INTERNATIONAL MONETARY FUND

Industrial Policy and Trade Tensions in Strategic Sectors

Lorenzo Rotunno, Michele Ruta and Priyam Verma

WP/26/155

2026
JUL

WORKING PAPER

 WP/26/155

IMF Working Paper
Strategy, Policy & Review

Industrial Policy and Trade Tensions in Strategic Sectors
Prepared by Lorenzo Rotunno, Michele Ruta and Priyam Verma*

Authorized for distribution by Daria Zakharova
July 2026

ABSTRACT: This paper examines the global trade and welfare effects of industrial subsidies, employing a multi-country, multi-sector general equilibrium trade model with economies of scale. We first estimate the magnitude of industrial subsidies across countries relying on a novel approach that exploits information on subsidy counts during the period 2015-23. We then quantify the impact of the implied subsidy rates on trade flows and find that subsidies boost net exports in strategic sectors especially for China, while causing export declines in competing economies. Subsidies by the EU and the US produce qualitatively similar but smaller effects, as these economies target relatively more non-strategic sectors. A decomposition of the trade effects highlights the role of economies of scale and productivity changes in explaining sectoral specialization in response to subsidies. Tariff actions in 2018-19 and since 2025 partly offset these trade patterns. While targeting strategic sectors, recent subsidies and import tariffs lower global welfare by creating distortions and negative cross-border externalities.

JEL Classification Numbers:	F12, F14
Keywords:	Industrial Policy; Trade Spillovers; sectoral imbalances; Geoeconomics.

Author’s E-Mail Address:	lrotunno@imf.org; mruta@imf.org; priyam.verma@ashoka.edu.in

* We are grateful to Dominick Bartelme, Helge Berger, Samuele Centorrino, Diego Cerdeiro, Pierre-Olivier Gourinchas, Ahmad Lashkaripour, Andrés Rodríguez-Clare, Martin Sommer, Kei-Mu Yi and Robert Zymek for comments and advice, and participants at the 2026 Spillovers conference and Georgetown internal trade seminar for insightful comments. The views expressed in this paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

WORKING PAPERS

Industrial Policy and Trade Tensions in Strategic Sectors

Prepared by Lorenzo Rotunno, Michele Ruta and Priyam Verma[1]

[1] We are grateful to Dominick Bartelme, Helge Berger, Samuele Centorrino, Diego Cerdeiro, Pierre-Olivier Gourinchas, Ahmad Lashkaripour, Andrés Rodríguez-Clare, Martin Sommer, Kei-Mu Yi and Robert Zymek for comments and advice, and participants at the 2026 Spillovers conference and Georgetown internal trade seminar for insightful comments. The views expressed in this paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

1 Introduction

The recent increase in industrial policies and subsidies targeting strategic sectors, i.e., sectors that are considered of significant importance for a country's economic or national security, has spurred a debate on their effectiveness and impact on global markets (Juhász et al., 2022; Evenett et al., 2025). Although industrial policies have a recognized economic rationale in the presence of market failures (Juhász, Lane and Rodrik, 2024), their efficient targeting is difficult in practice and their repercussions on trade patterns and global prices may promote perceptions of unfair competitive advantages for subsidized firms on the international stage. In fact, governments have often adopted countermeasures such as import tariffs and retaliatory subsidies in response to trade partners' industrial policies, especially if they target strategic sectors (Bown, 2024), making the interaction between subsidies and tariffs an equally important policy question. In spite of their spillover effects and policy responses, there remains relatively little understanding of how recent industrial policy could reshape global markets, especially in more sensitive and strategic sectors.

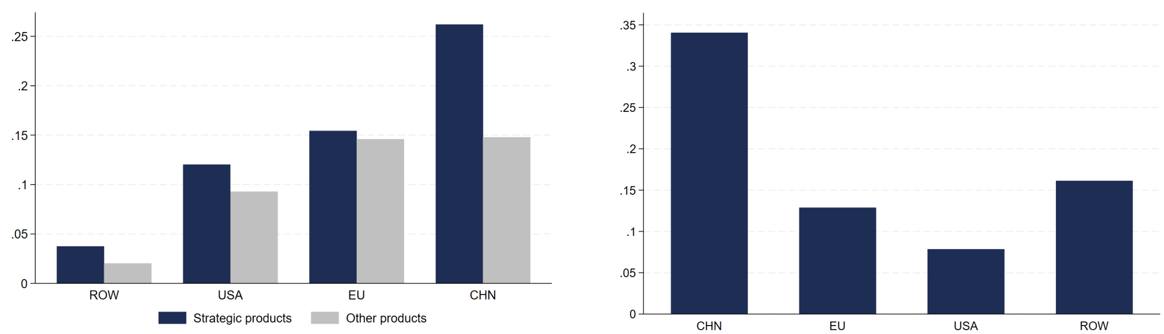
Against this backdrop, this paper makes two main contributions. First, we introduce new estimates of industrial subsidies by sector and across countries — which cover the 2015-23 period, complementing existing measurement efforts. Second, we use these estimates as policy shocks in a quantitative multi-country, multi-sector general equilibrium trade model with external economies of scale to assess how recent subsidy changes across many countries and sectors reshape global trade patterns and welfare. We also analyze how the US-China tariff actions of 2018-19 and since 2025 interact with these subsidy trends. We remain agnostic about the WTO-consistency of the subsidy measures identified in our analysis and on the tariff actions, focusing instead on their observed trade effects irrespective of their legal framing or stated policy rationale.

In the analysis, we focus on strategic sectors, which have been at the center of geoeconomic rivalries (Clayton, Maggiori and Schreger, 2023; Aiyar et al., 2023). These sectors are dominated by large economies. As illustrated in Figure 1, panel (a), China, the EU, and the US together account for over half of global exports of strategic products — captured here by the list of Advanced Technology Products (ATPs) as defined by the US Census Bureau — which include semiconductors, industrial robots, biotech, and other high-tech items. More tellingly, their combined share of world exports of strategic products exceeds their share of world exports of all products by roughly 10 percentage points, underscoring the highly concentrated nature of these markets. The figure further highlights China's significant role in global markets of strategic products, with a larger export share than both the EU and US, whereas China's share is comparable to the EU and US in non-strategic products. Figure 1, panel (b), also reveals that China has implemented the largest share of subsidies targeting strategic products during the same period, based on subsidy measures recorded in the Global Trade Alert (GTA) database. By contrast, for the EU and the US the shares of subsidy measures targeting strategic products are less than half that of China.

This paper examines how subsidies — serving as the primary instrument of industrial policy — impact global markets across sectors over the long term. Our interest is in the enduring consequences of such policies. Specifically, we ask: How do recent industrial policies shape the global landscape for strategic industries? How do tariffs change the trade effects of these subsidies? And what are the implications for global efficiency and welfare? We assess the reallocation effects that these industrial policies would have in the long run, holding fixed other potentially important structural and policy-driven determinants of trade flows and aggregate efficiency.

Figure 1: Global exports of and subsidies to strategic products (2012-23 average)

(a) Share of global exports (b) Share of subsidy measures



Note: Averages over 2012-23. Strategic products are HS products included in the US Census Bureau list of Advanced Technology Products (ATPs). In panel (a), the Rest of the World (ROW) share is an export-weighted average of each country's share of world exports (excluding CHN, EU and USA). In panel (b), subsidies are policy measures classified as 'domestic' subsidies in the GTA (i.e., excluding trade finance and export subsidy measures). We consider measures introduced since 2009 and in force in a given year which are classified by the GTA database as distorting trade flows. For subsidies without an expiry date, we assign the average duration in the sample (see Section 2 for details). Source: OECD ICIO and Global Trade Alert database .

To evaluate the impact of industrial subsidies, we utilize a quantitative trade model incorporating external economies of scale, building on Ju et al. (2024). This framework enables us to isolate the effects of subsidies not only within the subsidizing countries and targeted sectors, but also to capture cross-border spillovers affecting trade patterns in other countries and across multiple sectors. By integrating production externalities at the sector level, the model reflects the positive production spillovers commonly observed in advanced manufacturing industries (e.g., Goldberg et al. (2024)). The theoretical framework incorporates multiple countries and sectors, with firms operating under perfect competition. Production relies on a single factor of production and traded intermediate goods. Industrial policy enters the model through production subsidies and import tariffs, which generate a wedge between producer and consumer prices. In the model, the rationale for policy intervention is the correction of a market failure arising from external economies of scale: production subsidies proportional to sectoral scale elasticities target the underlying production externality (Bartelme et al., 2025; Lashkaripour and Lugovskyy, 2023). As a result, the trade effects we document arise even though subsidies are not targeted at exports, but operate instead through their impact on production costs and sectoral specialization. In the static framework of the model, policy shocks do not alter the aggregate deficit, which is held constant. Model simulations can identify policy effects on sectoral net exports through reallocation, abstracting from any possible implications for the aggregate trade balance. In the model, net government expenditure is financed by, or rebated through, lump-sum transfers to and from consumers.

