Exchange Rate Transmission through Multinational Firms: Evidence from Japan*

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Abstract

We study an income-account channel of exchange-rate transmission using matched data on Japanese multinational parents and their foreign affiliates. During the sharp yen depreciation of 2021–22, we find that (i) foreign affiliates with greater exchange-rate exposure expanded their activity and generated more profits, with larger payments to their Japanese parents, and (ii) more exposed parents increased their average wages and shifted employment toward commercial branches and offices involved in sales, purchasing, and related business functions, with offsetting declines in other employment. A multinational firm model in which scarce parent-side support inputs are allocated between domestic operations and foreign affiliates rationalizes these findings. To study the aggregate implications, we embed this mechanism in a two-country general-equilibrium model with trade and multinational production. The model shows that moving foreign-market activity from exports to affiliate production reduces the domestic real GDP response to depreciation and shifts more of the external adjustment from trade and toward income earned abroad. Depreciation therefore need not generate a large expansion in domestic production.

JEL Codes: F31, F23, F32, F41.
Keywords: Exchange rates; Multinational firms; Current account; Japan

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1 Introduction

Understanding how exchange-rate dynamics affect domestic activity and the current account is a central question in international macroeconomics. Standard open-economy models emphasize a trade-based transmission in which depreciation induces expenditure switching toward home goods. This raises domestic production and improves the trade balance, so current-account adjustment occurs primarily through trade. But the current account also includes cross-border income flows, notably direct investment income generated by multinational firms. As multinational production has become increasingly important, exchange-rate transmission may depend not only on where goods are produced and traded, but also on where the income generated by production accrues.

Japan's experience during the 2021–22 yen depreciation looks quite different from the standard trade-based transmission. Despite the sharp depreciation, the trade balance deteriorated, while direct investment income increased and helped sustain the current-account surplus. This raises the question we study in this paper: how does depreciation affect the home economy when firms earn a substantial part of their income through production abroad?

This paper studies an income-account channel of exchange-rate transmission operating through multinational firms (MNEs). Using matched parent-affiliate data for Japanese MNEs, we examine how yen depreciation affects foreign affiliate activity and how these changes spill back to parent firms in Japan. Our empirical strategy combines bilateral exchange-rate movements with firms' pre-existing foreign affiliate networks. Parents whose pre-period networks were concentrated in currencies that appreciated more against the yen experienced greater revenue-side exchange-rate exposure. The identifying variation thus comes from cross-parent differences in predetermined affiliate networks interacted with bilateral exchange-rate movements that individual affiliates and parents take as given.

Our main empirical finding is that greater exposure to yen depreciation raises foreign affiliate activity and employment at parent commercial branches and offices, without generating a corresponding expansion of domestic production. Greater exposure is associated with higher affiliate profits, higher average wages at the parent, and employment growth at commercial branches and offices involved in sales, purchasing, and related business functions, while total parent employment remains broadly flat. The expansion occurs primarily abroad: affiliate employment, dispatched workers, and investment rise, while domestic adjustment is concentrated in wages and employment composition rather than production. This pattern contrasts with the standard view of depreciation as a broad stimulus to domestic activity.

To interpret this evidence, we develop a stylized model of a multinational firm that represents the relevant parent-side activity as a support input. Both domestic production and foreign affiliate activity rely on this input, which is productive but scarce. A yen depreciation raises the

home-currency value of affiliate activity and therefore the marginal return to directing parent support toward foreign affiliates. The firm responds by expanding support activity and shifting its use toward its affiliates, leaving less support available for domestic production. The model thereby rationalizes the joint rise in affiliate profitability, payments to the parent, commercial employment, and parent wages, alongside the absence of domestic production growth.

We then embed this mechanism into a two-country general-equilibrium model with trade, multinational production, and affiliate-to-parent income flows. Japanese aggregate data discipline the steady-state scale and organization of foreign activity, including exports and direct-investment-income credits relative to GDP, while the firm-level estimates discipline the support-allocation mechanism within multinational firms. The model then quantifies how this mechanism interacts with standard expenditure switching to shape domestic production and the external accounts.

The quantitative model delivers two main results. First, under the baseline uncovered interest parity (UIP) shock, endogenous affiliate expansion amplifies the direct-investment-income response beyond mechanical currency translation. A shock normalized to generate a 10% real depreciation raises the direct-investment-income balance by 0.51 percentage points of GDP on impact, approximately twice the mechanical currency-translation response obtained when affiliate operating surpluses are held fixed. As a magnitude check, proportionally scaling the model response to Japan's 25–30% real effective depreciation over 2020–22 brings it materially closer to the observed increase in Japan's direct-investment-income surplus than does mechanical currency translation alone.

Second, exchange-rate transmission depends on how firms organize their foreign-market activity. In a counterfactual that holds fixed the impact depreciation and total foreign-facing sales relative to GDP, shifting foreign sales from exports to affiliate production increases the direct-investment-income response but weakens the domestic real-GDP and overall current-account responses, because the reduction in trade-balance adjustment exceeds the increase in foreign income. Multinational production therefore weakens the domestic production response and shifts the composition of external adjustment away from trade and toward income generated abroad.

Finally, we ask whether the separation between foreign income and domestic production that emerges from the firm-level evidence and the quantitative model is also visible across countries. Following the same exposure-based logic, we construct a country-level measure that weights bilateral depreciations by predetermined outward foreign direct investment (FDI) positions relative to GDP. Across 70 economies over 2014–2024, and conditional on conventional trade-weighted exchange-rate exposure and the overall scale of outward FDI, greater depreciation exposure through a country's multinational network is followed by higher direct-investment-

income credits and weaker real GDP growth. Although suggestive, these estimates provide broader aggregate evidence consistent with the paper's central mechanism: exchange-rate exposure transmitted through foreign affiliate networks is associated with stronger income receipts without a commensurate expansion of domestic production.

Related Literature. Our paper contributes primarily to the international macro literature on exchange-rate transmission. Standard open-economy models emphasize expenditure switching, import-price pass-through, and financial frictions as key channels through which exchange-rate movements affect domestic activity and the external accounts (Galí and Monacelli, 2005, Devereux and Engel, 2003, Gopinath, Boz, Casas, Díez, Gourinchas and Plagborg-Møller, 2020, Gabaix and Maggiori, 2015, Itskhoki and Mukhin, 2021). A recent literature has questioned how strong expenditure switching is once pricing and invoicing patterns are taken seriously, and how much exchange-rate movements ultimately show up in trade and net exports. These responses can be weaker or more delayed than in standard models and can depend on the shock that moves the exchange rate (McLeay and Tenreyro, 2026, Miyamoto, Nguyen and Oh, 2025, Mac Mullen and Woo, 2025, Fukui, Nakamura and Steinsson, 2025, Bodenstein, Cuba-Borda, Gornemann and Presno, 2024, Camara, Christiano and Dalgic, 2025).

We focus on a different margin that arises when domestic firms produce abroad through foreign affiliates. In this case, exchange-rate movements affect the home economy not only through trade and import prices, but also through the income generated by foreign production and the resources that parent firms allocate to support it. This matters for both domestic production and the way external adjustment takes place. Following a depreciation, part of the improvement in the current account can come from income earned abroad rather than from a larger trade surplus, while domestic output may respond less.

Our paper is also related to research incorporating multinational production into quantitative macroeconomics and international transmission. McGrattan and Prescott (2010) show that multinational production and technology capital are central for interpreting external positions and the current account, while Ramondo and Rodriguez-Clare (2013) develop a general-equilibrium framework in which trade and multinational production are alternative modes of serving foreign markets. Cravino and Levchenko (2017) show that multinational firms transmit shocks internationally through parent-affiliate linkages and thereby contribute to international comovement. Relative to this literature, we emphasize how exchange-rate movements alter parent activity and the allocation of scarce support inputs across domestic operations and foreign affiliates. Our empirical contribution is to show that yen depreciation expands foreign affiliate activity and employment at parent commercial branches and offices without generating a broad expansion of domestic production. Our quantitative contribution is to show that this organizational margin weakens the domestic output response and shifts the composition of external adjustment away

from trade and toward direct investment income.

The organizational mechanism also relates to work on shock transmission and within-firm resource allocation. Multi-unit firms reallocate capital and labor across establishments in response to local shocks, propagating those shocks across regions and markets (Giroud and Mueller, 2015, Hyun and Kim, 2026), while parent-country disruptions transmit to foreign affiliates through intra-firm input linkages (Boehm, Flaaen and Pandalai-Nayar, 2019). Within multinationals, parent-provided intangible inputs raise affiliate performance (Bilir and Morales, 2020), and parent-affiliate linkages contribute substantially to international comovement (di Giovanni, Levchenko and Méjean, 2018, Kleinert, Martin and Toubal, 2015). More broadly, managerial talent and organizational capacity are productive inputs deployed across activities and locations (Burstein and Monge-Naranjo, 2009, Bloom, Sadun and Van Reenen, 2012). Closest to our parent-side evidence, Alviarez, Chen, Pandalai-Nayar, Varela, Yi and Zhang (2026) use Japanese multinational microdata to show that host-country FDI liberalization shifts parent employment from manufacturing toward services and R&D. We apply the central insight of this literature—that shocks propagate through firms' internal organization—to exchange-rate transmission.

Finally, our income-account channel connects to the international macro literature on valuation effects and external adjustment. That literature studies how changes in exchange rates, asset prices, and relative returns revalue countries' gross foreign asset and liability positions, thereby changing net foreign wealth through capital gains and losses that are not recorded in the current account (Gourinchas and Rey, 2007, Tille, 2008, Lane and Milesi-Ferretti, 2007, 2018). We study a distinct but complementary flow channel involving direct investment income recorded in the current account. A depreciation mechanically raises the home-currency value of a given flow of foreign-currency affiliate earnings, but it can also change affiliate activity and operating surplus. Our analysis separates this mechanical translation component from the endogenous income response and traces the resulting real spillbacks to parent firms.

The rest of the paper proceeds as follows. Section 2 presents the macroeconomic motivation and documents the role of direct investment income in Japan's external adjustment. Section 3 describes the data, empirical strategy, and firm-level evidence. Section 4 develops a stylized multinational-firm model to interpret the empirical patterns. Section 5 embeds the mechanism into a two-country general-equilibrium framework, and Section 6 calibrates the model and studies its quantitative implications. Section 7 concludes.

2 Direct Investment Income and External Adjustment

Before turning to the firm-level analysis, we document the aggregate patterns that motivate our focus on direct investment income. Figure 1 highlights two facts. First, the 2021–22 yen depreciation coincided with a deterioration in Japan's trade balance and an increase in its

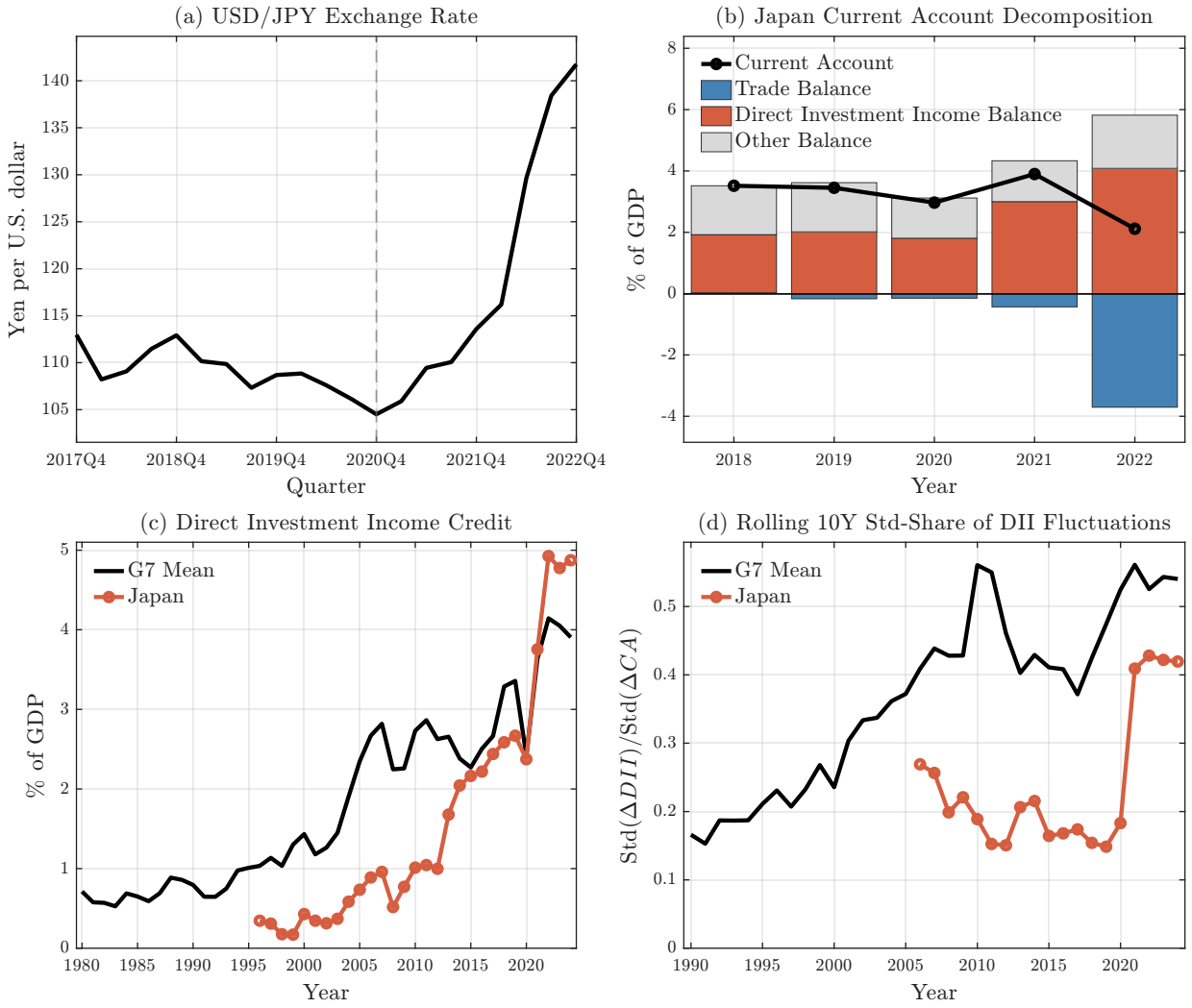

Figure 1: Yen Depreciation, Direct Investment Income, and Current Account Dynamics

