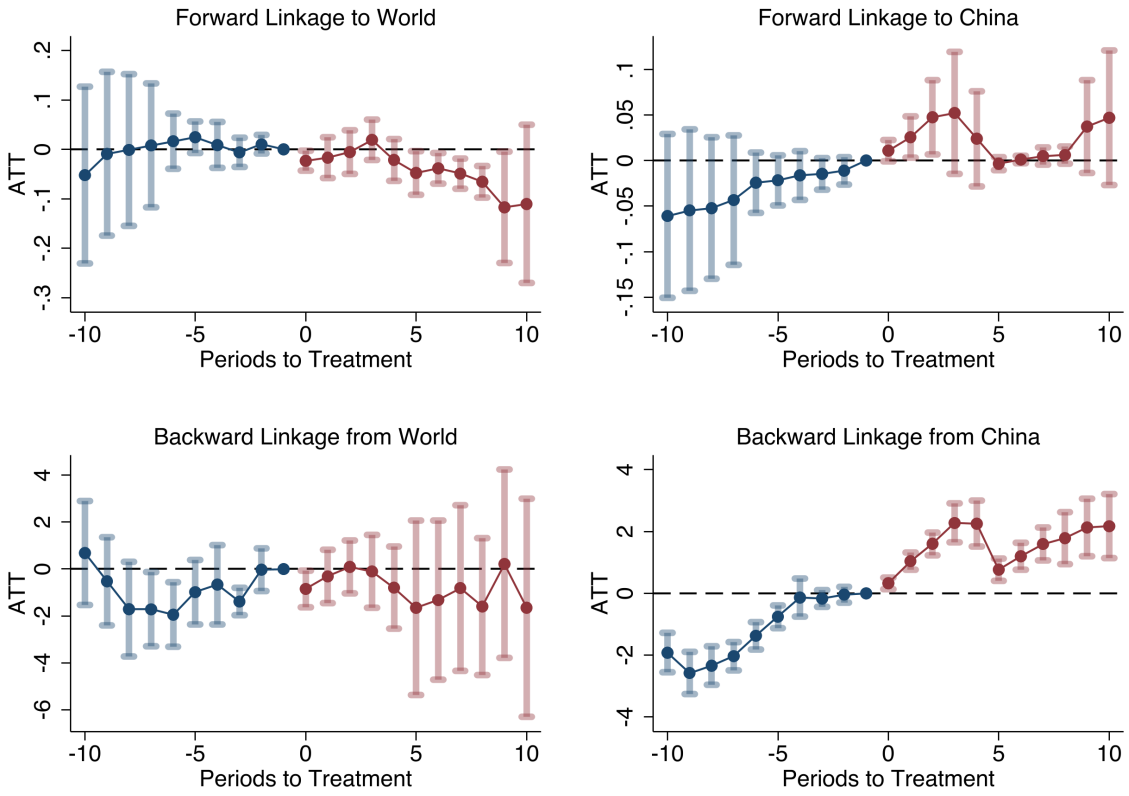
C.3 Effects on GVC Linkages

FIGURE 18: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Countries



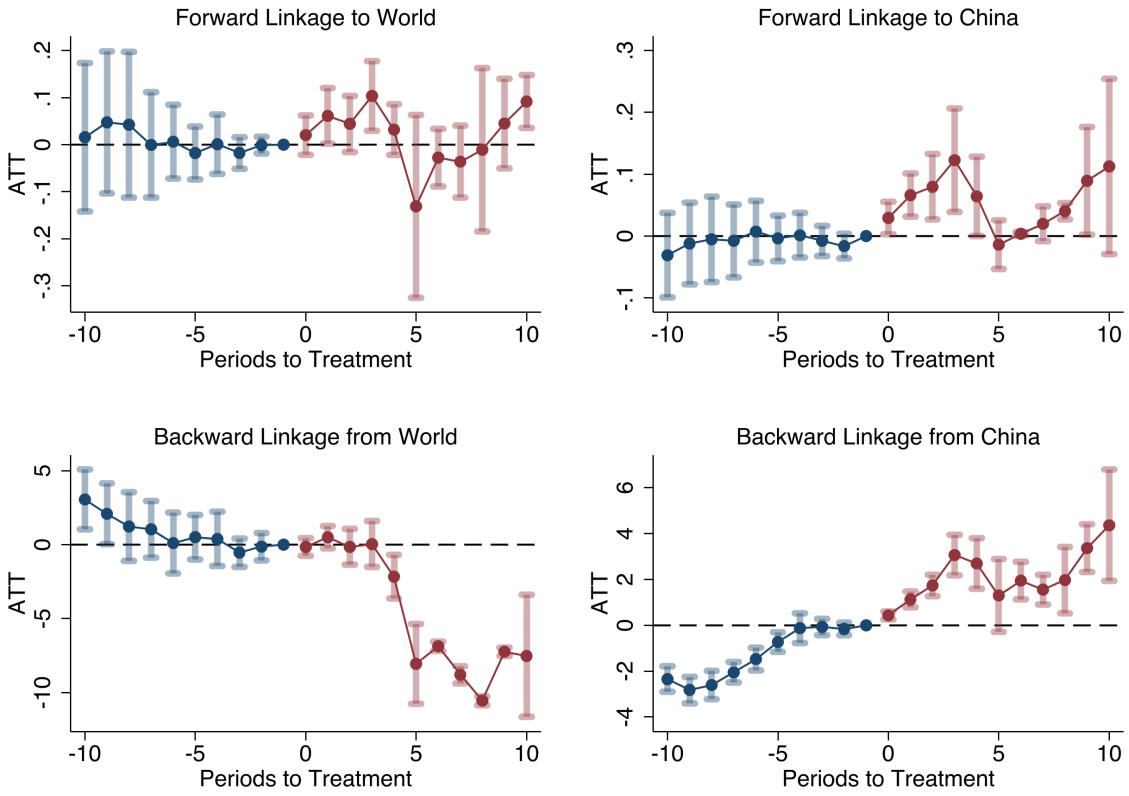
Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Wooldridge (2025) difference-in-differences estimator. The estimator is based on a pooled regression with cohort-time interaction terms, using never-treated units as the comparison group. Standard errors are clustered at the destination–industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT). The dashed horizontal line denotes zero. Top-left: forward linkage to world. Top-right: forward linkage to China. Bottom-left: backward linkage from world. Bottom-right: backward linkage from China.

FIGURE 19: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Connector Countries



Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Wooldridge (2025) difference-in-differences estimator. The estimator is based on a pooled regression with cohort-time interaction terms, using never-treated units as the comparison group. Standard errors are clustered at the destination–industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT). The dashed horizontal line denotes zero. Top-left: forward linkage to world. Top-right: forward linkage to China. Bottom-left: backward linkage from world. Bottom-right: backward linkage from China.

FIGURE 20: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving ASEAN Countries