In this general equilibrium setting, subsidies can influence trade patterns through three types of effects. First, in the subsidizing country and supported sectors, subsidies are expected to raise exports and lower imports, as the price of subsidized products goes down. Crucially, resource reallocation toward these sectors further reduces producer prices through economies of scale — a productivity effect that compounds the direct price-reducing effect of subsidies. In addition, subsidies can enhance competitiveness by decreasing the cost of subsidized inputs, within the same sector or from other upstream industries. These positive impacts on net exports in targeted industries can be partially offset by rising wages in the subsidizing country relative to those of other economies. Second, in sectors that receive lower subsidies, the reallocation mechanism operates in reverse, leading to declines in net exports. Third, subsidies are expected to lower exports by trading partners with lower subsidies in the same targeted sectors. By effectively acting as import barriers, subsidies reduce exports to the subsidizing countries. They also undermine exports from non-subsidizing countries to third markets, as exports from the subsidizing countries become globally more competitive. These export-reducing cross-border spillovers may be partially mitigated in a general equilibrium setting, as factor prices increase in the subsidizing country and imported subsidized inputs lower production costs.

Unlike recent quantitative studies that rely on hypothetical subsidy scenarios (Ju et al., 2024; Hodge et al., 2024; Bartelme et al., 2025; Lashkaripour and Lugovskyy, 2023), we offer a quantitative assessment of the trade effects stemming from actual recent subsidy trends across countries and sectors. The global coverage of the subsidy data allows us to evaluate the cross-country spillovers from industrial policy. Our subsidy rate estimates, covering the period 2015-23, are derived using a two-step empirical methodology that combines data from the New Industrial Policy Observatory (NIPO) and the Global Trade Alert (GTA). First, a 10-fold cross-validation procedure (James et al., 2013; Zhang, 1993) is applied to NIPO data for 2023-24 to identify the most accurate predictive relationship between subsidy rates (measured per dollar of output) and subsidy policy counts at the sector level. This relationship is then used to estimate annual subsidy rates, by leveraging GTA policy counts from 2009 to 2023. This approach represents a novel attempt to quantify the scale of industrial subsidies across countries and sectors.[1] The predicted subsidy rates we obtain compare fairly well with the admittedly few estimates of subsidies available in the literature

[1]The definition of subsidies includes only state aid and grants, because of the difficulty in interpreting budgeted values for tax reductions as actual disbursements and for consistency with the use

(Garcia-Macia et al., 2025; OECD, 2025*a*; European Commission, 2025) despite some well-known limitations in the GTA data, such as the lack of legacy subsidies introduced before 2009 and the recording of separate firm- and region-specific interventions that could in reality belong to the same policy. As mentioned above, we employ the set of HS products defined as Advanced Technology Products (ATPs) by the US Census Bureau to identify strategic sectors. While the precise definition may well vary across countries and over time, the list has the merit of capturing sectors that the US authorities consider of special interest and that are often referred to in public debates as being of strategic importance, such as electronics, robotics, and biotechnology. Aggregated sectors in the model simulations are considered strategic if they include at least one product classified as ATP.

Consistent with evidence in Figure 1, China has the highest aggregate subsidy as a share of value added in goods sectors, with subsidies averaging 1.8 percent between 2015 and 2023. In comparison, the US and the EU exhibit relatively lower subsidy rates at around 1.3 and 0.6 percent respectively. Interestingly, estimated subsidy rates have increased more strongly in strategic sectors, with important differences across countries. Globally, while subsidy values as a share of value added were at around 0.5 percent in 2015 for both strategic and non-strategic sectors, they rose to 1.8 percent within strategic sectors and to 0.9 percent in other sectors in 2023. This global relative increase in subsidies to strategic sectors is driven by China, where the increase in the subsidy rate in strategic sectors is more than three times the increase observed in other industries. In the EU and the US, the increase in subsidies to strategic sectors is weaker as their policies target other sectors such as agriculture and mineral products.

We simulate the trade effects of the estimated changes in subsidy rates during 2015-23 using our quantitative trade model. The model is calibrated with 2015 data on trade, value added, and input-output linkages from the OECD Inter-Country Input-Output (ICIO) tables (OECD, 2025*c*), for the ten largest subsidizers and a rest-of-the-world (ROW) aggregate. The economy is divided into 20 sectors, including a services aggregate, with 8 sectors defined as strategic since they contain at least one product in the ATP list. The trade and scale elasticities are drawn from Giri, Yi and Yilmazkuday (2021) and Bartelme et al. (2025).[2] We first introduce observed subsidies from China, the US, and the EU individually, and then jointly incorporate subsidy changes from all countries in the sample. In extended analyses, we also incorporate import tariff changes between the US and China during the 2018-19 period of heightened trade tensions, and the tariff changes since February 2025.

The simulation results quantify the trade effects of subsidies highlighted in the theoretical framework, and underscore the significant long-term impact of China's sub-

of production subsidies in the model.

[2]The size and distribution across sectors of scale elasticities and the correlation with trade elasticities determine the extent of reallocation and hence the trade and welfare effects of the subsidy and tariff policies. In the data, the scale elasticities are higher in strategic sectors and correlate with China's subsidy and US tariff increases. They also correlate negatively with trade elasticities.

sidies on trade patterns across sectors. In a scenario where only China implements the estimated 2015-23 subsidy changes — holding everything else fixed relative to a 2015 baseline — its exports in strategic sectors rise by approximately 12 percent. In contrast, when only the EU or only the US implements their own estimated subsidy changes, the subsidizing country's strategic-sector exports increase by around 2 percent. The asymmetry largely reflects the different targeting of subsidies by China, the EU, and the US, coupled with differences in the strength of economies of scale, which are stronger in sectors targeted by China's subsidies. Therefore, subsidies by the EU and the US still meaningfully reshape trade flows, but more so in non-strategic sectors, reflecting where these countries direct a larger share of their subsidies. The trade effects observed under the China-only subsidy scenario are largely confirmed in a scenario that incorporates subsidy changes from all countries in the sample. China's share of world exports of strategic products rises to around 29 percent, while other countries experience declines in their market shares. This dynamic impacts sectoral trade balances. China's net exports in strategic sectors increase while others' decline, with the opposite pattern emerging in non-strategic sectors, consistent with resources being reallocated away from non-strategic toward subsidized sectors.

These outcomes are driven by China's specialization in strategic sectors such as electronics and pharmaceuticals in response to subsidies. In a scenario where all countries implement the 2015-23 subsidy changes, China's electronics exports increase by around 20 percent over the long term, while exports in other non-strategic sectors such as agriculture and textiles decline. Consequently, strategic sectors exhibit pronounced export spillovers: the EU and US experience export reductions of around 1 percent overall, and up to 7 percent in electronics. Under the same subsidies scenario, the EU and the US instead expand net exports mainly in non-strategic sectors with weak economies of scale, such as agriculture.

A decomposition of the trade effects of subsidies reveals that economies of scale and the associated productivity responses are important drivers behind the specialization patterns. A conceptual contribution of our analysis is a distinction between the partial-equilibrium price-reducing effect of subsidies and the other general equilibrium effects, including notably changes in sectoral productivity due to economies of scale. Our results indicate that China's expansion in the electronics sector — and the corresponding decline in exports from other countries — is primarily driven by shifts in sectoral employment and the associated productivity gains induced by subsidies.[3] Across all sectors and subsidizing countries, input-output linkages tend to amplify trade responses through lower input prices, while higher subsidy-led competition in foreign markets attenuates export expansions.