Notes: Exchange-rate data are from the International Monetary Fund's (IMF) *International Financial Statistics*. GDP data are from the IMF *World Economic Outlook*, and balance-of-payments data are from the IMF *Balance of Payments Statistics* (BPM6). The top-left panel plots yen per U.S. dollar, so an increase denotes a yen depreciation. In the top-right panel, the current account is decomposed into the trade balance, the direct investment income balance, and other balance-of-payments components, all expressed as ratios to GDP. The direct investment income balance is equal to direct investment income credits minus debits. The bottom-left panel plots direct investment income credits as a share of GDP. The bottom-right panel plots the rolling 10-year ratio of the standard deviation of changes in the direct investment income balance to the standard deviation of changes in the current account. Direct investment income credit for the United Kingdom is unavailable for 2014–15 and 2017, while the direct investment income balance is unavailable for 2014–17. Balance-of-payments data for Japan are available from 1996 onward, whereas data for other G7 countries are available from at least 1980. Missing UK and Japan observations are excluded when computing the G7 average in the bottom-left panel. In the bottom-right panel, missing UK direct investment income balance observations are linearly interpolated solely for constructing the G7 average. All variables are expressed as ratios to GDP prior to aggregation, and the G7 average is computed as the cross-country mean. Rolling 10-year statistics use trailing windows.

direct investment income surplus. Second, direct investment income has become quantitatively important in the external accounts of Japan and other G7 economies. To interpret the current-account decomposition in the figure, we write

$$CA_t = TB_t + DII_t + Other_t,$$

where CA_t denotes the current account balance, TB_t the trade balance, DII_t the direct investment income balance, and $Other_t$ the balance of all remaining current-account components, including primary income other than direct investment income, such as portfolio income, as well as secondary income flows.

The top-left panel shows the sharp yen depreciation against the U.S. dollar during 2021–22. The top-right panel shows that external adjustment during this episode was not trade-led. Japan's trade balance deteriorated sharply, while its direct investment income surplus increased from about 2 percent of GDP in 2020 to about 4 percent in 2022. The increase in direct investment income partly offset the trade-balance deterioration and thereby limited the decline in the current account. This pattern motivates our focus on direct investment income as a non-trade component of exchange-rate transmission.

In the longer sample, the bottom panels show that direct investment income has become an important component of the external accounts of G7 economies. The bottom-left panel plots direct investment income credits as a share of GDP. These credits record income accruing to residents through outward direct-investment relationships, including distributed earnings, reinvested earnings, and interest on intercompany debt. They are therefore broader than cash payments remitted by foreign affiliates, but constitute the aggregate balance-of-payments counterpart most closely related to foreign affiliate income. Direct investment income credits have risen substantially over time, especially for Japan, where they approach 5 percent of GDP. The long-run rise in these income flows is naturally connected to the expansion of external balance sheets documented by Lane and Milesi-Ferretti (2007, 2018), who emphasize the growing role of equity-type positions, including FDI, in advanced economies. This expansion makes direct investment income a quantitatively important margin of external adjustment, but our focus is different: we study the cyclical response of these income flows to exchange-rate movements and the associated spillbacks to parent firms.

We next ask whether direct investment income is quantitatively relevant not only in levels, but also for current account fluctuations. The bottom-right panel plots the rolling ten-year ratio

$$\frac{\text{Std}(\Delta DII_t)}{\text{Std}(\Delta CA_t)}.$$

This statistic compares the volatility of changes in the direct investment income balance with that of changes in the current account. The ratio reaches roughly one-half for the G7 average and 0.4

for Japan in recent years, suggesting that direct investment income is not merely a slow-moving trend component, but also fluctuates on a scale that is meaningful relative to overall current account movements.

These aggregate patterns motivate a broader question: when direct investment income rises following a depreciation, how much reflects the mechanical currency translation of a given foreign-currency earnings flow, and how much reflects endogenous changes in multinational activity? The distinction matters because foreign affiliate activity may depend on parent-side organizational and commercial inputs. Changes in affiliate activity may therefore be accompanied by parent-level adjustments in wages, employment composition, and domestic production. Whether such spillbacks occur, and what form they take, is an empirical question.

We therefore turn to matched parent-affiliate microdata for Japan. While aggregate balance-of-payments data establish the quantitative importance of direct investment income, the firm-level data allow us to examine whether firms with greater exchange-rate exposure experience both stronger affiliate outcomes and corresponding adjustments at the Japanese parent.

3 Firm-Level Evidence on the Multinational Spillback Channel

This section studies whether greater exposure to yen depreciation generates gains at foreign affiliates and corresponding adjustments at their Japanese parent firms. We first describe the linked parent-affiliate data and the parent-side outcomes used to measure domestic adjustment. We then construct revenue- and purchase-side exchange-rate exposure measures from affiliates' pre-period transaction geography and bilateral yen movements. Finally, we use event-study and long-difference specifications to assess pre-trends, trace the timing of adjustment, and quantify affiliate-side gains and parent-side responses during the 2021–22 depreciation.

3.1. Data and Sample Construction

Japan provides a natural setting for studying multinational spillbacks. Japanese firms have substantially expanded their overseas production networks over recent decades (Hogen, Ito, Kanai and Kishi, 2024), and Japan now holds one of the world's largest outward FDI positions.[1] More importantly for our purposes, Japan's Ministry of Economy, Trade and Industry (METI) conducts surveys of Japanese multinational firms that link individual foreign affiliates to their Japanese parent firms. These linked surveys allow us to study affiliate and parent outcomes within the same multinational firm.

Our affiliate-level data come from METI's *Basic Survey of Overseas Business Activities*, an annual survey of Japanese firms' foreign affiliates. The survey reports affiliate sales, purchases,

[1] According to UN Trade and Development's *World Investment Report 2025*, Japan's outward FDI stock reached about $2.15 trillion in 2024, equivalent to just over half of GDP.

employment, balance-sheet information, and the geographic composition of revenues and purchases across host-country markets, Japan, and third countries. It also reports financial flows between affiliates and their Japanese parents, including dividends, royalties, and related transfers. We refer to these flows collectively as affiliate-to-parent payments and examine whether greater exchange-rate exposure is associated with larger financial flows to the parent.

We merge the affiliate data with parent-level data from METI's *Basic Survey of Japanese Business Structure and Activities*. The parent survey reports wages, employment, employment composition, fixed assets, and other balance-sheet variables. The two surveys share a common parent identifier, allowing us to link each foreign affiliate to its Japanese parent. Workers employed by legally separate foreign affiliates are recorded in the affiliate survey rather than as parent employees. Changes in parent employment therefore capture adjustment within the Japanese parent organization rather than employment growth at its foreign affiliates.

Parent employment composition. A key advantage of the parent survey is that it reports employment separately for the parent firm's head office and for establishments outside the head office.[2] We use this information to construct three mutually exclusive parent employment categories: head-office employment, non-production support employment, and other parent employment. Total parent employment is the sum of the three plus workers the parent dispatches to other firms, whom the survey records separately. First, *head-office employment* is total employment at the parent firm's head office. Second, we define *non-production support employment* as employment at domestic commercial establishments outside the head office, including commercial branches, offices, sales establishments, and related business establishments. Because our sample consists predominantly of manufacturing firms, we use this label to distinguish commercial and business functions, such as sales and purchasing, from direct manufacturing production. The label is organizational and establishment-based: it does not imply that these employees do not contribute to firm output or value added, particularly for parents in wholesale, retail, and other nonmanufacturing industries. The relevant activities may serve either domestic operations or overseas subsidiaries and affiliated companies, but the survey does not identify how individual employees allocate their work across these uses.[3] Third, *other parent employment*

[2] The survey separately reports employment in head-office departments and in non-head-office establishments, including manufacturing and mining establishments, commercial establishments, service establishments, laboratories, warehouses, overseas branches and offices, and other units. Within the head office, the survey further distinguishes departments such as planning, information processing, R&D, international operations, and other administrative functions.

[3] In correspondence with METI, we asked whether the relevant survey category, item 0216, which covers employment in commercial establishments such as retail stores, branches, offices, and sales offices outside the head office, includes personnel engaged in purchasing or sales transactions with overseas subsidiaries or affiliated companies. METI clarified that item 0216 does not restrict purchasing or sales activities by counterparty. Thus, personnel engaged in such transactions with overseas subsidiaries or affiliated companies are conceptually included, although the survey does not separately identify whether individual workers support domestic or overseas operations.

consists primarily of workers at domestic manufacturing establishments and therefore largely captures production employment in our sample. The category also includes employment at mining establishments, warehouses, laboratories, service establishments, overseas branches and offices, and other units.[4]

Summary statistics. Our baseline sample covers 2015–2022, and summary statistics for the matched parent-affiliate data are reported in the Appendix. Three features are especially relevant. First, affiliate revenue is earned overwhelmingly abroad: the local host market accounts for about two-thirds of affiliate revenue on average, while sales to Japan account for less than 20 percent. Affiliate activity is therefore primarily oriented toward serving foreign markets rather than selling back to the home country. Second, affiliate-to-parent payments are quantitatively large relative to affiliate current income: the mean ratio is about 74 percent. Because these payments include several types of intrafirm transfers, we interpret the ratio as a measure of the strength of the affiliate-to-parent financial linkage rather than as an exact payout rate or accrual-based measure of direct investment income. Third, non-production support workers, as defined above, account for around 23 percent of parent employment, making this a quantitatively important margin of parent-side adjustment. The Appendix details the survey coverage and cleaning steps and traces the sample from the raw affiliate panel to the estimation samples.

Exchange rates. We obtain bilateral yen exchange rates from the International Monetary Fund's *International Financial Statistics*. Exchange rates are measured as yen per unit of foreign currency, so an increase denotes a yen depreciation. We measure each currency's depreciation against the yen by the percentage change in the bilateral exchange rate between October 2020 and October 2022.

3.2. A Nested Shift-Share Exposure Design

The empirical design asks which Japanese parent firms were more exposed to the 2021–22 yen depreciation through their foreign affiliate networks. We construct separate revenue- and purchase-side exposure measures using two layers of predetermined shares. At the affiliate level, pre-period transaction shares describe how revenues and purchases are distributed across the host country, Japan, and third countries. These shares map bilateral yen movements into the exchange-rate exposure implied by each affiliate's transaction geography. At the parent level, pre-period network shares aggregate these affiliate-level exposures according to each affiliate's importance in the parent's foreign operations. The resulting measures are larger for parents whose pre-period affiliate activity was more heavily exposed to currencies that appreciated against the yen. The design is in the spirit of Amiti, Itskhoki and Konings (2014), but applies

[4] Production workers account for roughly three quarters of this category in the parent data. The category is not exclusively domestic, but the overseas component is tiny: employment at overseas branches and offices is 0.3 percent of this category in aggregate and zero for the median parent, since most parents report none.

shift-share exposure to multinational affiliate networks rather than to the parent firm's own export and import flows.

For parent firm f, the revenue- and purchase-side exposure measures are

$$\Delta \ln E_f^x = \sum_{a \in A_f} w_{f,a}^x \Delta \ln E_a^x, \qquad x \in \{S, P\},$$

where A_f denotes the set of foreign affiliates owned by parent f, $w_{f,a}^x$ is affiliate a's pre-period share in parent f's foreign affiliate network on side x, and $\Delta \ln E_a^x$ is affiliate a's exchange-rate exposure on side x. Here $x = S$ denotes the revenue side and $x = P$ the purchase side. The network weights are side-specific: revenue exposure uses each affiliate's share of the parent's total foreign affiliate revenue, whereas purchase exposure uses its share of total foreign affiliate purchases. The weights sum to one across affiliates within each parent and side.

Affiliate-level exposure is constructed as

$$\Delta \ln E_a^x = \sum_d s_{a,d}^x \Delta \ln E_d, \qquad x \in \{S, P\},$$

where $s_{a,d}^x$ is affiliate a's pre-period transaction share mapped to currency d, and $\Delta \ln E_d$ is the change in the log yen exchange rate against currency d between 2020 and 2022. For $x = S$, $s_{a,d}^S$ denotes revenue shares; for $x = P$, $s_{a,d}^P$ denotes purchase shares. The currency shares sum to one within each affiliate and side, and the exchange-rate change assigned to yen transactions is zero.

We average the transaction shares over 2016–2020 to smooth year-to-year noise and ensure that they are predetermined with respect to the depreciation episode. The parent-network weights are fixed at their 2020 values, the last pre-depreciation year, so that they capture each parent's affiliate network as it stood going into the episode.

We do not observe invoicing currencies in the affiliate survey and therefore map transaction geography into currencies using a baseline assignment. Revenues and purchases involving the host-country market are assigned to the host-country currency, transactions with Japan are assigned to the yen, and third-country transactions are assigned to the U.S. dollar, except those involving European counterparties, which are assigned to the euro. These conventions are consistent with broad invoicing patterns among Japanese overseas subsidiaries: local currencies are generally used for local-market sales and procurement, the yen and U.S. dollar account for most transactions with Japan, and the U.S. dollar is used extensively in Asian subsidiaries' transactions with third countries (Ito, Koibuchi, Sato and Shimizu, 2015). More generally, Boz, Casas, Georgiadis, Gopinath, Le Mezo, Mehl and Nguyen (2022) document the U.S. dollar's role as the dominant global vehicle currency and the euro's regional importance in trade invoicing. Because these assignments approximate rather than directly observe currency denomination, the Appendix reports robustness to alternative currency mappings.