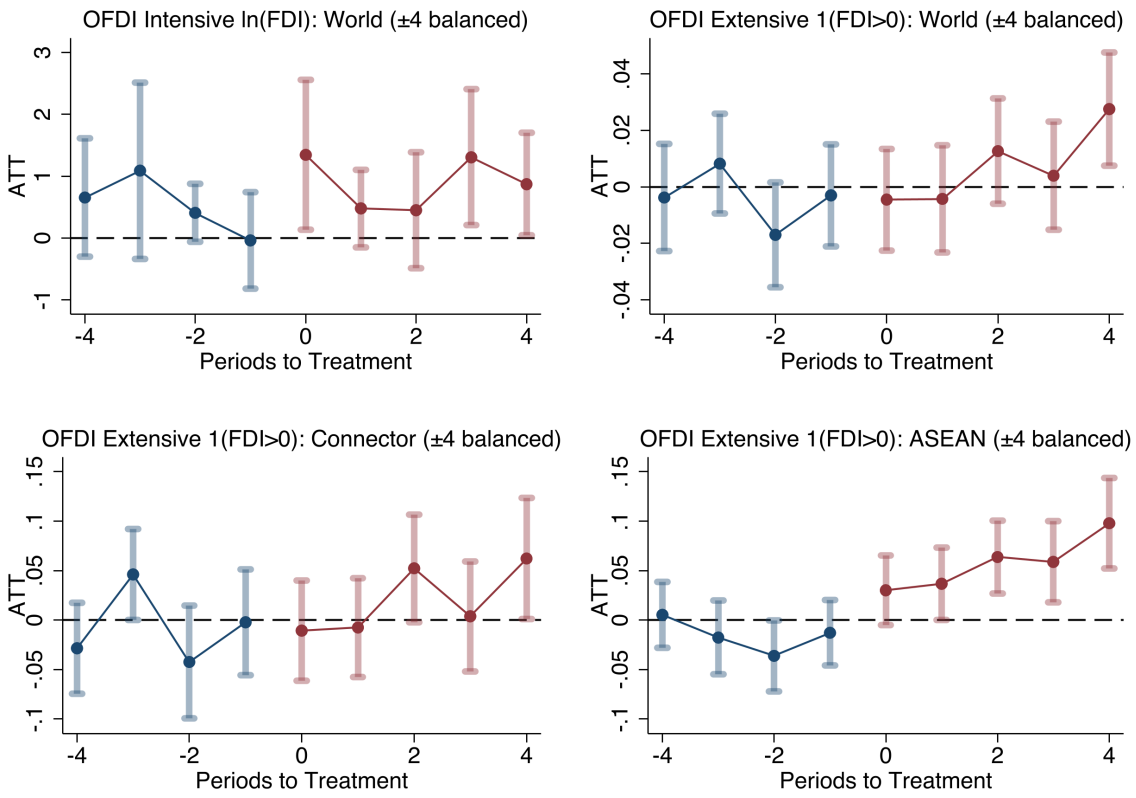


Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries, estimated using the Wooldridge (2025) difference-in-differences estimator. The estimator is based on a pooled regression with cohort-time interaction terms, using never-treated units as the comparison group. Standard errors are clustered at the destination–industry level. The horizontal axis denotes periods relative to the first year of treatment (export control imposition), and the vertical axis reports the average treatment effect on the treated (ATT). The dashed horizontal line denotes zero. Top-left: forward linkage to world. Top-right: forward linkage to China. Bottom-left: backward linkage from world. Bottom-right: backward linkage from China.

D Robustness Checks: Balanced Cohorts

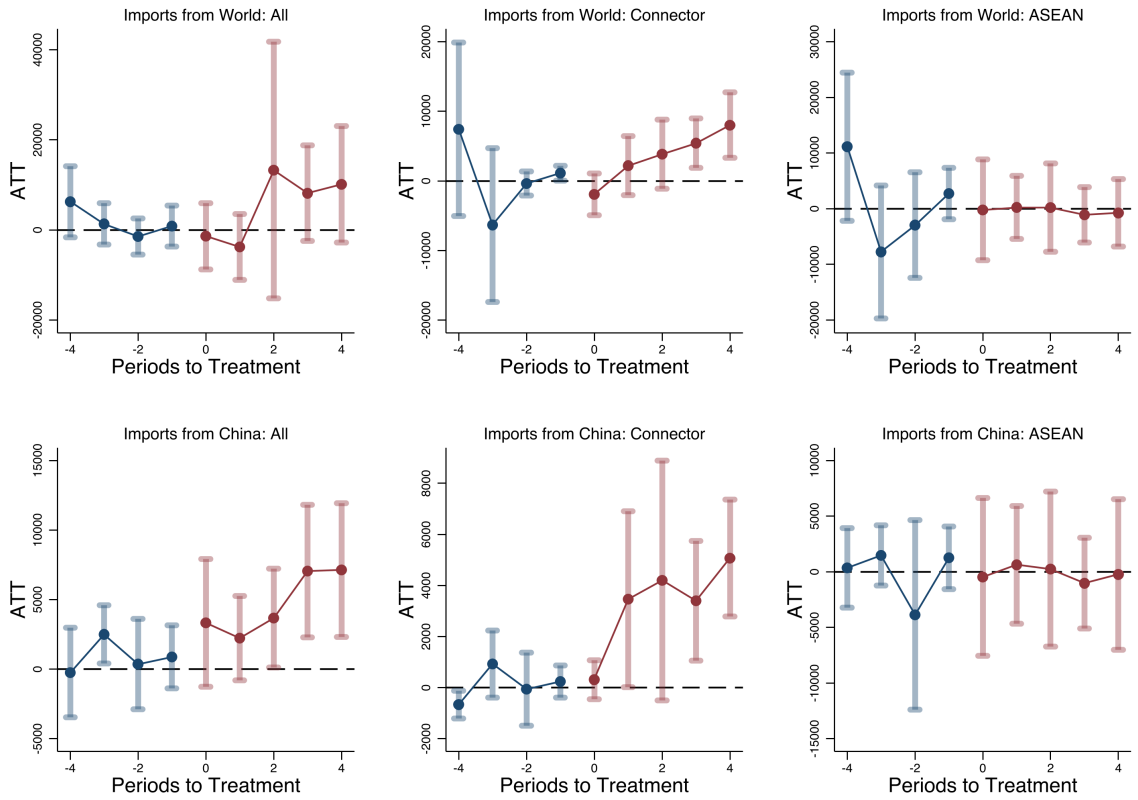
In this section, we re-estimate the event-study specifications using balanced cohorts as a robustness check against composition effects that may distort the interpretation of dynamic treatment effects over time. The corresponding results for Figure 3a, Figure 3b, Figure 4, Figure 5, Figure 6, and Figure 7 are presented below.