We extend our counterfactual analysis by incorporating the US-China tariff in-

[3] To emphasize the role of economies of scale and subsidy-led productivity changes, we find that neutralizing external economies of scale in the model would approximately halve the percent increase in China's exports and reduction in China's imports in strategic sectors.

creases implemented during 2018-19, and the recent US tariff actions since February 2025 and the response by China. These are the most significant tariff policy shifts since 2015 (and since the tariff hikes of the inter-war period), and the implementing countries have at times framed them as a response to the need to protect domestic strategic industries in the face of industrial policies and subsidies by other countries.[4] Interestingly, the sectoral distribution of the 2018-19 and 2025 tariff actions differs significantly across China and the US in our data. While China's tariff hikes have roughly maintained the higher rates for non-strategic sectors, US tariff changes have been biased toward strategic sectors, which in 2025 receive a higher average import tariff than other sectors.

The simulations suggest that the 2018-19 tariff changes reduce significantly US imports from China despite the export-enhancing effect of China's subsidies. As a result, the rise in China's exports in strategic sectors is attenuated relative to a subsidy-only scenario. The US-China 2018-19 tariff hikes trigger some reallocation of US imports — consistent with findings in the empirical literature, e.g. Fajgelbaum et al. (2024) and Freund et al. (2024), and slightly increase China's exports in strategic sectors toward non-US markets. The 2025 tariff actions further intensify US-China decoupling. Overall, US-China trade declines across both strategic and non-strategic sectors under the 2025 tariffs, with little reallocation of US imports toward alternative exporters. The 2025 tariffs also dampen China's export growth in strategic sectors to other markets by curbing the sectoral reallocation that drives productivity gains from economies of scale. Because of their sectoral bias, US tariffs in 2025 also act as an implicit subsidy to strategic sectors, allowing producers to take advantage of the economies of scale in the domestic market. Importantly though, US exports in strategic sectors decrease further following the introduction of import tariffs.

In the last part of our analysis, we examine the welfare implications of recent subsidy and tariff policies. In our framework with external economies of scale, optimal subsidies are proportional to the sector-specific scale elasticities (Bartelme et al., 2025; Lashkaripour and Lugovskyy, 2023). The 2015-23 subsidy changes are correlated with scale elasticities across sectors, and this correlation is strongest for China, whose subsidies are more concentrated in sectors with higher scale elasticities than those of the EU and the US — suggesting that these policies may target market failures associated with production externalities. Our simulations indicate, however, that the subsidy changes by all countries lower welfare globally — hence they are not optimal. Under the all-country subsidy scenario, real wages increase on average — and most for China

[4] WTO rules permit the use of tariffs in response to foreign subsidies under specific conditions — most notably through countervailing duties (CVDs) under the Agreement on Subsidies and Countervailing Measures (ASCM), which require a determination of material injury to domestic industry — see Mavroidis (2025) and Grossman and Sykes (2025). The tariff changes considered here are the observed applied tariffs over the period, irrespective of the legal framing or stated policy rationale of the implementing countries.

— reflecting the alignment between subsidies and economies of scale.[5] The fiscal cost of the subsidies outweighs these gains, and real income — the welfare-relevant measure in the model — decreases.

Introducing tariffs deepens global welfare losses while creating asymmetric effects across countries. Under a scenario with subsidies and US-China tariffs up until March 2026, average real wages across countries decrease, erasing any efficiency gains from subsidies. Globally, the losses include consumption and production distortions in the tariffing country and negative terms-of-trade externalities imposed on tariffed countries. On average, these losses dominate any gains for the tariffing country from improved terms of trade and from tariff hikes being biased toward sectors with stronger production externalities. As a result, global real income decreases by 0.3 percent under this subsidies-and-tariff scenario. These findings underscore the global efficiency costs of an uncoordinated subsidy-tariff spiral.

Our analysis contributes to the emerging literature on the global effects of subsidies and industrial policy by drawing on quantitative general equilibrium trade models with economies of scale.[6] We build on the theoretical framework developed by Ju et al. (2024), who analyze the welfare implications of industrial policy in China and the US-China tariffs of 2018-19. Our approach differs in two key respects. First, we calibrate industrial policy shocks using novel estimates of subsidy rates derived from observed subsidy measures across multiple countries, rather than relying on stylized policy scenarios (see also Hodge et al. (2024), Bartelme et al. (2025), and Lashkaripour and Lugovskyy (2023) for stylized analyses). This enables us to take a global perspective on the trade and spillover implications of industrial policy. Second, our emphasis lies on the trade ramifications of industrial policies — a perspective particularly relevant to contemporary policy debates, where trade measures are increasingly framed as responses to the trade distortions created by prior industrial policies.

Recent empirical studies have examined the trade and productivity effects of industrial policies and subsidies across countries and sectors (OECD, 2025*b*; Rotunno and Ruta, 2024*b*; Huang et al., 2025; Machado Parente et al., 2025). While the econometric difference-in-difference approaches used in these studies identify relative trade effects across products or firms, our quantitative trade model allows us to simulate the

[5]The global efficiency and welfare effects of subsidies are robust to different values for scale elasticities. Assuming zero scale economies makes subsidies welfare-reducing across the board, while increasing the dispersion of the scale elasticities across sectors widens the differences in welfare effects across countries.

[6]Traditional models of comparative advantage struggled to reconcile perfect competition with external economies of scale, as multiple equilibria could reverse trade patterns based on natural comparative advantage and lead to trade losses (Graham, 1923; Ethier, 1982). Introducing Bertrand competition and a continuum of industries, Grossman and Rossi-Hansberg (2010) mitigate these issues and ensure positive trade gains. Lyn and Rodríguez-Clare (2013) demonstrate the intractability of this framework under finite trade costs, while Kucheryavyy, Lyn and Rodríguez-Clare (2023) develop a model with perfect competition, product differentiation, economies of scale, and positive trade costs that preserves trade patterns grounded in natural comparative advantage when scale economies are moderate.

'level' trade responses to changes in subsidies. Conceptually, we use the theoretical framework to decompose the trade effects of subsidies, distinguishing between direct partial-equilibrium effects of subsidies and general equilibrium responses, for instance through economies of scale and input-output linkages — channels that can hardly be teased out by reduced-form econometric approaches. Quantitatively, the response in sectoral productivity plays an important role in explaining the simulated trade effects. Furthermore, our general equilibrium framework captures trade spillovers to non-targeted sectors and non-subsidizing countries — an aspect that is challenging to identify using reduced-form empirical methods. More broadly, our quantitative trade analysis complements a large body of micro-level research estimating the impacts of industrial policies on productivity and other industrial outcomes, often for single sectors within individual countries (e.g., Lane (2025); Kalouptsidi (2018); Manelici and Pantea (2021); Choi and Levchenko (2025); Goldberg et al. (2024); Barwick et al. (2025)).

Our study contributes to the literature on geoeconomics (Clayton, Maggiori and Schreger, 2023; Mattoo, Ruta and Staiger, 2024; Aiyar et al., 2023).[7] This body of work highlights great power rivalry (Mearsheimer, 2014) and the strategic use of trade relationships by governments to exert influence over other countries (Hirschman, 1945). Notably, Clayton, Maggiori and Schreger (2024) demonstrate how concerns over dependence can trigger a "fragmentation doom loop", where efforts by nations to shield themselves from foreign influence lead to globally inefficient outcomes through excessive economic fragmentation, highlighting the persistent benefits of cooperation. Meanwhile, Becko and O'Connor (2024) illustrate how countries employ industrial policy to build domestic industries and international trading ties that enhance their leverage in anticipation of future geopolitical conflicts. Our study complements these works by showing that industrial policies targeting strategic sectors do indeed lead to high concentration and by analyzing how tariffs and subsidies interact in shaping trade patterns.

Our sectoral approach to studying how subsidies can shape net exports complements the recent macroeconomic literature on the impact of industrial policy on global imbalances (Gourinchas et al., 2026; Itskhoki and Mukhin, 2025; Cesa-Bianchi et al., 2026). One finding in this literature is that "microeconomic" or sectoral industrial policies, like the targeted subsidies considered in this paper, alone have unclear and quantitatively limited effects on aggregate trade balances, while they may affect sectoral outcomes. Our findings highlight how these measures can shape sectoral trade balances — with potentially important economic and geoeconomic implications.

The rest of the paper is organized as follows. Section 2 outlines the methodology and data used to estimate subsidy rates and presents descriptive patterns. Section 3 provides a concise overview of the quantitative trade model, emphasizing its predictions for trade flows. Section 4 discusses the simulation results, and Section 5 concludes by identifying potential directions for future research.

[7] See Mohr and Trebesch (2025) and Clayton, Maggiori and Schreger (2025) for recent surveys.