We construct separate exposures because yen depreciation affects affiliate operations through

both revenues and costs. Revenue-side exposure, $\Delta \ln E_f^S$, is larger when affiliates with greater weight in the parent network have more revenue assigned to currencies that appreciated against the yen, increasing the yen-denominated value of affiliate revenues and profits. Purchase-side exposure, $\Delta \ln E_f^P$, is larger when affiliates with greater network weight have more purchases assigned to currencies that appreciated against the yen, increasing yen-denominated input costs. Our mechanism centers on revenue-side exposure, while purchase-side exposure is included throughout as a control for cost-side exchange-rate exposure.

The parent-level measure is the main exposure used in the parent-firm regressions. We also estimate affiliate-level regressions using $\Delta \ln E_a^x$. These regressions allow us to examine whether the exposure measure predicts affiliate outcomes and allow us to assess whether nominal gains are accompanied by quantity adjustments rather than reflecting currency translation alone. Because our question concerns the value of foreign affiliate activity from the perspective of Japanese parent firms, nominal affiliate and parent outcomes are measured in yen, as reported in the surveys. Quantity outcomes, including employment and dispatched workers, are unaffected by currency conversion and therefore allow us to assess affiliate expansion beyond mechanical currency translation.

Figure 2 illustrates the exchange-rate shifters underlying the nested shift-share design. After 2020Q4, the yen depreciated sharply against the major currencies relevant for Japanese foreign affiliates, generating a broad increase in the yen value of foreign affiliate activity. The magnitude of the depreciation nevertheless differed substantially across currencies. Combined with predetermined differences in affiliate transaction geography, this cross-currency dispersion generates the firm-level exposure variation used in the analysis. The pre-2021 paths also show that the episode represented a departure from the preceding pattern rather than the continuation of an existing broad depreciation trend.

The Taiwan dollar and the Korean won provide an intuitive illustration. Taiwan and Korea are both important East Asian hosts for Japanese multinationals, with substantial affiliate activity in electronics and machinery. Their Japanese affiliates also have similar revenue geography in our data: approximately 70 percent of affiliate revenue is earned in the local market in both countries, while less than 10 percent comes from sales to Japan. Accordingly, under our baseline currency mapping, most of these affiliates' revenue exposure is assigned to the respective host-country currency. Through 2020, the yen followed nearly identical paths against the two currencies, with the series crossing repeatedly and remaining within a few log points of each other. Beginning in 2021, however, the paths diverged. By the end of 2022, the cumulative yen depreciation was approximately 22 log points against the Taiwan dollar and 11 log points against the won. All else equal, a parent whose network was weighted toward Taiwan therefore experienced substantially greater revenue-side exposure than one weighted toward Korea. The comparison illustrates

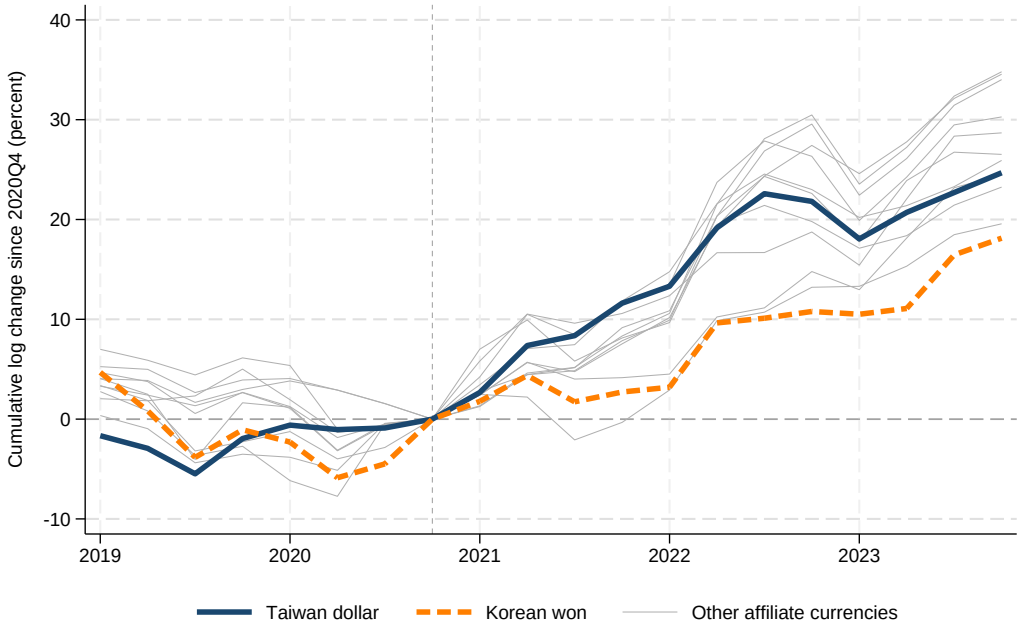

Figure 2: Yen Depreciation against Major Affiliate Currencies around 2021–22

Notes: This figure plots 100 times the cumulative log change in the yen exchange rate against each of the twelve currencies with the largest aggregate weights in the baseline revenue-side exposure measure, with each series normalized to zero in 2020Q4. Bilateral exchange rates are measured as yen per unit of foreign currency using quarterly data from the IMF's *International Financial Statistics*, so an increase denotes a yen depreciation. The Taiwan dollar and the Korean won are highlighted to illustrate the identifying variation: affiliates in Taiwan and Korea have similar revenue geography in our data, while the yen moved similarly against the two currencies through 2020 before the paths diverged beginning in 2021. The gray lines represent the remaining ten currencies: the U.S. dollar (USD), Chinese yuan (CNY), euro (EUR), Thai baht (THB), Singapore dollar (SGD), Indonesian rupiah (IDR), British pound (GBP), Hong Kong dollar (HKD), Australian dollar (AUD), and Canadian dollar (CAD).

how similar affiliate transaction structures generate different exposure when the currencies associated with local-market revenue move differently against the yen.

The exposure measures place the greatest weight on the U.S. dollar, the Chinese yuan, and other major Asian currencies. The United States and China account for approximately 30 and 17 percent of aggregate affiliate revenue, respectively, with other major Asian hosts accounting for much of the remainder. The underlying exposure components are also highly persistent. In the affiliate-year panel over 2015–2020, affiliate fixed effects account for approximately 97 percent of the variation in within-parent network weights and between 85 and 92 percent of the variation in transaction shares, whereas year fixed effects account for essentially none. The predetermined shares and weights therefore capture persistent features of firms' affiliate networks rather than short-run adjustments around the depreciation. Recomputing the exposure using the pre-pandemic 2015–2019 window produces similar results, as shown in the Appendix.

Identification. The identifying variation comes from the interaction of macro-level exchange-rate movements with predetermined affiliate transaction patterns and parent networks. At the affiliate level, exposure differs because affiliates differ in their pre-period transaction geography. At the parent level, exposure additionally reflects the composition of the affiliate network and each affiliate's importance within it. Bilateral yen movements are common to all Japanese firms exposed to a given currency and are taken as given by individual affiliates and parents. Identification requires that, conditional on the controls and fixed effects used below, these predetermined transaction patterns and network weights not proxy for other factors that differentially affect outcomes during the depreciation episode. In particular, more- and less-exposed units should not have been on different outcome trends before the depreciation or simultaneously affected by other shocks correlated with their currency exposure. The event-study specification below assesses whether more- and less-exposed units followed differential pre-trends and traces the timing of any subsequent differential adjustment.

3.3. Empirical Specifications

We estimate two complementary specifications for the affiliate- and parent-level outcomes examined in the empirical results that follow. Affiliate outcomes include operating performance, payments to the parent, and employment; parent outcomes include average wages, employment by category, and fixed assets. For notational compactness, let u index the unit of observation—an affiliate a in affiliate-level regressions and a parent firm f in parent-level regressions—and let $\Delta \ln E_u^x$, $x \in \{S, P\}$, denote the corresponding affiliate- or parent-level exposure measure.

The first specification is an event-study design. Its main purpose is diagnostic: it allows us to test for differential pre-trends and to trace the timing of adjustment around the 2021–22 depreciation. For outcome Y_{ut}, we estimate

$$Y_{ut} = \sum_{\tau \neq 2020} \beta_\tau \left(\Delta \ln E_u^S \times \mathbf{1}\{t = \tau\} \right) + \sum_{\tau \neq 2020} \gamma_\tau \left(\Delta \ln E_u^P \times \mathbf{1}\{t = \tau\} \right) + \alpha_u + \delta_t + \Lambda' X_{ut} + \varepsilon_{ut}. \quad (3.1)$$

Here τ indexes calendar years in the event-study window, with 2020 omitted as the base year. The exposure measures $\Delta \ln E_u^S$ and $\Delta \ln E_u^P$ are fixed unit-level measures constructed from the 2020–2022 exchange-rate changes. The coefficients β_τ trace whether units with greater revenue-side exposure experience differential changes relative to 2020, conditional on purchase-side exposure, fixed effects, and any additional controls included in the specification. Pre-2020 coefficients provide a test for differential pre-trends, while post-2020 coefficients trace the relative adjustment of more exposed units during the depreciation episode. The unit fixed effect α_u absorbs time-invariant differences across affiliates in affiliate-level regressions and across parent firms in parent-level regressions, while the year fixed effect δ_t absorbs shocks common to all units in a given year. The vector X_{ut} denotes any additional specification-specific controls, and ε_{ut} is an error term. When additional controls are included, they are reported in

the corresponding figure notes.

The second specification is a long-difference regression over the depreciation episode:

$$\Delta Y_u^{2020\text{–}2022} = \beta \Delta \ln E_u^S + \gamma \Delta \ln E_u^P + \mu_{g(u)} + \Gamma' X_u + \varepsilon_u.$$

Here $\Delta Y_u^{2020\text{–}2022}$ denotes the change in the outcome between 2020 and 2022. The coefficient of interest is β, which captures the effect of revenue-side exposure. The purchase-side exposure, $\Delta \ln E_u^P$, is included throughout as a control for cost-side exchange-rate exposure. The fixed effect $\mu_{g(u)}$ absorbs group-specific shocks, X_u contains additional pre-period controls when included, and ε_u is an error term. For affiliate-level specifications, $\mu_{g(u)}$ denotes host-country-by-sector fixed effects; for parent-level specifications, it denotes parent-industry fixed effects. The long-difference estimates provide our main quantitative magnitudes for the 2021–22 depreciation episode, using 2020 as the pre-depreciation base year. For log outcomes, β measures how the 2020–22 log change in the outcome varies with revenue-side log exchange-rate exposure.

3.4. Empirical Results

We present the results in two steps. We first analyze affiliate-side outcomes, asking whether revenue-side exposure raises yen-denominated affiliate gains and whether the response includes real affiliate expansion beyond valuation alone. We then turn to parent-side outcomes to assess whether those gains are associated with changes in wages, employment composition, and domestic production activity at the Japanese parent.

3.4.1. Affiliate-Side Effects. Figure 3 presents event-study estimates for affiliate value added and total payments to the parent. Affiliate value added, defined as total sales minus intermediate input purchases, captures the net operating margin through which revenue- and purchase-side exchange-rate exposure affect affiliate activity. Total payments to the parent, which include dividends, royalties, and other transfers, measure the extent to which affiliate gains are transmitted financially to the Japanese parent.

The event-study estimates serve two purposes. First, they provide a pre-trend check: before the depreciation episode, affiliates with greater revenue-side exposure do not exhibit systematically different changes in value added or payments to the parent. Second, they show the timing of the response. Both outcomes rise only after 2020, when the yen depreciation begins, indicating that revenue-side exposure translated into higher yen-denominated affiliate gains and larger affiliate-to-parent payments during the depreciation episode.

Table 1 reports long-difference estimates for a broader set of affiliate outcomes. The 2021–22 depreciation episode coincided with substantial global disruptions, including pandemic-related restrictions, sector-specific demand shifts, and supply-chain bottlenecks. To separate exchange-rate exposure from these broader shocks, all specifications include host-country-by-sector fixed effects. These fixed effects absorb average changes common to affiliates operating in the same

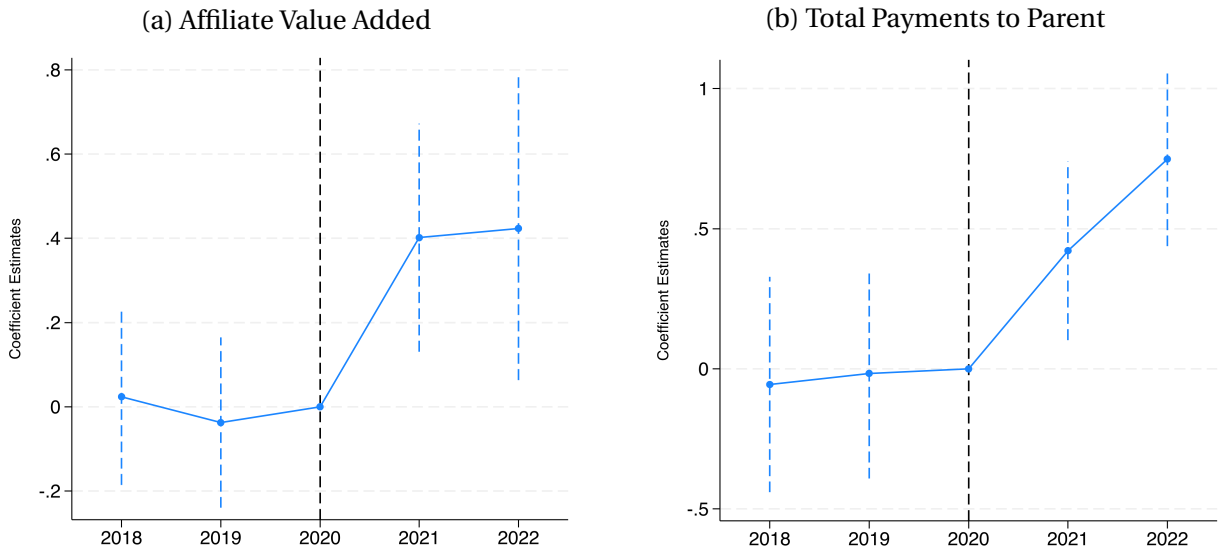

Figure 3: Event Study: Affiliate Value Added and Affiliate-to-Parent Payments

Notes: This figure reports the revenue-side coefficients β_τ from Equation (3.1), with 90% confidence intervals. The dependent variables are the log of affiliate value added and the log of total affiliate-to-parent payments. Affiliate value added is total affiliate sales minus purchases of intermediate inputs. All specifications include affiliate and year fixed effects, as well as the purchase-side shock interacted with year indicators. No additional controls are included. Standard errors are two-way clustered by host country and parent firm.

host country and sector, such as local COVID restrictions, destination-sector demand shifts, or supply disruptions affecting a particular market-sector cell. The estimates therefore compare affiliates operating in the same host country and sector that differ in their pre-period transaction geography and hence in their revenue- and purchase-side currency exposure.