FIGURE 21: Export Controls on Chinese Outward FDI: Intensive and Extensive Margins



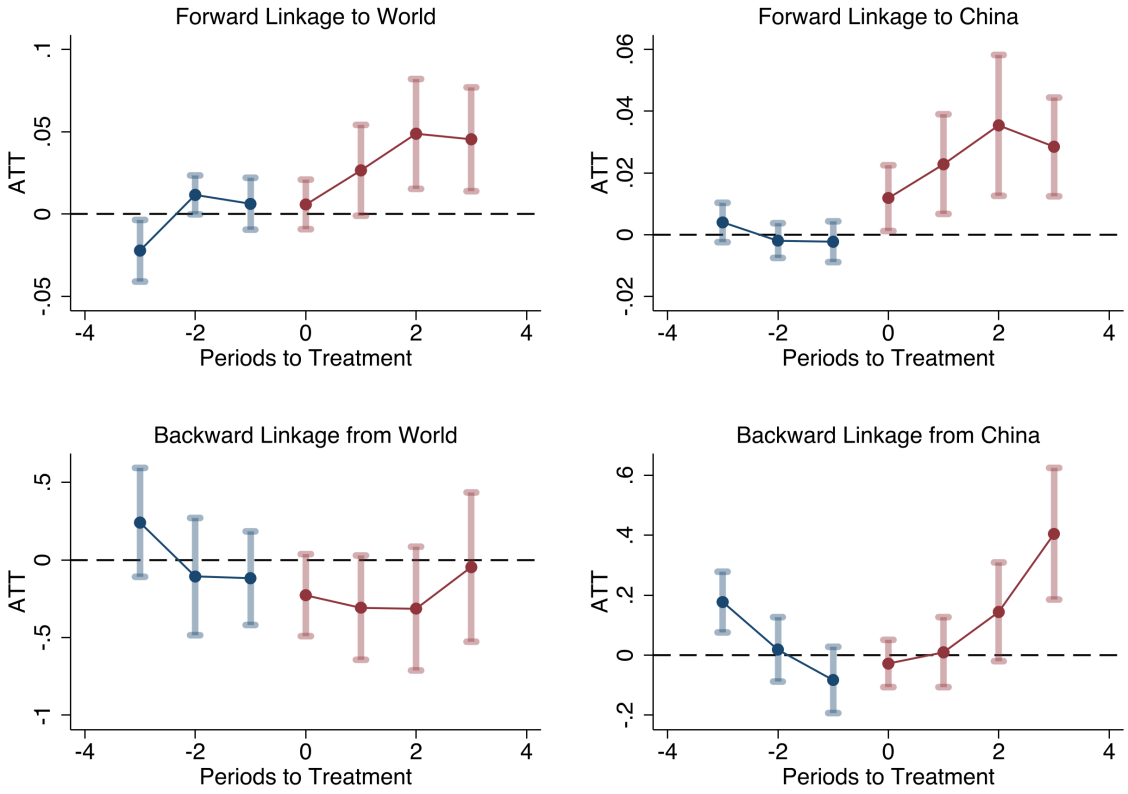
Notes: Dynamic effects of export controls on Chinese outward greenfield FDI for affected industries, estimated following Callaway and Sant'Anna (2021). Panels report the intensive margin ($\log(FDI)$) for the World, and the extensive margin ($\mathbf{1}\{FDI > 0\}$) for the World, Connector, and ASEAN destination groups. The estimation sample is restricted to treatment cohorts observed over the full ±4 event window. As the sample spans from 2008 to 2024, we restrict our estimation to cohorts that are first treated between 2012 and 2020, so that every event-time coefficient averages the same set of cohorts. The horizontal axis denotes periods relative to the first year of treatment (export control imposition on China), and the vertical axis reports the average treatment effect on the treated (ATT). We plot the 95% confidence interval of the estimate, and robust standard errors are clustered at the destination–industry level.