2 Estimating Subsidies

Quantifying subsidies implemented over recent years is essential to assess the role of industrial policy in shaping trade patterns within strategic industries. Recent studies have utilized country-specific data to estimate industrial subsidies in China (Garcia-Macia et al., 2025; Boullenois, Kratz and Rosen, 2025) and the EU (Hodge et al., 2024). The MAGIC database (OECD, 2025*a*) offers cross-country industrial subsidy estimates based on disclosures from large publicly listed firms. While this dataset includes some strategic industries such as semiconductors, aerospace, and defense, it omits others — most notably, many electronics products. We contribute to these measurement efforts by employing a method that relies on data from the New Industrial Policy Observatory (NIPO) and the Global Trade Alert (GTA), enabling consistent identification of subsidy measures across countries and sectors, and over time.

Both NIPO and GTA are databases that monitor trade-related policy measures. The GTA initiative started in the aftermath of the Great Financial Crisis and has been collecting information about government policies that affect trade since 2009.[8] The NIPO applies specific filters to the full set of GTA measures to isolate industrial policies (Evenett et al., 2024). Notably, NIPO records the budgeted subsidy values for measures introduced since January 2023. Therefore, the NIPO subsidy values are non-existent for the years before 2023, and are likely to be underestimated for 2023 onward, as they exclude disbursements under subsidy measures introduced before 2023 that are still active.

To overcome these issues, we follow a two-step approach. First, we estimate the relationship between subsidy values and policy counts using NIPO data from 2023-24. Second, we apply these estimates to back-cast subsidy values over 2009-23.[9] The remainder of this section details our methodology and presents the subsidy estimates.

Relationship between subsidy values and counts. First, we use NIPO data to estimate the empirical relationship between subsidy values (S) and subsidy counts (NS). To ensure broad coverage and representativeness, we include subsidy measures across all sectors. Since the data records only new subsidy measures, we analyze yearly changes in subsidy values by country and industry — using the 2023 level (due to the absence of prior data) and the annual change in 2024. Our goal is to identify the best predictive relationship between changes in subsidy values and subsidy counts, specified

[8] See Rotunno and Ruta (2024*b*) for a discussion of GTA subsidy data, including its strengths and limitations.

[9] For the year 2023, we use the estimated subsidy values based on the GTA counts rather than the observed values from NIPO to keep consistency with the way we obtain values for the previous years, and because the values from NIPO exclude disbursements from policies introduced in previous years. Moreover, since NIPO includes only a subset of the policy measures in the GTA, it may miss some subsidy measures.

as:

$$\Delta S_{i,t}^{j} = f\left(\Delta NS_{i,t}^{j}\right) + \alpha_i + \mu^j + \delta_t + \varepsilon_{i,t}^{j} \quad (1)$$

The subscript i indicates the country, and t the year (2023 and 2024). The superscript j indicates the sector, as defined in the OECD Inter-Country Input-Output (ICIO) tables (OECD, 2025*c*). In particular, we focus on goods sectors — in the model simulations, we assign a subsidy of zero value to the aggregate service industry. We control for fixed effects to identify the best predictive function $f(\cdot)$ net of structural differences in subsidy values and counts in the NIPO data. In particular, the α term collects country fixed effects, controlling for systematic differences in changes across countries, including those related to reporting practices. The μ and δ terms are industry fixed effects and a year dummy, respectively.

We employ a 10-fold cross-validation method (James et al., 2013) to select the best predictive function $f(\cdot)$ among several candidates: dummy variables for up to 20 quantiles of ΔNS, a linear specification, and polynomial functions up to fifth order. This approach involves partitioning the sample into ten equally sized parts, or "folds".[10] In each iteration, nine folds (the training set) are used to estimate the model in equation (1), while predictions are made on the excluded fold (the testing set) based on the estimated $\widehat{f(\cdot)}$.[11] Predictive performance is assessed using the median absolute deviation (MAD) of the prediction errors, a measure robust to outliers. For each $\widehat{f(\cdot)}$, we calculate the median or mean MAD across all iterations. The function that delivers the lowest predictive score is selected as the best fit.

We clean the raw NIPO data before performing the estimations. This cleaning is to ensure that the direct transfers considered in the analysis are the closest empirical counterpart to the way we introduce subsidies in the model, which is through production subsidies per dollar of output. To this end, the sample of subsidies is restricted to measures transferring resources directly from governments to firms.[12] We exclude subsidy measures that reduce government revenues, such as tax breaks, because the actual transfer amounts are difficult to estimate at policy introduction — for example, the value of a corporate tax break depends on realized profits. Additionally, we omit

[10] Due to clustering in the NIPO data, folds are formed by randomly selecting groups of countries (39 plus the EU).

[11] We exclude the fixed effects from the prediction to abstract from the influence of systematic differences across countries and sectors — e.g., due to reporting. Moreover, using the estimated fixed effects in the pre-2023 period is complicated by the absence of estimated effects of year dummies. Applying the 10-fold cross-validation procedure without fixed effects delivers the same specification choice (the linear function), as shown in Figure A.2 in Appendix. The estimated coefficient of 47.3 (standard error = 12.7) — higher than the 35.8 one from equation (1) — scales up the estimated subsidy value uniformly across countries and sectors.

[12] In the data, these measures are classified under the following categories: "Production subsidies", "State aid, unspecified", "Capital injection and equity stakes (including bailouts)", "Financial grant", "In-kind grant", and "State aid, nes". The grouping follows the UNCTAD (2019) classification.

subsidies like preferential state loans, which transfer risk from firms to governments, as these do not align with our theoretical framework, where firms are assumed not to face financial constraints. Overall, direct transfers such as state grants are easier to measure — subsidy values in NIPO are indeed missing for many entries classified as tax breaks or preferential loans.[13] While subsidy measures like state grants are different from the production subsidies considered in the model, they can have qualitatively similar effects on prices and trade flows by spurring entry in models with monopolistic competition (e.g., Krugman (1979)), which feature comparative statics that are isomorphic to those of our model (Kucheryavyy, Lyn and Rodríguez-Clare, 2023).

Another challenge in aligning the data with the model is that the database records the budgeted value of subsidy measures, whereas the model requires the actual annual disbursement of funds. We approximate this by allocating the budgeted value proportionally over the subsidy's duration, based on the number of days the measure is active within each year. For example, a subsidy introduced on July 1, 2023, and expiring on June 30, 2024, has its budget split equally between 2023 and 2024. For measures without a specified expiration date — accounting for roughly 80 percent of the sample — we impute the duration using the sample average of about 809 days. It is important to note that although our sample ends in 2024, most subsidies introduced in 2023 and 2024 are expected to remain in effect beyond that year, continuing to incur spending.

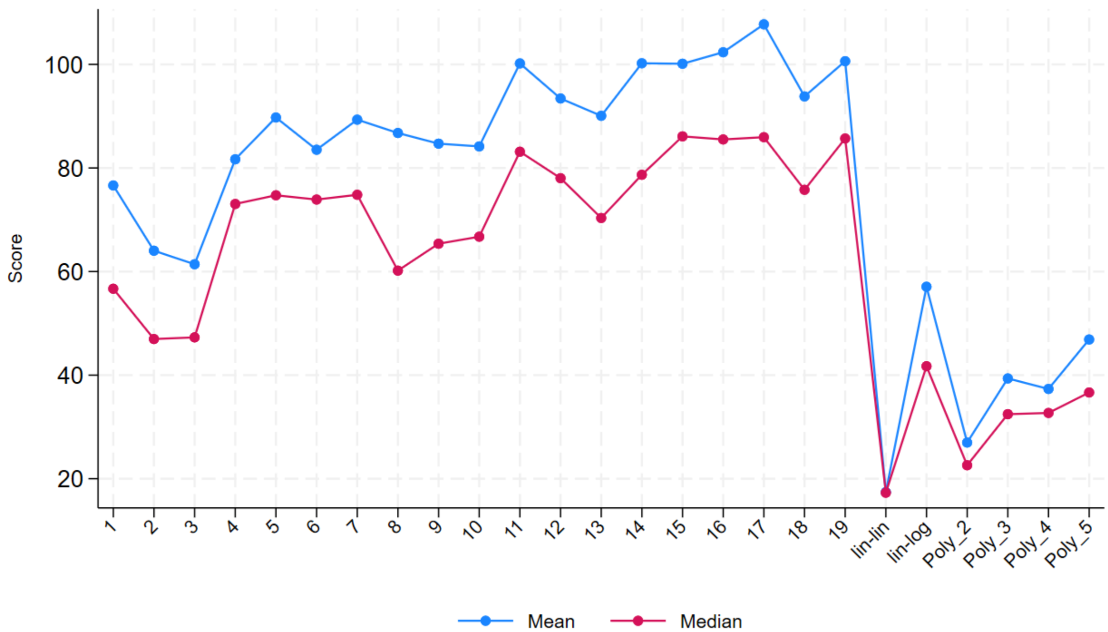
Each subsidy measure in the NIPO data specifies targeted products at the HS 6-digit level (2012 revision). To construct subsidy rates for the 24 aggregated sectors in the OECD ICIO dataset, we aggregate subsidy values and count the number of measures within each sector.[14] To prevent double-counting of subsidies spanning multiple sectors, we allocate each measure and its value proportionally based on the sectoral share of the targeted HS 6-digit products.