Panel A shows broad increases in reported affiliate performance and financial flows. Revenue-side exposure is associated with higher value added, current profit, payments to the parent, and retained earnings, while the royalty response is not statistically significant. The magnitudes are economically meaningful: moving an affiliate from the 10th to the 90th percentile of the revenue-exposure distribution is associated with an approximately 19 percent increase in reported current profit. Current profit and payments to the parent also have similar point estimates, consistent with affiliate income gains being accompanied by larger payments to the parent.

Because these outcomes are reported in yen, their responses may combine changes in underlying affiliate performance with currency conversion. The survey reports neither the currencies in which the underlying transactions are denominated nor the conventions used to translate foreign accounts, so we do not attempt to decompose the estimates. This also cautions against expecting every payment component to respond uniformly. Royalties constitute a small share of total payments and may differ from dividends in their currency denomination or contractual adjustment, neither of which we observe. The insignificant royalty estimate is

Table 1: Impact of Exchange Rate Shocks on Affiliate Outcomes

Panel A: Profitability and Financial Flows					
	Value Added	Profit	Total Pay	Royalty	Ret. Earn
	(1)	(2)	(3)	(4)	(5)
$\Delta \ln E_a^S$	0.497**	0.754***	0.622***	0.064	0.832***
	(0.213)	(0.230)	(0.160)	(0.261)	(0.289)
$\Delta \ln E_a^P$	-0.272**	0.020	-0.364	-0.005	0.161
	(0.107)	(0.178)	(0.225)	(0.210)	(0.220)
Sector×Country FE	✓	✓	✓	✓	✓
p90–p10 effect (E^S)	0.129	0.193	0.147	0.015	0.219
N	8384	5601	4194	2365	4096
R-squared	0.100	0.096	0.085	0.132	0.093
Panel B: Real Activity					
	Emp	Disp. Emp	Rent Cost	R&D Cost	Cap. Invest.
	(1)	(2)	(3)	(4)	(5)
$\Delta \ln E_a^S$	0.149**	0.184**	-0.187	0.428	0.211
	(0.057)	(0.088)	(0.129)	(0.397)	(0.329)
$\Delta \ln E_a^P$	-0.216***	-0.177***	-0.083	-0.448	-0.186
	(0.044)	(0.057)	(0.128)	(0.452)	(0.324)
Sector×Country FE	✓	✓	✓	✓	✓
p90–p10 effect (E^S)	0.040	0.048	-0.048	0.102	0.054
N	9240	6379	6317	828	4642
R-squared	0.073	0.068	0.075	0.164	0.089

Notes: The dependent variables are the log changes in the indicated affiliate outcomes between 2020 and 2022. A log change requires a strictly positive value in both years, so each column is estimated on the affiliates positive for that outcome in 2020 and 2022, and the estimates describe the intensive margin rather than entry into or exit from profitability or from paying. Panel A reports profitability and financial flow outcomes and Panel B reports real activity outcomes. Value Added is defined as total affiliate sales minus total purchases of intermediate inputs. Profit is current profit. Total Pay is total payments to the parent company, including dividends, royalties, and related transfers; dividends account for nearly all of these payments for the typical affiliate. Royalty is royalty payments to the parent. Ret Earn is current retained earnings. Total Emp is total affiliate employment (headcount), including workers dispatched from the parent. Disp Emp is the number of workers dispatched from the parent to the affiliate. Rent Cost is rental expenditure, R&D Cost is research and development expenditure, and Cap Invest is capital investment expenditure excluding land. $\Delta \ln E_a^S$ is the revenue-side exchange-rate shock and $\Delta \ln E_a^P$ is the purchase-side shock. The "p90–p10 effect" row reports the predicted effect of moving an affiliate from the 10th to 90th percentile of the revenue shock distribution. All specifications include host-country × sector fixed effects. Standard errors are two-way clustered by host country and parent firm. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

therefore not inconsistent with the broader increase in affiliate-to-parent payments. We interpret Panel A as showing that revenue-side exposure raises reported affiliate income and payments to the parent, without assigning the response entirely to valuation or real activity.

Panel B provides more direct evidence of real affiliate expansion. Revenue-side exposure increases both affiliate employment and the number of workers dispatched from the Japanese

parent. Total affiliate employment includes dispatched workers, but excluding them leaves the result essentially unchanged. The response is therefore visible in affiliate labor use as well as in reported yen-denominated outcomes.

None of the remaining revenue-side expenditure estimates is statistically significant. The point estimates are positive for capital investment and R&D and negative for rental costs, but none is precisely estimated.

The increase in dispatched workers is particularly informative because it provides an observable, albeit narrow, measure of labor supplied directly by the parent to foreign affiliates. In the Appendix, we test whether this response is stronger among sales- and services-oriented affiliates, where parent-supplied commercial and coordination functions may be especially important, than among manufacturing affiliates. The dispatched-worker response is significantly stronger among sales- and services-oriented affiliates, while total affiliate employment shows no comparable differential, whether measured before or after subtracting dispatched workers. Although we do not observe the specific tasks performed by dispatched workers, this pattern points to a parent-supplied support component beyond the broader increase in affiliate labor demand.

Finally, although purchase-side exposure is not the focus of the paper, its estimates provide a useful internal check on the exposure design. Greater purchase-side exposure reduces value added in Panel A and both affiliate employment and dispatched workers in Panel B, while its remaining coefficients are imprecisely estimated. This contrasting pattern supports the interpretation that the two exposure measures distinguish revenue and cost channels rather than capturing a generic response to foreign-currency movements. Including purchase-side exposure throughout also means that the revenue-side estimates are conditional on affiliates' cost exposure.

Overall, the affiliate evidence documents the first link in the spillback channel: greater revenue-side exposure is associated with higher reported affiliate income and larger payments to the parent, alongside employment-based evidence of real affiliate expansion. We next turn to whether these affiliate-side gains are associated with adjustments in wages, employment composition, and domestic activity at the Japanese parent.

3.4.2. Parent-Side Effects. We now turn to parent-side outcomes in Japan. Figure 4 presents event-study estimates for parent wages and employment composition. To distinguish exposure through foreign affiliates from conventional trade exposure and other pre-existing firm differences, these specifications interact a set of predetermined parent characteristics with year indicators.

Panel (a) shows no differential pre-trend in average wages, followed by an increase after 2020 among parents with greater revenue-side affiliate exposure. Panel (b) shows that the employment adjustment is concentrated in composition rather than total employment. Non-production

Figure 4: Event Study: Parent Wage and Employment Composition

Notes: This figure reports the revenue-side coefficients β_τ from Equation (3.1), with 90% confidence intervals. Panel (a) uses log average parent wages as the dependent variable. Panel (b) uses log non-production support employment, log other parent employment, and log total parent employment, defined as in Section 3.1. Non-production support and other parent employment do not exhaust total parent employment, which also includes head-office employees and workers dispatched by the parent. The omitted year is 2020. All specifications include parent-firm and year fixed effects, the purchase-side shock interacted with year indicators, and pre-period parent controls interacted with year indicators. Exposure-related controls—affiliate revenue and purchase coverage and parent export and import shares—are measured in 2020, the baseline year for the depreciation episode, whereas the total wage bill, total parent employment, and R&D expenditure are measured in 2018 to capture broader firm characteristics before the pandemic. Standard errors are clustered by industry.

support employment rises after 2020, while other parent employment declines and total employment stays approximately flat. The divergence emerges only with the depreciation episode, consistent with a shift in the composition of parent-side activity toward support functions rather than a broad expansion of domestic employment.

Table 2 reports long-difference estimates for parent-firm outcomes. The results reinforce the event-study evidence. Revenue-side affiliate exposure raises average parent wages, while total parent employment remains broadly unchanged. The employment response instead appears in composition: non-production support employment increases, while other establishment employment declines. Head-office employment, which the table reports separately, does not respond.

The magnitudes are economically meaningful. Moving a parent firm from the 10th to the 90th percentile of the revenue-exposure distribution raises non-production support employment by approximately 9 percent and reduces other employment by approximately 7 percent. Domestic fixed assets also decline by about 5 percent. The parent-side response is therefore concentrated in wages and employment composition rather than in total employment or domestic capital

expansion.

Table 2: Impact of Affiliate Exchange Rate Shock on Parent Outcomes

	Avg Wage	Total Emp	Head Emp	NP Support Emp	Other Emp	Fix Asset
$\Delta \ln E_f^S$	0.169**	-0.014	-0.160	0.384**	-0.297*	-0.201***
	(0.098)	(0.054)	(0.174)	(0.200)	(0.186)	(0.062)
	[0.080]	[0.038]	[0.129]	[0.152]	[0.173]	[0.064]
$\Delta \ln E_f^P$	-0.038	-0.033	-0.036	0.111	-0.007	-0.033
	(0.080)	(0.060)	(0.120)	(0.183)	(0.205)	(0.047)
	[0.071]	[0.048]	[0.101]	[0.198]	[0.164]	[0.059]
p90–p10 effect (E^S)	0.042	-0.004	-0.039	0.093	-0.070	-0.049
Industry FE	✓	✓	✓	✓	✓	✓
N	1,811	1,811	1,811	1,125	1,446	1,811
R^2	0.136	0.072	0.057	0.084	0.092	0.063

Notes: This table reports long-difference estimates of the effect of affiliate exchange-rate shocks on parent-firm outcomes. The dependent variables are log changes in the indicated outcomes between 2020 and 2022. $\Delta \ln E_f^S$ is the revenue-side parent-level exchange-rate shock, constructed as the pre-period affiliate-revenue-share-weighted average of affiliate-specific shocks. $\Delta \ln E_f^P$ is the corresponding purchase-side shock. Ave Wage is average wage. Total Emp is total parent employment. Head Emp, Support Emp, and Other Emp are head-office employment, non-production support employment, and other parent employment. Fix Asset is parent fixed assets. Controls include affiliate revenue and purchase coverage, parent export and import shares, R&D expenditure, the total wage bill, and total employment, all measured in 2020. All specifications include industry fixed effects. The "p90–p10 effect" row reports the predicted effect of moving a parent firm from the 10th to the 90th percentile of the revenue-shock distribution. Parentheses report industry-clustered standard errors. Brackets report shift-share robust standard errors following Borusyak et al. (2022). Significance levels are based on shift-share robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Because the parent survey reports average wages only at the firm level, we cannot determine whether the wage response reflects wage increases within employment categories, changes in workforce composition, or both. We therefore interpret the result as an increase in average wages at the parent without assigning it to a particular worker-level margin.

To assess whether the employment response is connected to foreign operations, the Appendix examines how it varies with the scale of the parent's foreign affiliate workforce. The response is concentrated among parents with larger affiliate workforces, with little response below the median. Although the survey cannot identify the activities supported by individual employees, this heterogeneity provides indirect evidence linking the parent-side employment response to foreign affiliate operations.

Purchase-side exposure does not generate a comparable parent-side response. Its coefficients are small and generally statistically insignificant across wages, employment categories, and fixed assets. This pattern accords with the affiliate-level evidence: cost-side exposure affects some affiliate outcomes but is not associated with comparable parent-facing income gains. The parent-side results therefore point to the revenue-side affiliate-income channel as the primary source of

spillbacks to Japanese parents.

The results are qualitatively similar across alternative fixed-effect structures, controls, samples, and exposure constructions, as reported in the Appendix.

3.5. Empirical Takeaways

The empirical evidence reveals a common pattern across foreign affiliates and their Japanese parents. Greater revenue-side exposure raises reported affiliate value added, profits, retained earnings, and payments to the parent. Affiliate employment and dispatched workers also increase, showing that the response includes real affiliate expansion. At the parent, average wages and non-production support employment at domestic commercial establishments rise, while total employment remains broadly unchanged and domestic fixed assets decline. Foreign affiliate gains are therefore accompanied by a shift in the composition of parent-side activity rather than a broad domestic expansion.

Taken together, these findings point to a parent-support margin in multinational adjustment. The increase in dispatched workers directly captures a narrow form of labor supplied by parents to foreign affiliates. The rise in non-production support employment indicates a broader parent-side adjustment. Although the survey cannot determine whether individual support employees serve domestic operations or foreign affiliates, the response is concentrated among parents with larger foreign affiliate workforces. Additional tests reported in the Appendix find no evidence that the response is amplified by affiliates' sourcing from Japan or varies systematically with pre-period parent leverage.