FIGURE 22: Dynamic Treatment Effects on Centrality-Weighted Import Volume Index



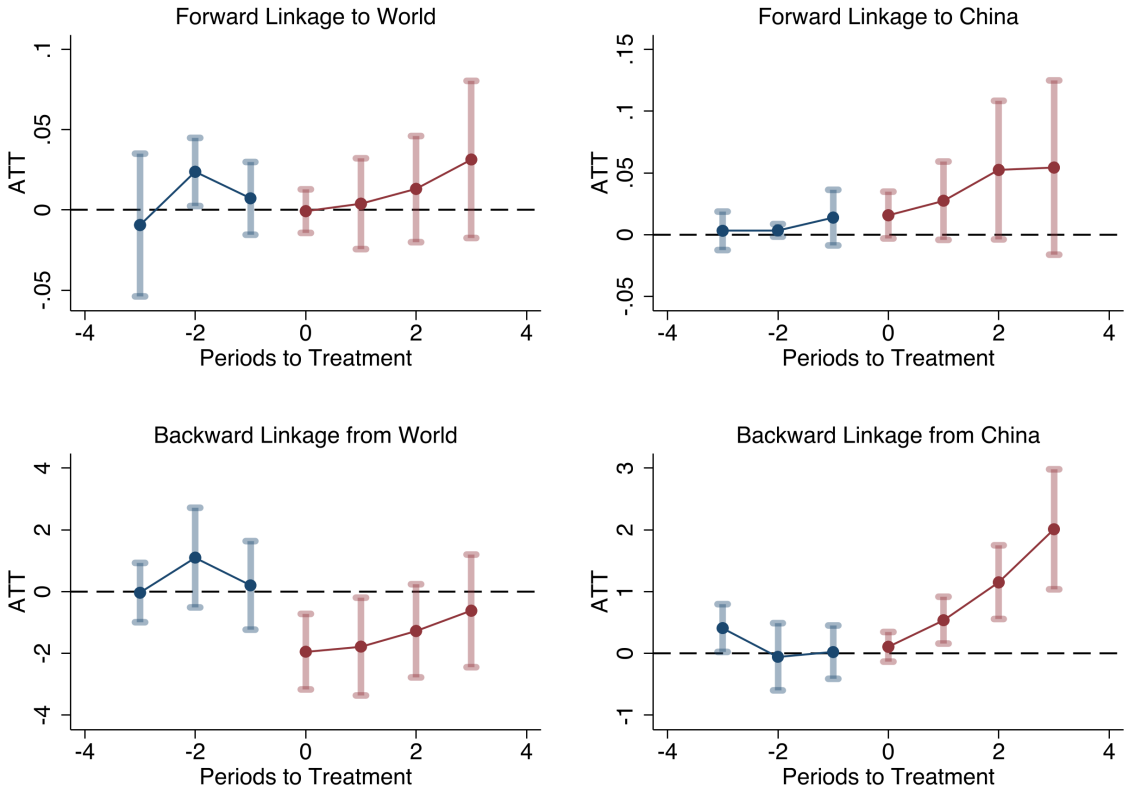
Notes: Dynamic effects of export controls on the centrality-weighted import volume indices of Chinese FDI-receiving economies, estimated following Callaway and Sant'Anna (2021), for imports from the World (top row) and from China (bottom row) across the All, Connector, and ASEAN destination groups. The estimation sample is restricted to treatment cohorts observed over the full ±4 event window. As the sample spans from 2008 to 2023, we restrict our estimation to cohorts that are first treated between 2012 and 2020, so that every event-time coefficient averages the same set of cohorts. We plot the 95% confidence interval of the estimate, and the robust standard errors are clustered at the destination-industry level.