Figure 2 shows the prediction score of the different functional forms $f(.)$. The linear model is the one that minimizes both the median and average absolute deviation, and hence is selected to estimate subsidy rates.

[13] Restricting our subsidy measure to direct transfers only underestimates the estimated value of subsidy support, which over time has become increasingly determined by tax reductions and preferential access to credit (OECD, 2025*a*).

[14] Relative to the original sector classification in the OECD ICIO tables (OECD, 2025*c*), we aggregate Agriculture and Hunting (A01) and Forestry Logging (A02), and Mining of coal and lignite (B05) and Extraction of crude petroleum (B06), since there are fewer than 10 HS 6-digit products in sectors A02 and B06.

Figure 2: Mean and median of median absolute deviations (MADs) of prediction errors from 10-fold cross-validation



Note: Mean and median of MAD values from 10-fold cross-validation exercises applied to different functional forms of a regression of the changes in the dollar value of subsidies on the changes in the count of subsidy measures. Models are labeled along the horizontal axis. The labels "1" to "19" denote the number of dummies for quantiles of the count variable (the first quantile being always the excluded category).

Back-casting of subsidies. We apply the estimated linear relationship on the full NIPO dataset, using the coefficient of 35.8 (with a standard error of 9.5) on ΔNS to predict annual changes in subsidy values from 2009 onward. These predictions are based on the changes in subsidy counts recorded in the GTA database. Within GTA, we calculate the cumulative sum of subsidy measures introduced since 2009 that remain in force in each given year up to 2023.

Before calculating annual changes, we apply the same data cleaning steps used for NIPO: restricting to direct transfers only, imputing subsidy durations for measures without expiration dates, and distributing subsidies covering multiple aggregate sectors.[15] We then multiply the NIPO-based coefficient by changes in subsidy counts from GTA to estimate annual changes in subsidy values. Because GTA data begins in 2009, we predict subsidy values introduced since 2009 and disbursed in each year as the

[15]For each sector, our count variable equals the difference between GTA-classified trade-distortive ("red") subsidy measures and the (very low) number of trade-liberalizing ("green") subsidies. Since all domestic subsidies are classified as trade-distortive in GTA, "green" cases represent announcements that interrupt existing subsidy policies. This coding practice is absent in NIPO.

cumulative sum of subsidy changes by country and sector.[16] We focus on the period starting in 2015 to reduce downward bias from considering only new subsidy measures since 2009, which likely affects the sample's early years. Additionally, the post-2015 period coincides with the implementation of the Made in China 2025 plan and an increase in industrial policy activity in China and other major economies (Rotunno and Ruta, 2024*a*; Ju et al., 2024).

One concern with the GTA data is that it may under-count policy measures in smaller economies. While excluding the years before 2015 should alleviate this issue, subsidy counts are still zero for G20 economies such as Saudi Arabia and Argentina in the first years of the 2015-23 period.[17] To minimize biases in the estimate values, we restrict our sample in the simulations to the 10 largest subsidizers during 2015-23, and group other countries in a rest-of-the-world (ROW) aggregate. To evaluate their significance, predicted subsidy values are expressed as a share of sectoral value added from the OECD ICIO tables.[18]

Figure 3, panel (a), presents the average subsidy rates during 2015-23 for the ten largest subsidizers, which are the countries included in our model simulations — plus the ROW. Panel (b) illustrates the changes over time for the five largest subsidizers. China is the largest subsidizer, with an average subsidy relative to value added of 1.8 percent over the period. In contrast, the US and the EU maintain lower aggregate subsidy rates of 1.3 and 0.6 percent respectively. Over time, China's subsidies have grown from 1 to 2.6 percent of value added, widening its lead over other subsidizers. Subsidy rates in other countries such as Canada and Australia have also experienced substantial increases.

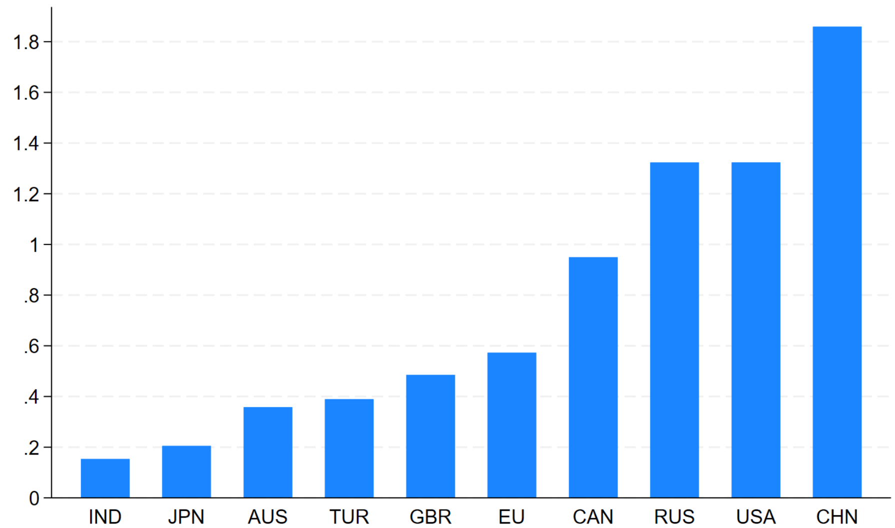
[16]This methodology has also been applied to estimate subsidy values and rates in IMF (2025, Chapter 3). As a result of the estimation approach, the estimated subsidy values are anchored to the observed values in NIPO. As Figure A.1 and Table A.2 show, the annual changes in predicted subsidy values and in the NIPO values for 2023 (the only year where the two series overlap) are strongly correlated, and the relationship is not driven by systematic differences across countries or sectors.

[17]The underestimation of subsidy values for emerging economies is likely to be substantial. Using alternative data sources on aggregate subsidies, Fernandes and Reed (2026) find that "direct funding" (closest to our empirical definition of subsidies) accounts for around 1.5 percent of GDP in middle income economies. Crucially for our study, their sample however excludes China and lacks sector-level information.

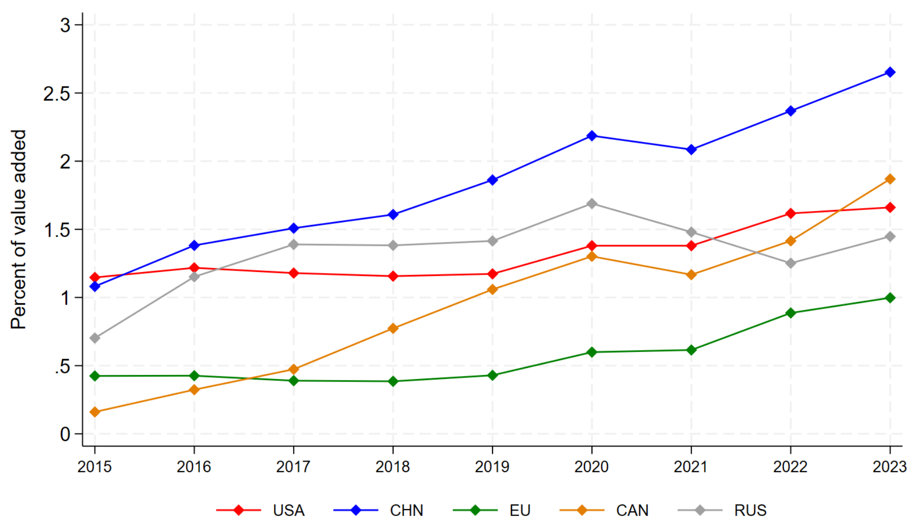
[18]The OECD ICIO tables extend through 2022 (OECD, 2025*c*). For 2023, sectoral value added is estimated by applying country-level annual GDP growth rates to the 2022 sectoral values.