These findings motivate the firm-level model developed next. We subsequently embed the mechanism in a general-equilibrium framework to study its implications for exchange-rate transmission.

4 A Model of Exchange-Rate Transmission within MNEs

We develop a stylized model in which parent-side support services are productive, scarce, and allocated between domestic operations and foreign affiliates. The model formalizes the allocation margin suggested by the empirical evidence: a depreciation raises the parent-currency value of foreign affiliate activity and therefore raises the relative return to allocating parent-side support services to foreign affiliates. This framework rationalizes the expansion of support functions without a broad expansion of domestic production. It also generates higher support wages, one possible contributor to the increase in average parent wages observed in the data.

The model builds on the idea that multinational production uses parent-side organizational inputs that are not freely scalable across locations. This idea goes back to the span-of-control logic of Lucas (1978), in which managerial or organizational capacity is a scarce factor that

limits the scale of production. It is also closely related to Burstein and Monge-Naranjo (2009), who model managerial know-how as requiring direct involvement and therefore entailing an opportunity cost across tasks and locations. The organizational input in our model is broader than managerial know-how narrowly defined. We interpret it as an operational support margin encompassing coordination, logistics, procurement, sales support, engineering, and other business functions. Our employment measure captures one observable component of this broader margin—employment at domestic commercial establishments—and does not require support activity to be located in formal headquarters units.

Other aspects of the model are intentionally parsimonious. We abstract from vertical input sourcing, global value-chain linkages, transfer pricing, endogenous affiliate location or ownership, and capital accumulation. This lets us isolate a revenue-side exchange-rate shock and focus on the internal allocation margin directly connected to the empirical patterns in Section 3.

4.1. Multinational Firm

Consider a multinational firm composed of a domestic parent and a foreign affiliate. The parent produces domestic output using production labor and parent-side support services:

$$Y = F(S_d, L),$$

where Y is domestic output, L is domestic production labor, and S_d denotes support services allocated to domestic operations. We assume that F is twice continuously differentiable and increasing in both inputs:

$$\frac{\partial F(S_d, L)}{\partial S_d} > 0, \qquad \frac{\partial F(S_d, L)}{\partial L} > 0.$$

The parent also produces support services using non-production support labor:

$$S = N,$$

where N is support labor. These support services are allocated between domestic operations and the foreign affiliate:

$$S = S_d + S_a,$$

where S_a denotes support services allocated to the foreign affiliate. This allocation constraint captures the idea that managerial, sales, logistics, coordination, and administrative inputs are scarce within the firm.

The foreign affiliate produces output using local production labor and support services from the parent:

$$Y^* = F(S_a, L^*),$$

where Y^* is affiliate output and L^* is foreign production labor. Affiliate operating surplus is

$$\widetilde{\Pi}^* = P^* Y^* - W_L^* L^*.$$

Let $\mathscr{E}$ denote the nominal exchange rate, measured as units of domestic currency per unit of foreign currency. Thus, for a Japanese parent, an increase in $\mathscr{E}$ denotes a yen depreciation. An effective fraction $\xi \in [0,1]$ of affiliate operating surplus is internalized by the Home parent in its income and resource-allocation decisions.[5] The Home-currency value of affiliate income entering the parent's problem is therefore $\xi \mathscr{E} \widetilde{\Pi}^*$.

To define the operating value of domestic and affiliate production, let domestic and foreign inverse demands be summarized by revenue functions

$$R(Y) \equiv P(Y)Y, \qquad R^*(Y^*) \equiv P^*(Y^*)Y^*.$$

The price choice is therefore implicit in the inverse demand curve: conditional on output, domestic and affiliate operations charge the prices that clear demand.

Given support services S_d, the domestic parent operation chooses production labor to maximize operating profit:

$$V(S_d) \equiv \max_L \{R(F(S_d, L)) - W_L L\}. \tag{4.1}$$

Similarly, given support services S_a, the affiliate chooses local production labor to maximize operating profit:

$$V^*(S_a) \equiv \max_{L^*} \left\{R^*\left(F(S_a, L^*)\right) - W_L^* L^*\right\}. \tag{4.2}$$

The parent chooses total support labor and the internal allocation of support services. It hires support labor from an upward-sloping firm-specific labor supply curve:

$$W_N(N) = \overline{W}_N \left(\frac{N}{\overline{N}}\right)^{1/\varepsilon_N}, \qquad \varepsilon_N > 1.$$

The total cost of support labor is therefore

$$C(N) = W_N(N)N,$$

with marginal cost $C'(N)$. For the isoelastic labor supply schedule above,

$$C'(N) = W_N(N)\left(1 + \frac{1}{\varepsilon_N}\right),$$

and $C''(N) > 0$.

[5] We interpret ξ as a reduced-form affiliate-income pass-through parameter, rather than as the Home parent's legal equity share or the affiliate's statutory dividend payout rate. In the quantitative model, ξ is disciplined using affiliate-to-parent payments relative to affiliate current income, which we use as a proxy for the strength of the income linkage between the affiliate and the parent. The model abstracts from the accounting distinction between distributed and reinvested earnings and from the associated financial-account entry. The remaining share does not enter the Home parent's reduced-form objective.

Given the above operating value functions, the parent chooses total support labor and its allocation across domestic and affiliate operations to solve

$$\max_{S_d, S_a, N} V(S_d) + \mathscr{E}\xi V^*(S_a) - C(N),$$

subject to

$$N = S_d + S_a.$$

Under this formulation, support allocated to the affiliate is an unpriced internal input rather than a service sold separately to the affiliate. The parent bears the support-labor cost $C(N)$, while its return from affiliate operations enters through $\mathscr{E}\xi V^*(S_a)$.

4.2. Optimal Allocation of Support

Substituting the support-resource constraint $N = S_d + S_a$ into the parent's problem, the parent solves

$$\max_{S_d, S_a} V(S_d) + \mathscr{E}\xi V^*(S_a) - C(S_d + S_a). \tag{4.3}$$

For an interior allocation, the first-order conditions are

$$V'(S_d) = C'(N),$$
$$\mathscr{E}\xi V^{*\prime}(S_a) = C'(N).$$

Combining these conditions gives the central allocation equation:

$$V'(S_d) = \mathscr{E}\xi V^{*\prime}(S_a). \tag{4.4}$$

Equation (4.4) shows how exchange rates affect the internal allocation of support services. A depreciation raises $\mathscr{E}$, and therefore raises the parent-currency marginal value of affiliate operating profits. At the initial allocation, the marginal value of support allocated to the foreign affiliate rises relative to the marginal value of support allocated to domestic operations. The parent therefore has an incentive to shift support toward the affiliate.

The first-order conditions also discipline the scale of support employment. Total support N is chosen so that the marginal cost of support labor equals the marginal value of support in each operation. Hence, the response to depreciation has both an allocation margin and a scale margin: the parent can reallocate support across operations, but can also expand total support employment at increasing marginal cost. The following proposition characterizes these two margins jointly.

Proposition 4.1 (Depreciation and support reallocation)**.** *Consider the parent support-allocation problem in Equation* (4.3)*. Suppose the optimum is interior,* $\mathscr{E} > 0$*, and the pass-through parameter* ξ *is fixed and strictly positive. Suppose* $V(S_d)$ *and* $V^*(S_a)$ *are increasing and strictly*

concave. Suppose also that support labor costs are convex, $C''(N) > 0$, and that the support wage is increasing in support employment, $W_N'(N) > 0$. Then, locally, a depreciation, $d\mathcal{E} > 0$, reallocates support services toward the foreign affiliate and away from domestic operations, while raising total support employment and the support wage:

$$dS_a > 0, \qquad dS_d < 0, \qquad dN > 0, \qquad dW_N > 0.$$

Proof. See the Appendix. ■

Proposition 4.1 characterizes the model's internal allocation margin. It shows that a depreciation shifts parent-side support services toward affiliate operations and away from domestic operations, while increasing total support employment and the support wage. In the data, however, the allocation of support services across domestic and affiliate operations is not directly observable. We therefore ask how this unobserved reallocation should be reflected in observed production outcomes.

Let

$$L = \ell(S_d), \qquad L^* = \ell^*(S_a)$$

denote the optimal production-labor choices from Equation (4.1) and Equation (4.2). In general, the sign of the production-labor response depends on whether allocated support raises the marginal profitability of production labor. If

$$\ell'(S_d) > 0, \qquad \ell^{*\prime}(S_a) > 0, \tag{4.5}$$

then the support reallocation in Proposition 4.1 maps into observed production labor responses:

$$dL^* > 0, \qquad dL < 0.$$

Thus the model links a latent internal resource-allocation margin to observable outcomes: affiliate production employment rises, while domestic production employment faces downward pressure.[6] The following corollary shows that this mapping from unobserved support reallocation to observed production labor obtains under standard demand and production assumptions.

Corollary 4.1 (Isoelastic demand and Cobb-Douglas production)**.** *Suppose domestic and affiliate revenue functions are isoelastic:*

$$R(Y) = AY^{\rho}, \qquad R^*(Y^*) = A^*(Y^*)^{\rho}, \qquad 0 < \rho < 1,$$

and the production function is Cobb-Douglas:

$$F(S, L) = S^{\alpha_S} L^{\alpha_L}, \qquad \alpha_S > 0, \quad \alpha_L > 0,$$

[6] The Appendix provides primitive conditions under which Equation (4.5) holds.

with

$$\rho(\alpha_S + \alpha_L) < 1.$$

Then optimized production-labor demand is increasing in allocated support:

$$\ell'(S_d) > 0, \qquad \ell^{*\prime}(S_a) > 0.$$

Therefore, if support is reallocated toward the affiliate, $dS_a > 0$ and $dS_d < 0$, then

$$dL^* > 0, \qquad dL < 0,$$

which implies

$$dY^* > 0, \qquad dY < 0.$$

Proof. See the Appendix. ■

The partial-equilibrium result should not be read as predicting an outright decline in aggregate domestic output. Expenditure switching, domestic demand, and aggregate shocks may offset the crowding-out force identified here. The implication is instead that support reallocation places downward pressure on domestic multinational production, so a depreciation need not generate a broad domestic production boom.

4.3. Discussion of the Mechanism

The model highlights a transmission channel distinct from standard expenditure switching. In the textbook channel, a depreciation stimulates domestic production by making Home goods cheaper relative to Foreign goods. Here, depreciation also operates through the multinational firm's internal organization: it raises the parent-currency value of foreign affiliate activity and thereby increases the return to parent-side support used in affiliate operations.

The key step is that the exchange-rate valuation gain need not be purely passive. The parent-currency value of affiliate operating surplus internalized by the parent is

$$\mathcal{E}\xi V^*(S_a).$$

Holding the foreign revenue function $R^*(\cdot)$, the foreign production wage W_L^*, and the pass-through parameter ξ fixed, a depreciation affects this object through two margins:

$$d\big(\mathcal{E}\xi V^*(S_a)\big) = \underbrace{\xi V^*(S_a)\,d\mathcal{E}}_{\text{valuation effect}} + \underbrace{\mathcal{E}\xi V^{*\prime}(S_a)\,dS_a}_{\text{support response}}.$$

The first term is the mechanical valuation effect: holding affiliate support fixed, a depreciation raises the parent-currency value of existing affiliate profits. The second term captures the endogenous production response of the multinational firm. If the higher parent-currency return to affiliate activity raises affiliate support, $dS_a > 0$, then depreciation increases affiliate surplus

itself, not only its currency value.

This distinction separates the mechanism from a pure valuation benchmark. A pure valuation channel can raise measured affiliate income, but by itself it has no direct implication for affiliate employment, parent-side support employment, support wages, or domestic production. The support response adds this missing margin: depreciation changes the parent firm's demand for support services and the allocation of those services across domestic and foreign operations.

Other mechanisms may also explain parts of the evidence. For example, a wealth or financial-relaxation channel could raise parent resources and activity broadly, while readily scalable support services could allow affiliate activity to expand without crowding out domestic operations. The scarce-support interpretation emphasized here is motivated by the joint pattern that affiliate activity expands, parent-side support employment and average parent wages rise, and domestic production responds weakly.[7]

5 Exchange-Rate Transmission in General Equilibrium

Section 4 characterizes how an individual multinational firm responds to a depreciation when parent-side support services are scarce and allocated across domestic and foreign operations. We now embed that multinational mechanism in a two-country New Keynesian environment. The general-equilibrium extension is needed to determine how this firm-level response interacts with expenditure switching, equilibrium wages and prices, monetary policy, and the external accounts. Unless otherwise noted, we retain the notation of Section 4, adding time subscripts to variables that now vary over time and sector or location subscripts where needed.

The model allows Home firms to serve Foreign demand in two distinct ways. Tradable firms produce at Home and export to Foreign households, generating domestic value added and trade-balance receipts. Multinational parents can instead serve Foreign customers through affiliates producing abroad. Affiliate production does not contribute to Home GDP or the Home trade balance, but the affiliate-income flow internalized by the Home parent is mapped into direct investment income.

Figure 5 summarizes the goods, parent-support, and affiliate-income flows. The tradable block generates the conventional expenditure-switching channel. The multinational block generates an income-account channel through the valuation and endogenous response of foreign affiliate operating surplus, together with the parent-support mechanism documented in the firm-level evidence. The Foreign economy is defined symmetrically.

The full equilibrium system is reported in the Appendix. In brief, households consume

[7] In the Appendix, we assess the financial-relaxation interpretation by interacting the revenue-side shock with the parent's initial leverage. More financially constrained parents do not respond more strongly, providing little support for a financial-relaxation mechanism.