FIGURE 23: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Economies



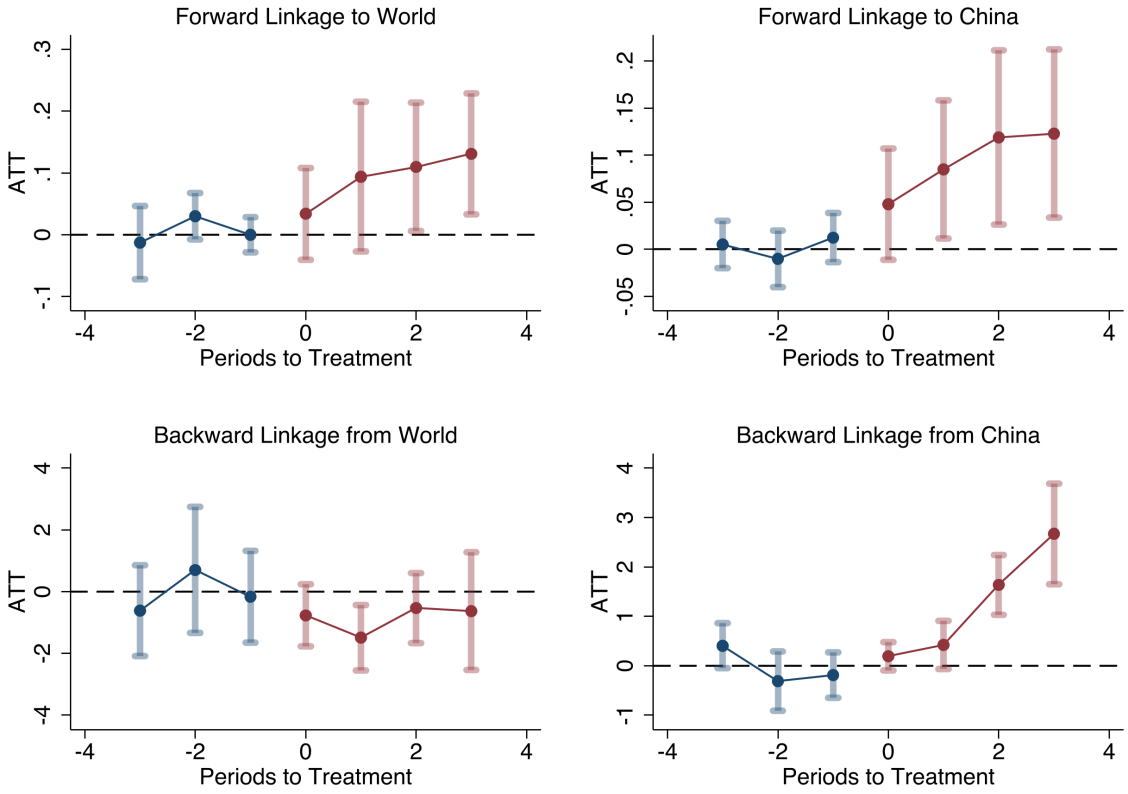
Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries across all destination economies, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Panels report forward linkages to the World and to China and backward linkages from the World and from China. The estimation sample is restricted to treatment cohorts observed over the full ±3 event window. As the samples spans from 2008 to 2022, we restrict our estimation to cohorts first treated between 2011 and 2019, so that every event-time coefficient averages the same set of cohorts. The horizontal axis denotes periods relative to the first year of treatment (export control imposition on China), and the vertical axis reports the average treatment effect on the treated (ATT). Standard errors are clustered at the destination-industry level.