Figure 3: Estimated subsidies as a share of value added

(a) 2015-23 Average



(b) 2015-23 Trends



Note: Subsidy values are estimated applying a coefficient of 35.8 to yearly changes in counts of subsidy measures from the GTA data, and taking a cumulative sum over time. Values are divided by sectoral value added obtained from the OECD ICIO, and estimated for 2023 applying yearly GDP growth rates by country.

The estimated subsidies vary across countries and sectors. Our focus is on sectors of strategic importance, whose definition however is inherently challenging, as the concept of what is strategic varies according to governments' objectives and thus differs across countries and over time. For our analysis, we adopt a classification that is both intuitive and applicable to cross-country trade and subsidy data. Specifically, we use the list of Advanced Technology Products (ATPs) compiled by the US Census Bureau as our working definition of strategic products. This list comprises 518 HS 10-digit products (based on the HS 2012 classification), grouped into ten categories: biotechnology, life sciences, opto-electronics, information & communications, electronics, flexible manufacturing, advanced materials, aerospace, weapons, and nuclear technology. It includes advanced manufacturing products such as semiconductors and industrial robots, which frequently feature in discussions on industrial and geoeconomic competition among major economies. Crucially, this list can be matched to product-level GTA data.[19]

For each sector, we count the number of subsidy measures targeting Advanced Technology Products (ATPs). Eight sectors in the OECD ICIO tables contain at least one ATP: fabricated metals, other manufacturing, chemicals, pharmaceuticals, electrical equipment, machinery, transport equipment, and electronics, with substantial variation in the ATP share across these sectors. In the paper, these 8 sectors are strategic.[20]

Figure 4 displays the 2015-23 average and change in subsidies as a share of value added for strategic and other sectors in the ten largest subsidizers. Subsidies are directed more toward strategic sectors in most countries, with China, Canada and Russia displaying the largest differences relative to other sectors (see Panel (a)). In the US and the EU, subsidies as a share of value added are instead higher in non-strategic sectors. Over the 2015-23 period, estimated subsidies as a share of value added have increased more in strategic sectors, consistent with the view that recent industrial policy targets disproportionally industries of strategic importance. Globally, the estimated subsidy rates stand at 1.8 percent in strategic sectors and 0.9 percent in other sectors in 2023, while they were both at 0.5 percent in 2015. As panel (b) in Figure 4 displays, the increase in bias toward strategic sectors varies markedly across countries. It is highest in China, Australia, India and Canada, while the difference between strategic and non-strategic sectors is lowest in major advanced economies such as the US, the EU and Japan.

These differences in subsidy patterns across countries and sectors are reflected also in subsidies as a share of gross output by sector — the variable that serves as policy shocks in the model simulations. As Figure A.7 in Appendix shows, the three sectors with the largest subsidy rate increases in China (pharmaceuticals, electronics, and electrical equipment) are all classified as strategic, while in the US and the EU non-strategic sectors like agriculture and mineral products are among the ones experiencing the highest subsidy increases. The largest increases in subsidy rates affecting strategic sectors, including electronics and electrical equipment, are observed in Australia and

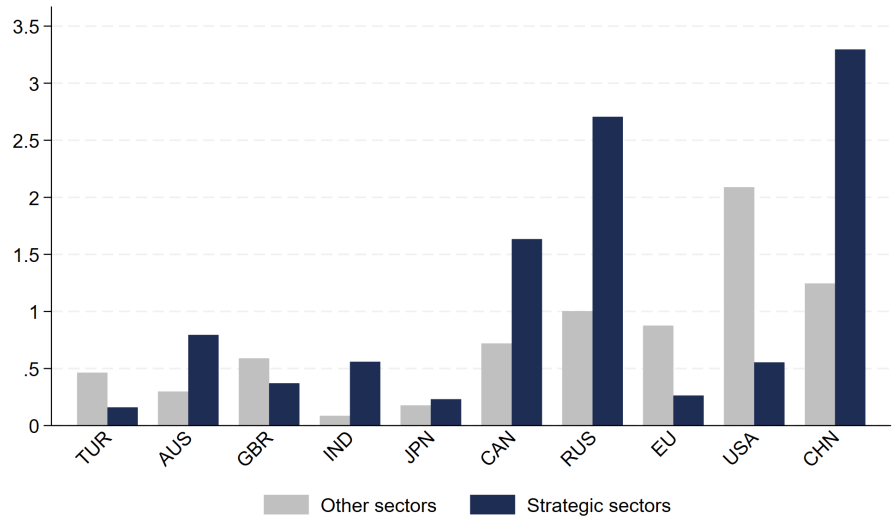
[19]We aggregate the classification to the 6-digit level to align with GTA data, considering an HS 6-digit product as ATP if at least one HS 10-digit subcategory is classified as ATP.

[20]See column (3) of Table A.1 in Appendix. Electronics has the highest share of strategic products, while other large sectors such as chemicals, fabricated metals and other manufacturing have relatively low shares.

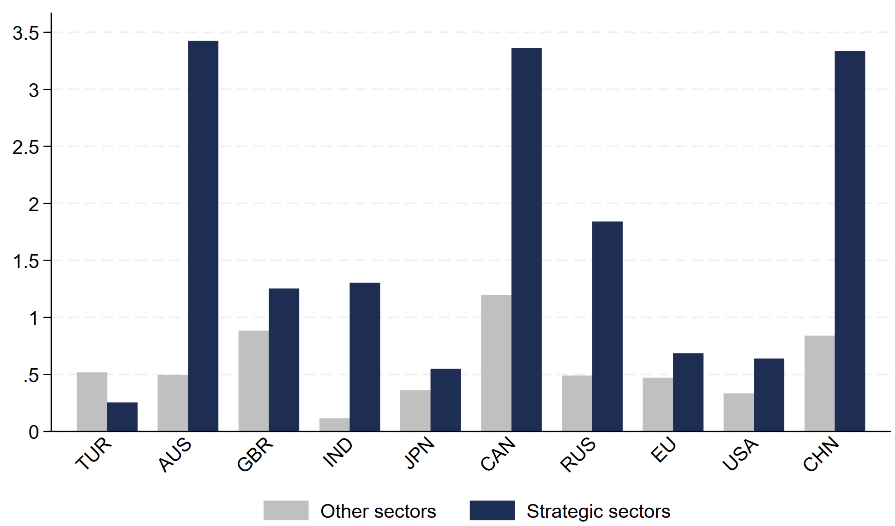
Canada, as the estimated subsidy values in those cases are close to zero in 2015.[21]

Figure 4: Predicted subsidies as a share of value added across sectors

(a) 2015-23 average



(b) 2015-23 changes



Note: Ten countries with the largest estimated subsidy values during 2015-23. Subsidy values are estimated applying a coefficient of 35.8 to yearly changes in counts of subsidy measures from the GTA data, and taking a cumulative sum over time. Strategic sectors are sectors in the OECD ICIO tables with at least one HS 6 digit product included in the ATP list of the US Census Bureau. Values are divided by sectoral value added obtained from the OECD ICIO, and estimated for 2023 applying yearly GDP growth rates by country.

Comparing our estimated subsidy rates with other measurement initiatives is chal-

[21] At the country level, total subsidies over gross output in goods sectors during 2015-23 equal 0.5 percent in China and the US, and 0.2 percent in the EU.

lenging due to differences in scope, data sources, and methodologies. The subsidy measures in the MAGIC database (OECD, 2025*a*) are perhaps the closest to ours, sharing a cross-country and sectoral focus. Both databases show similar subsidy levels and country rankings, with China emerging as the largest subsidizer. According to MAGIC, China's average subsidy rate from grants as a percentage of total revenues in sampled firms is 0.5 percent over 2005-22, which matches our average during 2015-23.[22] For the US, the 2015-23 average estimated subsidy as percent of gross output (0.5 as in China) is above the value reported by OECD (2025*a*) for North America over 2005-22 (0.1 percent). For the EU, the 1 percent estimated value of direct subsidies as a share of goods value added in 2023 is comparable to the 0.6 percent of GDP (including services) that comes from the European Commission State Aid Scoreboard (European Commission, 2025).[23]

Before turning to the model, it is worth flagging a few data caveats that readers should keep in mind. Our predicted rates, while broadly consistent with the limited existing literature, reflect limitations inherent in both the GTA data and the estimation method. Coverage and reporting of subsidies in GTA likely varies across countries and improves over time, with emerging economies particularly underrepresented.[24] Legacy subsidies introduced before 2009 but active during 2015-23 are also missing. Cross-country comparisons of subsidy counts and values are further complicated by the reliance on a mix of official government sources and firm financial statements, which can result in firm- or region-specific measures being recorded separately when they belong to a single policy intervention. On the methodology side, our out-of-sample predictions rest on an empirical relationship between subsidy values and counts estimated on NIPO data as of February 2025; as new data are released, this relationship may shift, affecting the back-casting of subsidy values. Finally, restricting subsidies to direct transfer instruments — necessary given data limitations and to ensure consistency with subsidies in the model — means that the overall value of subsidy measures is likely understated.