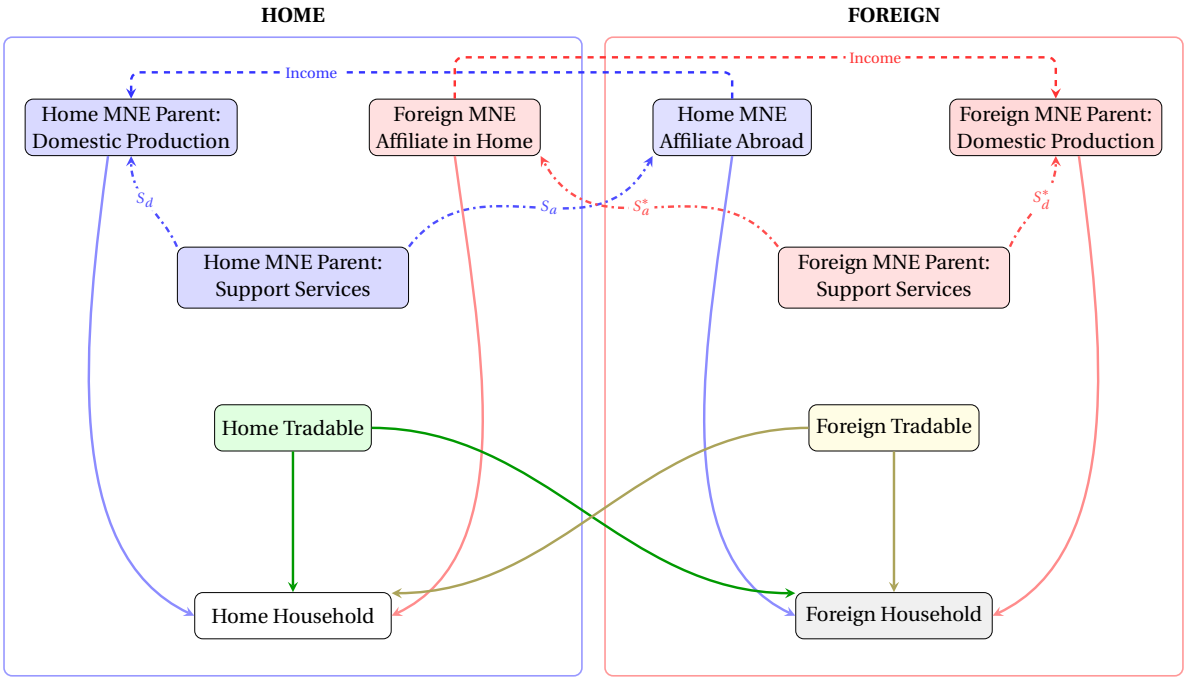

Figure 5: Goods, Support, and Affiliate-Income Flows in the Model

Notes: The figure is a partial flow diagram highlighting the goods, parent-support, and affiliate-income flows that enter the external-account decomposition. Household payments for goods, wage and profit payments, bond trade, and monetary policy are omitted. The support boxes are part of the parent firms and are drawn separately only to display the allocation of parent support between domestic production, S_d, and foreign affiliate activity, S_a. Solid arrows denote goods flows, dash-dotted arrows denote parent-support allocations, and dashed arrows denote flows entering the parent firm's income.

tradable and multinational goods, supply production and non-production support labor, and trade a one-period foreign-currency bond. Tradable and multinational producers set local-currency prices subject to Rotemberg adjustment costs. Monetary policy follows a Taylor rule, and the international bond position is stabilized by a debt-elastic interest-rate premium as in Schmitt-Grohé and Uribe (2003).

The rest of this section presents the four elements needed for the quantitative exercises. First, the demand system determines the relative scale of trade and multinational production. Second, the parent-support allocation condition carries the firm-level mechanism into general equilibrium. Third, the international financial-market block governs international asset pricing and introduces the disturbance used to generate the depreciation experiment. Fourth, the national-accounting structure distinguishes production located at Home from income generated abroad but accruing to Home residents.

5.1. Foreign-Market Organization

Because our focus is short-run exchange-rate transmission, we take each economy's existing organization of foreign-market activity between exports and multinational production as given.

Quantitative trade models have treated exports and multinational production as alternative ways of serving foreign markets (Ramondo and Rodriguez-Clare, 2013). Consistent with our empirical design, which measures exchange-rate exposure using firms' pre-existing affiliate networks, we treat this organization as predetermined over the horizon of interest and ask how it shapes exchange-rate transmission.[8]

Final consumption is a constant-elasticity-of-substitution (CES) aggregate of a multinational-goods composite, $C_{M,t}$, and a tradable-goods composite, $C_{T,t}$:

$$C_t = \left[\omega^{\frac{1}{\eta}} C_{M,t}^{\frac{\eta-1}{\eta}} + (1-\omega)^{\frac{1}{\eta}} C_{T,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}},$$

where ω governs the expenditure weight on multinational goods and η is the elasticity of substitution between multinational and tradable goods.

Each sectoral composite $C_{\ell,t}$, for $\ell \in \{M, T\}$, combines a Home and a Foreign component:

$$C_{\ell,t} = \left[\omega_\ell^{\frac{1}{\eta_\ell}} C_{\ell H,t}^{\frac{\eta_\ell-1}{\eta_\ell}} + (1-\omega_\ell)^{\frac{1}{\eta_\ell}} C_{\ell F,t}^{\frac{\eta_\ell-1}{\eta_\ell}} \right]^{\frac{\eta_\ell}{\eta_\ell-1}}, \qquad \ell \in \{M, T\}.$$

Within the tradable composite, $C_{TH,t}$ is consumption of Home-produced tradable goods and $C_{TF,t}$ is consumption of imported Foreign tradable goods. Thus, ω_T governs the Home share of tradable demand and disciplines the scale of the export channel.

Within the multinational composite, $C_{MH,t}$ is consumption of goods produced in Home by Home multinational parents, while $C_{MF,t}$ is consumption of goods produced in Home by affiliates of Foreign multinational parents. Thus, ω_M governs the parent-country composition of multinational goods consumed in Home. By symmetry, it also disciplines the scale of production abroad by affiliates of Home multinational parents. The top-level weight ω determines the aggregate importance of the multinational block.

To summarize how Home firms serve Foreign markets, let $\mathscr{X}$ denote steady-state Home exports and let $\mathscr{A}$ denote steady-state sales abroad by affiliates of Home multinational parents. We define the affiliate share of Home foreign-facing sales as

$$\vartheta_A \equiv \frac{\mathscr{A}}{\mathscr{X} + \mathscr{A}}. \tag{5.1}$$

A higher value of ϑ_A means that a larger share of sales to Foreign customers is supplied through affiliate production abroad rather than through exports produced at Home.

In the counterfactual exercises, we compare economies with different values of ϑ_A. For each target value, we jointly recalibrate the tradable and multinational home-bias weights, ω_T and ω_M, together with their Foreign counterparts under symmetry, so that the model matches the

[8] Endogenizing firms' choice between exporting and affiliate production would be important for studying FDI entry, plant location, and the long-run organization of production.

corresponding affiliate share while maintaining the baseline ratio of total foreign-facing sales to GDP. Equivalently, the two demand weights are chosen to match the implied export-to-GDP and affiliate-sales-to-GDP ratios. The top-level multinational expenditure weight ω and the remaining structural parameters are held fixed.

5.2. Multinational Production and Parent Support

The multinational block carries the parent-support mechanism from Section 4 into the general-equilibrium model. A Home parent hires support labor N_t, transforms it one-for-one into support services S_t, and allocates those services between domestic operations and its foreign affiliate:

$$S_t = N_t = S_{d,t} + S_{a,t}.$$

Domestic parent production and foreign affiliate production are

$$Y_{MH,t} = F(S_{d,t}, L_{MH,t}),$$
$$Y^*_{MH,t} = F(S_{a,t}, L^*_{MH,t}),$$

where $L_{MH,t}$ is production labor employed by the Home parent and $L^*_{MH,t}$ is production labor hired locally by the affiliate abroad. In the quantitative exercises,

$$F(S, L) = S^{\alpha_S} L^{1-\alpha_S}.$$

Parent support allocated abroad is not separately priced in the benchmark and therefore does not generate a service-export receipt; Section 5.4 states the corresponding national-accounting convention.

Let $\widetilde{\Pi}^*_{MH,t}$ denote the operating surplus of the affiliate of a Home multinational parent located abroad, measured in Foreign currency. As in Section 4, the Home parent internalizes an effective fraction (ξ) of this surplus. Its Home-currency value is

$$\mathscr{E}_t \xi \widetilde{\Pi}^*_{MH,t}.$$

Let $Q_{MH,t}$ be the Home-currency shadow value of relaxing the domestic MNE production constraint, and let $Q^*_{MH,t}$ be the Foreign-currency shadow value of relaxing the affiliate production constraint. The optimal allocation of parent support satisfies

$$Q_{MH,t} F_S(S_{d,t}, L_{MH,t}) = \mathscr{E}_t \xi Q^*_{MH,t} F_S(S_{a,t}, L^*_{MH,t}) = MC^N_t, \tag{5.2}$$

where MC^N_t is the marginal cost of a unit of parent support.

Equation (5.2) is the general-equilibrium counterpart of the allocation condition in Section 4. The underlying firm-level force is unchanged: a depreciation raises the Home-currency marginal value of support allocated to the foreign affiliate. The general-equilibrium environment makes the shadow values $Q_{MH,t}$ and $Q^*_{MH,t}$, as well as the marginal cost MC^N_t, endogenous to product

demand, wages, prices, and monetary policy. The parent-support decision can therefore affect both the location of multinational production and aggregate equilibrium outcomes. We do not repeat the comparative statics from Section 4; Section 6 evaluates their quantitative importance in general equilibrium.

5.3. International Financial Markets

Home households trade a one-period bond denominated in Foreign currency. Define the real exchange rate and the Home-currency real value of Foreign bond holdings as

$$q_t \equiv \frac{\mathscr{E}_t P_t^*}{P_t}, \qquad b_t \equiv \frac{\mathscr{E}_t B_{F,t}}{P_t}.$$

An increase in q_t denotes a Home real depreciation.

Let λ_t denote the Home household's marginal utility of consumption. The Euler equation for the Foreign-currency bond is

$$1 = \beta \mathbb{E}_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{R_t^*}{\pi_{t+1}^*} \frac{q_{t+1}}{q_t} \frac{\exp(\psi_{rp,t})}{1 + \psi_b (b_t - \overline{b})} \right], \tag{5.3}$$

where $\psi_b > 0$ is the debt-elastic premium parameter and $\psi_{rp,t}$ is an exogenous risk-premium disturbance. The quantitative experiment uses an innovation to this disturbance to generate a Home depreciation. The risk-premium disturbance generates deviations from uncovered interest parity.

5.4. Production Location and the External Accounts

The model distinguishes where production occurs from where the resulting income accrues. Production within Home contributes to Home GDP irrespective of the parent country of the producer. Production abroad by an affiliate of a Home multinational parent does not contribute to Home GDP, but the model counterpart of affiliate income internalized by the Home parent enters direct investment income.[9]

To close the national accounts, the benchmark normalizes the transfer price of parent support to zero rather than imposing an unobserved intrafirm service charge. Support allocated abroad is therefore not recorded as a service export. Its wage cost is borne by the Home parent and reduces the parent's resident operating surplus; the resulting labor compensation and reduction in operating surplus offset in Home GDP, so the activity does not constitute a separate addition to Home GDP. The effective fraction ξ of affiliate operating surplus accruing to the Home parent is recorded as direct investment income and therefore enters Home gross national income and the current account, but not Home GDP. The treatment is symmetric: support supplied by a

[9] Parent-country labels identify the multinational group with which the affiliate is associated. The parent determines the allocation of parent-side support, while ξ governs the effective fraction of affiliate operating surplus that enters the Home parent's income and allocation problem.

Foreign parent to an affiliate producing in Home is not recorded as a Home service import, while the affiliate's local production enters Home GDP and the income accruing to its Foreign parent is recorded as a direct-investment-income debit.[10]

All external-account flows are expressed in nominal Home-currency units. Let TB_t denote the Home trade balance, defined as export receipts from Home-produced tradable goods net of expenditure on imported tradable goods. Multinational goods, by contrast, are produced and consumed locally. Foreign affiliate activity therefore enters the external accounts through direct investment income rather than through the trade balance. The model counterpart of the Home direct investment income balance is

$$DII_t = \underbrace{\mathscr{E}_t \xi \widetilde{\Pi}^*_{MH,t}}_{\text{affiliate income of Home parents}} - \underbrace{\xi^* \widetilde{\Pi}_{MF,t}}_{\text{affiliate income of Foreign parents}}, \tag{5.4}$$

where $\widetilde{\Pi}_{MF,t}$ is the operating surplus of affiliates of Foreign multinational parents located in Home, and ξ^* is the corresponding effective affiliate-income pass-through parameter for Foreign parents.

A depreciation affects the first term in Equation (5.4) through two conceptually distinct margins. Holding affiliate operating surplus fixed, it raises the Home-currency value of Foreign-currency affiliate income. It may also change affiliate operating surplus through equilibrium demand and the reallocation of parent support.[11]

This distinction also broadens the transmission of exchange-rate movements to the current account. In standard open-economy models without multinational production, the production-side component of current-account adjustment is captured by cross-border trade flows, TB_t. With multinational production, foreign affiliate activity also generates a direct investment income balance, DII_t, so the Home current account in the model is

$$CA_t = TB_t + DII_t + PI_t,$$

where PI_t denotes net portfolio income on international bond holdings.

These relationships clarify the role of the general-equilibrium extension. The firm-level model in Section 4 determines how a depreciation reallocates activity within the multinational

[10] In practice, some parent activities are priced as management or technical services or as charges for the use of intellectual property. Our data identify neither destination-specific parent support nor the associated intrafirm transfer prices. Assigning a positive price—even one imputed at labor cost—would therefore require additional assumptions about cost allocation, markups, contracting, and tax treatment, introducing a distinct transfer-pricing mechanism that is not disciplined by our data. We use the zero-price normalization to isolate the real support-allocation channel, while disciplining aggregate affiliate income with measured direct-investment-income credits.