FIGURE 24: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving Connector Countries



Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries in Connector countries, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Panels report forward linkages to the World and to China and backward linkages from the World and from China. The estimation sample is restricted to treatment cohorts observed over the full ±3 event window. As the samples spans from 2008 to 2022, we restrict our estimation to cohorts first treated between 2011 and 2019, so that every event-time coefficient averages the same set of cohorts. The horizontal axis denotes periods relative to the first year of treatment (export control imposition on China), and the vertical axis reports the average treatment effect on the treated (ATT). Standard errors are clustered at the destination-industry level.

FIGURE 25: Dynamic Effects of Export Controls Targeting China on GVC Linkages of Chinese OFDI-Receiving ASEAN Countries



Notes: Dynamic effects of export controls on global value chain (GVC) linkage measures for affected industries in ASEAN countries, estimated using the Callaway and Sant'Anna (2021) difference-in-differences estimator. Panels report forward linkages to the World and to China and backward linkages from the World and from China. The estimation sample is restricted to treatment cohorts observed over the full ±3 event window. As the samples spans from 2008 to 2022, we restrict our estimation to cohorts first treated between 2011 and 2019, so that every event-time coefficient averages the same set of cohorts. The horizontal axis denotes periods relative to the first year of treatment (export control imposition on China), and the vertical axis reports the average treatment effect on the treated (ATT). Standard errors are clustered at the destination-industry level.

E Robustness Checks: Accounting for China's Industrial Structural Shifts

TABLE 13: Within strategic industries staggered-timing identification (IMF (2023) strategic definition)

Outcome	CSDID ATT (p)	ETWFE ATT (p)	Pre-trend p	n
Panel A: World				
OFDI intensive, ln(FDI)	**0.703 (0.068)***	**0.610 (0.059)***	**0.837**	**470**
OFDI extensive, 1(FDI>0)	**0.004 (0.614)**	**0.010 (0.073)***	**0.667**	**2074**
Import central China, level	5562 (0.001)***	7296 (0.016)**	0.070	216
Import central China, log	0.456 (<0.001)***	0.672 (<0.001)***	0.023†	216
GVC forward, China	0.002 (0.661)	0.006 (0.275)	0.076	321
GVC backward, China	-0.510 (<0.001)***	-0.629 (<0.001)***	0.008†	321
Panel B: Connector				
OFDI intensive, ln(FDI)	-0.606 (0.666)	1.913 (0.004)***	–	66
OFDI extensive, 1(FDI>0)	-0.006 (0.791)	-0.000 (0.991)	0.690	244
Import central China, level	3847 (<0.001)***	3958 (<0.001)***	0.055	43
Import central China, log	**0.428 (0.002)*** **	**0.258 (0.129)**	**0.225**	**43**
GVC forward, China	**0.017 (0.076)***	**0.030 (0.074)***	**0.118**	**37**
GVC backward, China	0.172 (0.504)	0.448 (0.121)	0.007†	37
Panel C: ASEAN-10				
OFDI intensive, ln(FDI)	0.073 (0.978)	1.867 (–)	–	87
OFDI extensive, 1(FDI>0)	**0.037 (0.040)** **	**0.027 (0.051)***	**0.666**	**360**
Import central China, level	1045 (0.637)	-2799 (0.731)	0.257	40
Import central China, log	**0.550 (<0.001)*** **	**0.589 (0.016)** **	**0.118**	**40**
GVC forward, China	**0.038 (0.066)***	**0.083 (0.021)** **	**0.308**	**40**
GVC backward, China	0.273 (0.177)	0.756 (0.009)***	0.002†	40