[22] Garcia-Macia et al. (2025), using data from listed firms, find that cash subsidies — closest to our definition of state aid and grants — account for 2 percent of manufacturing value added in China in 2023. This is slightly lower than our estimates shown in Figure 3, panel (b). They also report higher subsidy rates in strategic industries, such as around 5 percent for semiconductors and 3 percent for technology hardware.

[23] The 0.6 percent is obtained by multiplying the value of state support in 2023 as a share of EU GDP (1.09 percent) by the share of direct grants (59 percent) in total support.

[24] Recent work by Ju, Li and Wei (2026) and Fang, Li and Lu (2025) quantifies industrial policy (not only subsidy measures through state aid and grants) by applying Large Language Models (LLMs) to unstructured policy documents for the US and China, and over longer time periods than GTA. Overall, both studies find counts of industrial policies that are higher than those in the GTA data.

3 Model

In this section, we present the model used to simulate the general equilibrium trade effects of industrial subsidies, as estimated in the previous section at the country-sector level. Our framework builds on the quantitative model developed by Ju et al. (2024), which itself extends the multi-country, multi-sector trade model of Caliendo and Parro (2015). The model features N countries, indexed by i and n, and J sectors, indexed by j and s. Workers are immobile across countries but can move freely between sectors within each country. Each sector consists of a unit mass of differentiated varieties.

Model assumptions. The representative consumer in country i has two-tier preferences: Cobb-Douglas across sectors and CES across varieties within a sector,

$$(2) \quad U_i \;=\; \sum_{j=1}^{J} \alpha_i^j \, \log\left[\left(\int_0^1 C_i^j(\omega)^{\frac{\sigma^j-1}{\sigma^j}}\, d\omega\right)^{\frac{\sigma^j}{\sigma^j-1}}\right],$$

where α_i^j is the final expenditure share of sector j in country i, and σ^j is the elasticity of substitution across varieties (ω) in sector j. Shipping goods in sector j from i to n faces iceberg costs τ_{in}^j with $\tau_{ii}^j = 1$, and an ad valorem import tariff t_{in}^j with $t_{ii}^j = 0$. Country i can also subsidize the industry j through a production subsidy s_i^j. We define $t_{in}^j \geq 0$ and $s_i^j \geq 0$, and $\tilde{t}_{in}^j \equiv 1 + t_{in}^j$ and $\tilde{s}_i^j \equiv 1 + s_i^j$. While we assume tariffs are destination specific, production subsidies are uniform across destinations.

Variety ω of sector j in country i is produced under perfect competition using labor and a composite of intermediates. The unit cost of ω is $c_i^j(\omega) = \frac{1}{z_i^j(\omega)}\, c_i^j$, where the sectoral unit cost index in country i and sector j is

$$(3) \quad c_i^j \;=\; \frac{1}{\left(L_i^j\right)^{\psi^j}} w_i^{\beta_i^j} \left[\prod_{s=1}^{J} (P_i^s)^{\gamma_i^{sj}}\right]^{1-\beta_i^j}, \qquad \sum_{s=1}^{J} \gamma_i^{sj} = 1.$$

Here, w_i is the wage, P_i^s is the sector-s price index in country i, β_i^j is the value-added share, L_i^j is total labor used in sector j of country i, and $\psi^j \geq 0$ captures the strength of sectoral (external) scale economies — i.e., the scale elasticity measuring how a firm's output responds to sectoral size (as in Kucheryavyy, Lyn and Rodríguez-Clare (2023); Bartelme et al. (2025)). Productivity is Hicks-neutral and drawn i.i.d. from a Fréchet,

$$(4) \quad \Pr\left[z_i^j(\omega) \leq z\right] \;=\; \exp\left\{-T_i^j\, z^{-\theta^j}\right\}, \quad z > 0, \quad \theta^j > \max\{\sigma^j - 1,\, 1\},$$

where T_i^j is the sector-country technology shifter and θ^j the dispersion parameter. We assume that countries have ex-ante differences in sectoral productivity which form the basis of absolute advantage. How much these productivity differences influence the trade patterns depends upon the magnitude of θ^j. Small ex ante differences in T_i^j can translate to strong specialization if θ^j is large. In this model, comparative advantage is not only about relative productivity—it is a combination of technology, scale, and demand factors. A country could have lower productivity in a sector but still become an exporter if it has a sufficiently large home market to exploit industry-level scale economies. This is because the unit cost index decreases with industry size — see the scale effect $L_i^{j^{\psi^j}}$ in the denominator.

Equilibrium. Using properties of the Fréchet distribution and CES price aggregation, the sectoral price index in destination n is given by

$$(5) \quad P_n^j = \left[\sum_{i=1}^{N} T_i^j \left(\frac{c_i^j \, \tau_{in}^j \, \tilde{t}_{in}^j}{\tilde{s}_i^j} \right)^{-\theta^j} \right]^{-1/\theta^j} .$$

This expression for the sectoral price index is the same as in Caliendo and Parro (2015) except that the introduction of a subsidy puts downward pressure on unit costs, reducing prices. Thus if country n increases imports of sector j goods from countries that subsidize their firms, then their purchaser prices are lower.

The other equilibrium conditions (i.e., sectoral employment, national labor market clearing and sectoral goods market clearing) are described in Appendix A.1. In this static framework, aggregate trade deficits are fixed and net government expenditure is financed by, or rebated through, lump-sum transfers to and from consumers. Here we highlight the gravity equation for bilateral trade flows, which is the focus of our quantitative analysis. The share of country n's expenditure on sector j goods sourced from country i is

$$(6) \quad \pi_{in}^j \equiv \frac{X_{in}^j}{X_n^j} = \frac{T_i^j \left(\tilde{s}_i^j\right)^{\theta^j} \left(c_i^j \, \tau_{in}^j \, \tilde{t}_{in}^j\right)^{-\theta^j}}{(P_n^j)^{-\theta^j}} = \left(\tilde{s}_i^j L_i^{j^{\psi^j}}\right)^{\theta^j} \pi_{in}^{j^{CP}} .$$

The subsidies interact with the forces of absolute and comparative advantage in a way that increases exports from the subsidizing country in the targeted sectors. As a result of subsidies, the augmented productivity parameter becomes $T_i^j(\tilde{s}_i^j)^{\theta^j}$. The higher the level of subsidy, the higher the absolute advantage of that sector. The presence of subsidies and scale economies affect the trade share relative to its expression in Caliendo and Parro (2015) — $\pi_{in}^{j^{CP}}$. If in country i the subsidy is allocated to sectors which have a larger size and positive economies of scale, that would translate to a larger share of spending being allocated towards country i's goods from all other n countries (including i).

Following Ju et al. (2024) and Dekle, Eaton and Kortum (2007), the model can be usefully solved in changes ($\hat{x} \equiv x'/x$, with x' and x being the counterfactual and baseline values of x), decreasing the number of parameters to be calibrated (e.g., the productivity parameter T and trade costs τ do not need to be calibrated). The main equilibrium conditions in changes are reported and discussed in Appendix A.1. The trade equation in (6) expressed in relative changes is (assuming time invariant productivity parameter T)

$$(7) \quad \hat{\pi}_{in}^{j} = \frac{\left(\frac{\hat{c}_i^j \, \hat{\tau}_{in}^j \, \hat{\tilde{t}}_{in}^j}{\hat{\tilde{s}}_i^j}\right)^{-\theta^j}}{\sum_{k=1}^{N} \pi_{kn}^j \left(\frac{\hat{c}_k^j \, \hat{\tau}_{kn}^j \, \hat{\tilde{t}}_{kn}^j}{\hat{\tilde{s}}_k^j}\right)^{-\theta^j}}.$$

Increases in the subsidy rate in country i and sector j ($\hat{\tilde{s}}_i^j$) lead to higher exports in the targeted sector, whereas subsidies given to the same sector by other countries ($\hat{\tilde{s}}_k^j$) have a direct negative trade effect, by increasing the multilateral resistance term in the denominator.