[11] The model abstracts from the balance-of-payments decomposition of direct investment income into distributed earnings, reinvested earnings, and intercompany interest. The parameters ξ and ξ^* provide a reduced-form mapping from affiliate operating surplus to the affiliate-income flows entering the parent countries' external accounts. Affiliate-to-parent payments are used to discipline the strength of this mapping, but are not interpreted as an exact accounting measure of accrual-based direct investment income.

firm, while the general-equilibrium model determines how that reallocation affects domestic production, direct investment income, and the overall current-account response.

6 Quantitative Implications

We use the general-equilibrium model to quantify how multinational production shapes exchange-rate transmission. The calibration combines aggregate and firm-level evidence. Japanese aggregate data discipline the steady-state scale and composition of foreign-market activity, including the relative roles of exports and affiliate production, while the parent-level estimates in Section 3 discipline the allocation of support within multinational firms.

The quantitative analysis proceeds in three steps. First, we decompose the direct investment income response to a depreciation into a mechanical currency-translation component and an endogenous component arising from changes in foreign affiliate activity. Second, holding total foreign-facing sales relative to GDP fixed, we examine how the transmission of a given depreciation varies with the division of foreign-market activity between exports and affiliate production. Third, we provide complementary cross-country evidence on whether greater depreciation exposure through existing outward FDI networks is associated with higher direct investment income receipts and weaker domestic production, after accounting for conventional trade exposure and the overall scale of outward FDI positions.

6.1. Calibration

The model is calibrated at quarterly frequency as a symmetric two-country benchmark.[12] The aggregate calibration combines Japan's 2019 external-account data, which provide a pre-COVID benchmark, with 2020 multinational-activity data on domestic and foreign-affiliate sales. The parent-level targets use cross-sectional responses to exchange-rate exposure over 2020–22. Because the micro identification exploits differences in pre-existing exchange-rate exposure through parents' affiliate networks, these estimates discipline the model's firm-level response elasticities rather than the magnitude or structural source of the aggregate depreciation. Table 3 reports the baseline parameterization.

The aggregate calibration determines how Home firms serve foreign markets and the scale of the resulting affiliate-income flows. The tradable home-bias weight, $\omega_T = 0.750$, matches Japan's 2019 export-to-GDP ratio of 17.7%. The multinational home-bias weight, $\omega_M = 0.723$, matches the scale of foreign-affiliate sales relative to domestic MNE sales, which was approximately 38% in the aggregate MNE data. The effective affiliate-income pass-through parameter is set to $\xi = 0.743$, using affiliate-to-parent payments relative to affiliate current income in the matched data as a proxy for the strength of the income linkage between affiliates and their parents. Conditional on

[12] Section 6.5 considers an asymmetric calibration matching Japan's outward and inward multinational exposure.

Table 3: Baseline Calibration

Symbol	Description	Value	Source / Target
Preferences and policy			
β	Discount factor	0.99	4% annual real rate
σ	Relative risk aversion	2	Standard
φ	Inverse Frisch elasticity	1	Unit Frisch elasticity
ρ_R	Taylor rule persistence	0.8	Standard
ϕ_π	Inflation feedback	1.5	Standard
ϕ_y	Output feedback	0.125	Standard
Trade and multinational exposure			
ω_T	Home share in tradables	0.750	17.7% Japan exports/GDP
ω_M	MNE home share	0.723	Domestic vs affiliate sales
ω	MNE expenditure share	0.292	2.7% DII credits/GDP
ξ	Effective affiliate-income pass-through	0.743	Payments/income
η, η_M, η_T	Demand substitution elasticities	1.5	Common across CES nests
MNE technology and market structure			
α_S	Support-input share	0.361	Parent employment slopes
ε_N	Support-labor supply elasticity	2.34	Parent employment slopes
$\varepsilon_M, \varepsilon_T$	Goods elasticities	6	20% markup
ψ_p	Rotemberg price-adjustment cost	58.25	75% Calvo non-adjustment prob.
External block			
ψ_b	Debt-elastic premium	0.001	Schmitt-Grohé and Uribe (2003)
ρ_ψ	UIP risk-premium persistence	0.9	Standard

Notes: The baseline imposes symmetry across countries. Hence gross direct-investment-income receipts and payments are equal in steady state, the net direct-investment-income balance is zero, and the current account is balanced. The two parent-level regression slopes—0.384 for support employment and −0.297 for other parent employment—jointly identify α_S and ε_N.

these parameters, the top-level multinational expenditure weight, $\omega = 0.292$, is chosen so that the model's steady-state affiliate-income credits match Japan's measured direct-investment-income credits of 2.7% of GDP. Together, these targets determine the baseline division of foreign-facing activity between exports and affiliate production and imply an affiliate share, as defined in Equation (5.1), of $\vartheta_A = 0.305$.

The parent-side parameters are disciplined by the firm-level evidence. Holding aggregate conditions fixed, we expose otherwise identical parent blocks to the empirical distribution of revenue-side exchange-rate exposure, solve the model firm by firm, and estimate the same cross-sectional regressions in the simulated data as in the actual data. The simulated coefficients thus capture relative responses across parents, evaluated in the same exchange-rate environment in which the empirical slopes were estimated. The support-input share, α_S, and the support-labor supply elasticity, ε_N, are jointly chosen to match the estimated responses of support employment,

0.384, and other parent employment, −0.297, from Table 2.

Two further parent-level moments determine measurement constants rather than structural model parameters. The support-employment share within support plus other employment, 0.396, maps model support services into the observed support-employment category, while the average parent-wage slope, 0.169, maps the model support-service price into the observed average parent wage. Both mappings leave the firm block and the aggregate equilibrium unchanged; their role is to express model outcomes in survey units.[13] Under these mappings, the model reproduces the flat total-employment response in the data and is close to the p90–p10 effects of exposure on support employment, other employment, and the average wage.

The remaining preference, nominal-rigidity, monetary-policy, and international-financial-market parameters take conventional values. Goods varieties have elasticity $\varepsilon_M = \varepsilon_T = 6$, implying a gross markup of 1.2, or a 20% markup. The elasticities of substitution across the CES demand nests are set to $\eta = \eta_M = \eta_T = 1.5$. Rotemberg adjustment costs correspond to a Calvo non-adjustment probability of 0.75, monetary policy follows a standard Taylor rule, and international bond holdings are stabilized by a small debt-elastic premium following Schmitt-Grohé and Uribe (2003).

6.2. Exchange-Rate Experiment

The baseline experiment uses the risk-premium disturbance introduced in Equation (5.3):

$$\psi_{rp,t} = \rho_\psi \psi_{rp,t-1} + e_{\psi,t}, \qquad \rho_\psi = 0.9.$$

A positive innovation raises the effective return on Foreign-currency assets and generates a Home depreciation. For each model economy, we scale the innovation so that the Home real exchange rate depreciates by 10% on impact. This common normalization allows the responses to be compared across the baseline and foreign-market-organization counterfactuals.

The UIP disturbance serves as a controlled device for generating a persistent exchange-rate movement without introducing an independent productivity or foreign-demand disturbance. It is not intended to identify the structural source of any particular historical depreciation. The Appendix repeats the exercise using Foreign monetary-policy and Foreign discount-factor disturbances, each normalized to generate the same impact depreciation. These alternatives allow the endogenous response of affiliate profits to vary with the macroeconomic forces accompanying the depreciation.

6.3. Direct Investment Income Beyond Currency Translation

Figure 6 reports the baseline response to the exchange-rate experiment. Panel (a) shows the normalization: the Home real exchange rate depreciates by 10% on impact and then gradually

[13] Further details on the firm-level calibration and measurement mapping are provided in the Appendix.

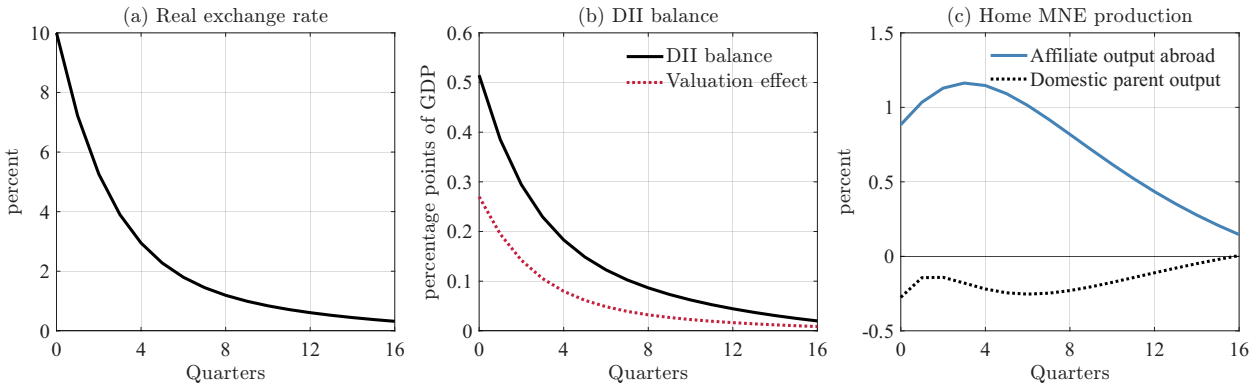

Figure 6: Direct Investment Income and MNE Production after a Home Depreciation

Notes: Impulse responses to a UIP risk-premium shock, normalized to a 10% real depreciation on impact. Panels (a) and (c) are in percent deviations from steady state; panel (b) is in percentage points of steady-state GDP. Panel (b) compares the model-implied direct investment income balance with the impulse response of the fixed-surplus benchmark, $\xi q_t \overline{\widetilde{\Pi}^*_{MH}/P^*} - \xi^* \overline{\widetilde{\Pi}_{MF}/P}$, labeled "valuation effect" in the figure. This benchmark allows the real exchange rate to follow its dynamic path while holding affiliate operating surpluses, expressed in local real units, at their steady-state levels. The gap between the two lines is the component arising from endogenous changes in operating surplus. Panel (c) reports output produced abroad by affiliates of Home multinational parents and domestic output produced by Home multinational parents.

returns to steady state.

Panel (b) separates the direct investment income response into a mechanical currency-translation effect (labeled as "valuation effect") and a component arising from endogenous changes in affiliate operating surplus. The currency-translation effect captures the increase in the Home real value of foreign affiliate income when the real exchange rate depreciates, holding affiliate operating surpluses fixed. Because the calibration matches Japan's direct investment income credits of 2.7% of GDP, a 10% real depreciation produces a mechanical increase of approximately 0.27 percentage points of GDP. The total direct investment income balance improves by 0.51 percentage points of GDP on impact. Thus, approximately half of the impact response reflects currency translation, while the remainder arises from endogenous changes in multinational activity.

Panel (c) shows the production response associated with this endogenous component. The depreciation raises the Home-currency marginal return to support allocated to the foreign affiliate, inducing the parent to shift support toward activity abroad. Affiliate output rises by approximately 0.9% on impact and peaks near 1.2%, while domestic parent output falls and remains below steady state over the first year. Direct investment income therefore rises not only because foreign affiliate earnings are worth more in Home real terms, but also because foreign affiliate operating surplus expands.

The magnitude provides a useful benchmark for the Japanese episode. Between 2020 and 2022, Japan experienced a real depreciation of roughly 25–30%, while its direct investment

income balance increased by about 2 percentage points of GDP.[14] To make this comparison, we express the model's cumulative first-year response relative to annual GDP. A fully persistent depreciation of this size would raise the Home real value of steady-state credits by 0.7–0.8 percentage points of GDP. Because the model's real exchange rate mean-reverts, its first-year currency-translation component is smaller, at 0.45–0.53 percentage points. Proportionally scaling the model's cumulative first-year response gives an increase of approximately 0.9–1.1 percentage points of annual GDP—roughly twice the currency-translation component and about half of the observed change.[15] These comparisons are illustrative, since the endogenous contribution depends on the persistence of the depreciation and the foreign profitability conditions accompanying it.

To assess how the source of depreciation matters, the Appendix considers a Foreign monetary policy shock and a Foreign discount-factor shock, each normalized to generate the same 10% impact real depreciation. Under the monetary policy tightening, weaker Foreign demand offsets the incentive created by the depreciation to expand affiliate activity, leaving the direct investment income response close to the currency-translation benchmark. Under the discount-factor shock, stronger Foreign demand raises affiliate profitability and induces a larger reallocation of parent support toward foreign affiliates. The extent to which affiliate expansion amplifies direct investment income beyond currency translation therefore depends on whether the forces generating the depreciation reinforce or offset profitability in the markets served by foreign affiliates. Conditional on initial affiliate earnings, the exchange rate determines the currency-translation component but not the endogenous direct investment income response.

6.4. Foreign-Market Organization and Domestic Adjustment

We next ask how exchange-rate transmission depends on the way Home firms serve foreign markets. The trade-intensive economy has an affiliate share of foreign-facing sales of $\vartheta_A = 0.10$, while the MNE-intensive economy has $\vartheta_A = 0.50$. The Japan baseline lies between these cases, with $\vartheta_A = 0.305$. Across the counterfactuals, we vary ϑ_A by jointly recalibrating ω_T and ω_M while holding steady-state total foreign-facing sales relative to GDP fixed. The exercise therefore changes the composition and location of foreign-market production rather than its steady-state scale.

Panel (a) shows that the direct investment income response rises sharply with the affiliate share. When more foreign demand is served through affiliate production, a depreciation raises the Home real value of a larger foreign income flow and induces a stronger expansion of affiliate

[14] Using annual averages of the Bank for International Settlements' broad real effective exchange-rate index, the 2020–22 change corresponds to approximately a 26% real depreciation.