Notes: We restrict the sample to strategic industries (IMF (2023) definition) only and the effect is identified based on the staggered timing of export controls with not-yet-treated controls. We report the aggregate effect of export controls obtained with Callaway and Sant'Anna (2021) estimator in the second column and Wooldridge (2025) extended TWFE estimator in the third column. The fourth column reports the p-value of the joint pre-treatment estimated coefficient Wald tests, where the coefficients are obtained from the Callaway and Sant'Anna (2021) estimator. † marks a csdid pre-trend rejected at the 5% level. Dashes denote cases where an estimate whose pre-trend joint Wald test p-value is not identified due to small sub-sample size. n is the number of destination×industry or destination×OECD-industry (GVC) units. Boldfaced rows indicate outcomes for which the pre-trend Wald test based on coefficients obtained with Callaway and Sant'Anna (2021) estimator is not rejected ($p \geq 0.10$) and at least one of the csdid or jwdid ATT estimates is statistically significant at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 14: Within-strategic industries staggered-timing identification (Freund et al. (2024) strategic definition)

Outcome	CSDID ATT (p)	ETWFE ATT (p)	Pre-trend p	n
Panel A: World				
OFDI intensive, ln(FDI)	**0.429 (0.407)**	**0.642 (0.066)***	**0.198**	**198**
OFDI extensive, 1(FDI>0)	-0.006 (0.547)	-0.001 (0.894)	0.852	1531
Import central China, level	**2444 (<0.001)*****	**3187 (<0.001)*****	**0.265**	**192**
Import central China, log	0.111 (0.111)	0.091 (0.353)	0.061	192
GVC forward, China	0.002 (0.661)	0.006 (0.275)	0.076	321
GVC backward, China	-0.510 (<0.001)***	-0.629 (<0.001)***	0.008†	321
Panel B: Connector				
OFDI intensive, ln(FDI)	-2.530 (<0.001)***	-1.377 (0.115)	–	40
OFDI extensive, 1(FDI>0)	-0.010 (0.678)	-0.003 (0.873)	0.485	184
Import central China, level	**3199 (0.047)****	**3195 (0.064)***	**0.109**	**37**
Import central China, log	0.474 (0.026)**	0.297 (0.265)	0.065	37
GVC forward, China	**0.017 (0.076)***	**0.030 (0.074)***	**0.118**	**37**
GVC backward, China	0.172 (0.504)	0.448 (0.121)	0.007†	37
Panel C: ASEAN-10				
OFDI intensive, ln(FDI)	-6.218 (–)	-0.810 (0.032)**	–	37
OFDI extensive, 1(FDI>0)	0.008 (0.745)	-0.001 (0.945)	0.114	248
Import central China, level	**4476 (0.004)*****	**4817 (0.001)*****	**0.111**	**34**
Import central China, log	0.501 (0.007)***	0.417 (0.041)**	0.004†	34
GVC forward, China	**0.038 (0.066)***	**0.083 (0.021)****	**0.308**	**40**
GVC backward, China	0.273 (0.177)	0.756 (0.009)***	0.002†	40

Notes: We restrict the sample to strategic industries (Freund et al. (2024)'s definition) only and the effect is identified based on the staggered timing of export controls with not-yet-treated controls. We report the aggregate effect of export controls obtained with Callaway and Sant'Anna (2021) estimator in the second column and Wooldridge (2025) extended TWFE estimator in the third column. The fourth column reports the p-value of the joint pre-treatment estimated coefficient Wald tests, where the coefficients are obtained from the Callaway and Sant'Anna (2021) estimator. † marks a csdid pre-trend rejected at the 5% level. Dashes denote cases where an estimate whose pre-trend joint Wald test p-value is not identified due to small sub-sample size. n is the number of destination×industry or destination×OECD-industry (GVC) units. Boldfaced rows indicate outcomes for which the pre-trend Wald test based on coefficients obtained with Callaway and Sant'Anna (2021) estimator is not rejected ($p \geq 0.10$) and at least one of the csdid or jwdid ATT estimates is statistically significant at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.