[15] Under the asymmetric calibration matching Japan's debit-to-credit ratio, the corresponding increase is 0.7–0.9 percentage points of annual GDP, or about 40% of the observed change and 1.6 times the currency-translation component.

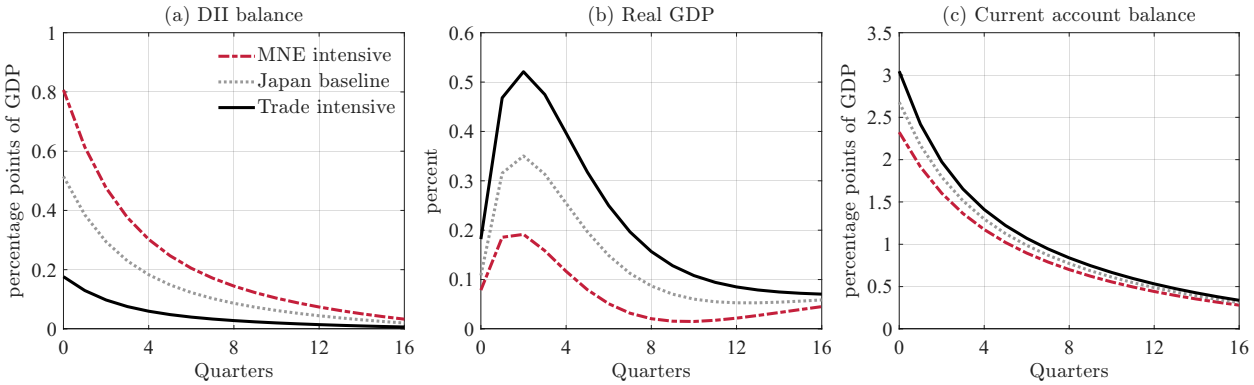

Figure 7: Foreign-Market Organization and Exchange-Rate Transmission

Notes: Impulse responses to a UIP risk-premium shock, each normalized to a 10% real depreciation on impact. The counterfactuals vary the affiliate share of foreign-facing sales, ϑ_A, by jointly recalibrating ω_T and ω_M, while holding steady-state total foreign-facing sales relative to GDP fixed. Solid black: trade-intensive economy ($\vartheta_A = 0.10$); dotted gray: Japan baseline ($\vartheta_A = 0.305$); dash-dotted red: MNE-intensive economy ($\vartheta_A = 0.50$). Panels (a) and (c) are in percentage points of steady-state GDP; panel (b) is in percent deviations from steady state. Real GDP aggregates production located in Home using each economy's steady-state value-added weights. At first order, this fixed-weight quantity index corresponds to the local approximation of a chain-weighted real GDP measure.

activity. The impact improvement in the direct investment income balance is therefore small in the trade-intensive economy, larger in the Japan baseline, and largest in the MNE-intensive economy.

The domestic production response moves in the opposite direction. Panel (b) reports real GDP, aggregating production located in Home using steady-state value-added weights. The peak response is largest in the trade-intensive economy, where expenditure switching toward Home goods translates more directly into production located at Home. As affiliate production becomes more important, more of the foreign-market response occurs abroad and therefore does not enter Home GDP. Parents also reallocate scarce support toward their foreign affiliates, crowding out domestic MNE activity. The peak and subsequent real GDP responses are consequently smaller in the Japan baseline and weakest in the MNE-intensive economy.

Panel (c) shows the resulting current account response. The current account improves in all three economies, but by less as foreign-market activity shifts toward affiliate production. When foreign demand is served through exports, the resulting receipts enter the Home trade balance. Affiliate sales, by contrast, are generated by production located abroad; only the income accruing to the Home parent enters the Home current account. The larger direct investment income response therefore only partly replaces the weaker trade balance response. On impact, direct investment income accounts for approximately 6% of the current account improvement in the trade-intensive economy, 19% in the Japan baseline, and 35% in the MNE-intensive economy.

Figure 7 therefore shows that multinational production changes the form of exchange-rate adjustment rather than simply adding an income response to the conventional trade channel.

Greater reliance on affiliate production shifts adjustment away from domestic production and trade and toward income generated abroad. It also widens the distinction between production located in Home and income accruing to Home residents. Affiliate output does not enter Home GDP, whereas income accruing to the Home parent enters Home gross national income (GNI) through direct investment income. Abstracting from the small portfolio-income response, greater affiliate intensity therefore widens the gap between the responses of GNI and GDP following a depreciation: foreign affiliate earnings support national income even as domestic production responds less.

6.5. Robustness

We consider three robustness exercises, detailed in the Appendix, covering the calibration of affiliate-income pass-through, the accounting treatment of parent support, and asymmetry between inward and outward MNE positions.

Affiliate-income pass-through. The pass-through parameter ξ is calibrated to the mean affiliate-to-parent payment ratio, whose distribution is highly skewed. We re-solve the model at $\xi = 0.5$ and at the median ratio, $\xi = 0.315$, recalibrating (ω, ω_T) to the same gross-flow targets. Holding measured credits fixed, a lower ξ requires a substantially larger affiliate sector: at the median, steady-state affiliate sales rise from 7.8% to 18.3% of GDP. Nevertheless, the aggregate responses change little. The net direct investment income response rises from 0.515 to 0.532 percentage points of GDP, and the component attributable to support reallocation rises from 0.19 to 0.23 percentage points of GDP.

Parent-support accounting. The baseline treats parent support deployed abroad as an internal, nontraded intrafirm input, so its contribution to affiliate output enters Foreign GDP and reaches Home through direct investment income. We alternatively treat this support as a service exported to the affiliate at the support wage. The real allocation is unchanged: the alternative convention reclassifies part of the associated cross-border flow from direct investment income to services trade and changes the corresponding GDP–GNI decomposition. Treating support as an exported service raises measured Home GDP, particularly at short horizons and in affiliate-intensive economies. It does not, however, eliminate the distinction between goods produced for export at Home and goods produced by foreign affiliates. Greater reliance on affiliate production still weakens the domestic goods-production response and shifts external adjustment toward flows associated with production abroad.

Asymmetric inward and outward MNE positions. As a final check, we relax symmetry only between gross inward and outward MNE positions, while retaining a balanced-current-account steady state and otherwise leaving the benchmark structure unchanged. This matters for net direct investment income because Japan's debits are only about one quarter of its credits. We ad-

just the inward MNE position to reproduce this debit-to-credit ratio while holding the credit and export targets fixed. The gross credit and current-account responses are essentially unchanged, as is the share of the endogenous response attributable to support reallocation. The net direct investment income response is about one-sixth smaller because the symmetric benchmark overstates the offsetting decline in payments to foreign parents.

6.6. Cross-Country Macro Patterns

This subsection asks whether the aggregate pattern highlighted by the model also appears across countries: whether depreciation exposure through outward FDI networks is associated with higher foreign income receipts and weaker domestic production. The firm-level estimates exploit differences across firms within Japan and therefore absorb the aggregate adjustments at the center of the model counterfactual. Country-level outcomes incorporate these adjustments, including the domestic general-equilibrium response. We construct a country-level analogue of the firm-level exposure variable by weighting realized bilateral depreciations by predetermined bilateral outward FDI positions relative to GDP. In both measures, predetermined multinational-network weights are interacted with realized bilateral exchange-rate movements.

Using this exposure, we estimate panel local projections for 70 economies over 2014–2024, tracing direct-investment-income credits relative to GDP and real GDP growth at horizons of up to two years. Because the bilateral weights sum to the outward-FDI position relative to GDP rather than to one, the specification includes this share sum as a control. This accounts for outcome differences associated with the overall scale of outward FDI while preserving the fact that a given network-weighted depreciation generates greater exposure in economies with larger outward-FDI positions. The specification also controls for conventional trade-weighted exchange-rate exposure, country and year fixed effects, and the lagged outcome. The remaining variation comes from whether a country's currency depreciates relatively more against currencies receiving larger predetermined weights in its outward FDI network, conditional on its trade-weighted depreciation and the overall scale of its outward FDI position.

Figure 8 reports the estimates. Greater depreciation against the destinations in a country's outward-FDI network is followed by higher direct-investment-income credits relative to GDP and weaker real GDP growth. The credit response is concentrated at the one- and two-year horizons, while the GDP response is already visible on impact and strengthens over time. The magnitudes are moderate: a one-standard-deviation increase in exposure is associated with direct-investment-income credits that are 0.13 percentage points of GDP higher at the one-year horizon and cumulative real GDP growth that is 0.8 percentage points lower at the two-year horizon.

The Appendix shows that the corresponding debit response is small and imprecisely estimated, indicating that the income response is concentrated in gross credits, the component

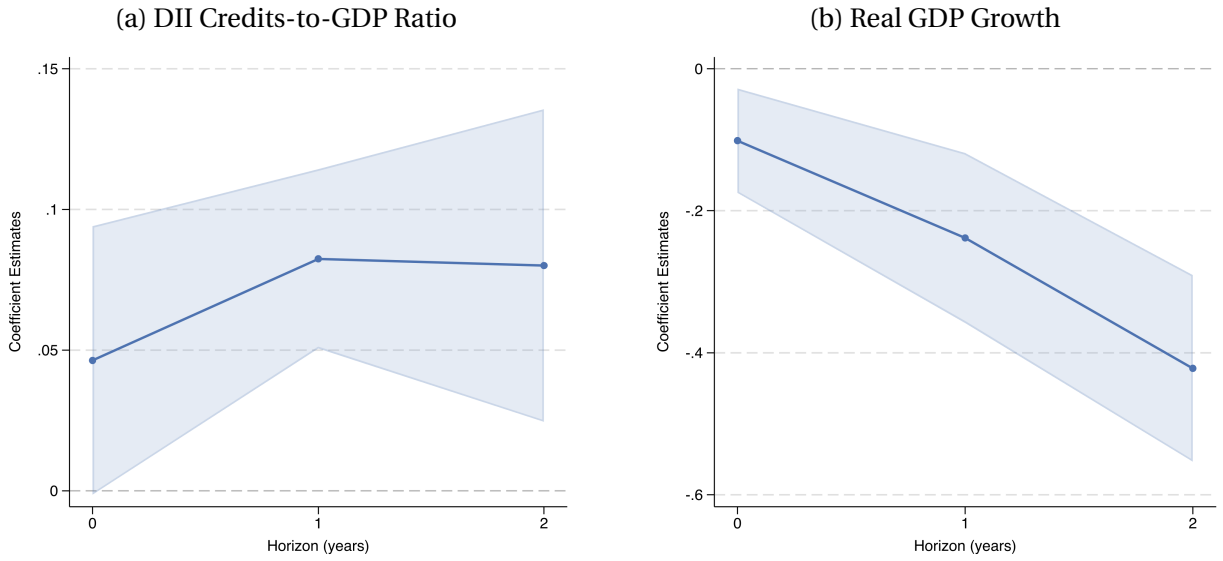

Figure 8: Cross-Country Panel Local Projections: FDI-Network Depreciation

Notes: This figure reports the coefficients β_h on the FDI-network depreciation exposure from panel local projections at horizons $h = 0, 1, 2$, with 90% confidence intervals based on standard errors clustered by country. The sample covers 70 economies with shock years 2014–2024. In panel (a), the dependent variable is the change in the ratio of direct investment income credits to GDP from $t-1$ to $t+h$, in percentage points. In panel (b), the dependent variable is cumulative real GDP growth from $t-1$ to $t+h$, in percent. The exposure is measured in percent, so a unit increase corresponds to one percentage point of FDI/GDP-weighted network depreciation; one standard deviation of the exposure is 1.6 percentage points in the credit sample and 1.9 in the real GDP sample. All specifications control for trade-weighted effective depreciation (nominal in panel (a) and CPI-deflated in panel (b)), the outward-FDI share equal to the sum of the bilateral FDI weights, and the lagged dependent variable, and include country and year fixed effects. The Appendix describes the data and specifications and reports robustness results.

associated with outward affiliate activity. The real-activity response is also present in manufacturing value added and is robust to alternative specifications and samples, including a specification adapting the local-projection difference-in-differences approach of Dube, Girardi, Jordà and Taylor (2023). The results also persist when we exclude the United States and dollar-pegged destinations, separate network geography from the scale of outward FDI, and control for demand conditions in destination markets.

We interpret these estimates as suggestive rather than causal. The geography of outward FDI is not randomly assigned, and bilateral exchange rates are equilibrium outcomes that may respond to some of the same forces driving income and output. Nevertheless, the joint pattern mirrors the model's central implication: depreciation exposure through foreign affiliate networks is associated with stronger foreign income receipts but weaker domestic activity.

7 Conclusion

This paper studies an income-account channel of exchange-rate transmission through multinational firms. Using matched data on Japanese parents and their foreign affiliates, we show that

greater exposure to the 2021–22 yen depreciation raised affiliate activity, profits, and payments to parents. At home, exposed parents increased wages and shifted employment toward support functions, but did not broadly expand domestic production. This pattern points to a targeted spillback from foreign affiliate gains to parent-side commercial and support activity.

We interpret these findings through a model in which domestic and foreign operations compete for scarce parent-side support. A depreciation raises the home-currency value of affiliate activity and induces parents to shift support toward foreign affiliates. This reallocation expands affiliate production, crowds out domestic multinational production, and can amplify the direct investment income response beyond what would arise from currency translation alone. Holding fixed the impact depreciation and steady-state total foreign-facing sales, model economies that rely more heavily on affiliate production consequently exhibit a larger direct investment income response but smaller domestic real GDP and current account responses than economies that rely more heavily on exports.

Suggestive cross-country evidence is consistent with this mechanism: greater depreciation exposure through a country's outward FDI network is followed by higher direct investment income credits and weaker domestic real GDP growth. More broadly, the results show that external adjustment can occur through income generated by production located abroad. Current account improvements therefore need not be accompanied by a commensurate expansion of domestic production.

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