Decomposition of trade effects. To evaluate the relative importance of different channels, we implement a decomposition exercise that isolates the different determinants of changes in trade flows following a counterfactual change in subsidy rates — while holding import tariffs and bilateral trade costs fixed ($\hat{\tau}_{in}^j = \hat{\tilde{t}}_{in}^j = 1$). Specifically, we use the unit cost equation (3) in changes and log linearize the trade gravity equation (6) to obtain an approximate decomposition of the effect of subsidy on exports of country i in sector j (Exp_i^j) into six components — see Appendix A.1 for details:

$$(8) \quad \Delta \ln Exp_i^j \approx \sum_{n \neq i} \bar{r}_{ni}^j \, \Delta \ln X_{ni}^j$$
$$= \theta^j [\underbrace{\Delta \ln \tilde{s}_i^j}_{\text{Subsidy}} + \underbrace{\psi^j \, \Delta \ln L_i^j}_{\text{Productivity}} - \underbrace{\beta_i^j \, \Delta \ln w_i}_{\text{Wage}} - \underbrace{(1-\beta_i^j) \sum_{s} \gamma_i^{sj} \, \Delta \ln P_i^s}_{\text{Input price}}] +$$
$$+ \sum_{n \neq i} \bar{r}_{ni}^j \Big(\underbrace{\theta^j \, \Delta \ln P_n^j}_{\text{Competition}} + \underbrace{\Delta \ln X_n^j}_{\text{Importer expenditure}} \Big).$$

Here, Δ denotes the log differences between counterfactual and baseline values ($\Delta \ln x = \ln x' - \ln x$), and $\bar{r}_{ni}^j \equiv \frac{1}{2}\left(r_{ni}^{j\,\prime} + r_{ni}^j\right)$ are Törnqvist expenditure weights, with $r_{ni}^j \equiv \frac{X_{ni}^j}{\sum_{n \neq i} X_{ni}^j}$ defined as country n's share in total exports of country i.

The first four terms in equation (8) are exporter-specific, capturing how subsidy changes affect the prices facing importers of sector j goods from country i. The trade elasticity θ^j governs the sensitivity of trade flows to these price changes.

The first term represents the direct "partial equilibrium" effect of subsidy changes. For example, if country i increases subsidies in sector j, the purchaser price falls, expanding demand for that country's exports in the same sector. This direct channel only operates when the subsidy shock affects country i and sector j directly, and is the main one identified by econometric studies on the trade and market share effects of subsidies (e.g., Rotunno and Ruta (2024*b*); OECD (2025*b*)). All other mechanisms operate through general equilibrium effects and may be triggered even if $\tilde{s}_i^j$ remains unchanged.

A key conceptual contribution of this decomposition is to appreciate the role of different general equilibrium channels. In particular, the second term in equation (8) captures how the subsidy shock influences exports through the reallocation of factors of production across sectors, which affects sectoral productivity in models with external economies of scale. When country i increases its subsidy rate in sector j relative to other sectors and countries, resources are drawn toward the subsidized sector. As labor demand rises in this sector, targeted firms benefit from enhanced productivity due to sector-specific production externalities. Conversely, non-subsidized or less subsidized sectors contract as labor shifts away, leading to reduced productivity and lower exports. The magnitude of these productivity effects — and their contribution to changes in trade flows — depends on the scale elasticity parameter ψ^j. If a sector lacks production externalities, the productivity effect is zero.

The third "wage" term captures a general equilibrium channel arising from changes in factor prices. The direction of this effect depends on the relative strength of subsidy policies across countries. For instance, if country i increases subsidies more than other countries, the resulting rise in demand for its labor pushes up wages, which in turn reduces the competitiveness of its exports.

The "input price" term captures the impact of subsidies transmitted through input-output linkages. When subsidies increase in sectors s that are key suppliers to sector j — including sector j itself — whether domestically or abroad (as sources of imported intermediates), the resulting reduction in input prices lowers production costs and thus enhances exports in sector j. Conversely, if sector j primarily sources inputs from sectors that are less subsidized or not targeted (including itself), which experience productivity declines due to factor reallocation, the input price effect may negatively impact exports in sector j.

The last two terms in equation (8) vary across destination markets and capture additional general equilibrium effects. The fifth term reflects changes in the sectoral price index in the importing market and is generally ambiguous when subsidy increases are relatively stronger in country i and sector j than in other countries. On one hand, the lower price of subsidized imports of sector j goods from country i reduces the price index. On the other hand, this gain comes at the expense of non-subsidizing exporters producing sector j goods, which lose market share. As these countries contract, their reduced scale raises the prices of their sector j products, increasing P_n^j. Therefore, the net change in ΔP_n^j following a relative subsidy increase by country i depends on which effect dominates — the price reduction from imports of j from i or the price increases of j from other countries. The larger is the share of imports affected by subsidy increases, the more likely it is that the fiercer subsidy-induced competition lowers exports from i.

The final term captures general equilibrium changes in sectoral expenditure in foreign markets. This channel tends to reduce exports in the subsidized sector j of country i, if the subsidy shock is higher than in other countries n. As wages — and thus income — decline in the non-subsidizing country n, expenditure on sector j goods for final consumption is expected to fall. Similarly, demand for sector j products used as intermediates in country n is likely to decrease, since most intermediate demand originates from the domestic non-subsidizing sectors and the sector itself.[25]

Calibration. We calibrate our quantitative model to the ten countries with the largest estimated subsidies during 2015-23 (e.g., see Figure 3) and ROW aggregate, encompassing 20 sectors (19 goods sectors plus a services aggregate).[26] Our counterfactual simulations focus on subsidies for the three major players — China, the EU, and the US — as well as other countries during 2015-23. The primary objective is to analyze trade effects — specifically how export and import flows adjust in general equilibrium across sectors and countries following changes in subsidy rates — and assess welfare implications. These subsidy rate changes ($\hat{\tilde{s}}_i^j$ in the model) are calibrated using the 2015-23 estimates from Section 2. In particular, estimated subsidy values are divided by sectoral gross output kept fixed at its 2015 level to rule out any endogenous output response. We present results by varying subsidy rates for China, the EU, and the US individually, and then consider the simultaneous subsidy changes across all the ten economies and ROW.

In the baseline exercise, import tariffs and bilateral trade costs are held constant

[25] Although increased subsidies raise demand for intermediates in the targeted sector j and subsidizing country i, potentially increasing country i's imports of intermediates from country n within the same sector, this effect is generally outweighed by the reduced demand from domestic non-subsidized sectors in country n.

[26] To calibrate the model, we further aggregate primary sectors into an "Agriculture" (Agriculture and hunting (A01), Forestry and logging (A02) and Fishing and aquaculture (A03)) and "Mining" (Mining of coal and lignite (B05), Extraction of crude petroleum and natural gas (B06), Mining of metal ores (B07), Other mining and quarrying (B08)) sectors. We also merge Manufacture of basic iron and steel (C24A) and Manufacture of basic precious and other non-ferrous metals (C24B) into a single "Basic Metals" sector, and Building of ships and boats (C301) and Manufacture of other transport equipment (C302T309) into a "Transport Equipment" sector. These aggregations are done to minimize the risk of extreme specialization patterns and corner solutions.

(i.e., $\hat{\tau}_{in}^{j} = \hat{\tilde{t}}_{in}^{j} = 1$). In extensions, we introduce shocks to US-China bilateral tariffs based on the observed tariff changes during the 2018-19 US-China trade tensions — arguably the most significant trade policy shift during 2015-23 — and changes in US and China tariffs since February 2025 and until March 2026 on imports from all trading partners. Baseline tariff rates are drawn from the applied tariffs of the ITC MacMap database for 2015, while the US-China tariff changes during 2018-19 are sourced from Bown (2021).[27] US and China tariffs at the product level as of March 2026 are sourced from the WTO-IMF Tariff Tracker (WTO-IMF, 2026). Bilateral applied tariffs at the product level are aggregated at the ICIO sector level by taking import-weighted averages, with import weights as of 2015 sourced from the CEPII BACI database.

To solve the model in differences, we require data on sectoral bilateral trade flows (X_{ni}^{j}), which we obtain from the OECD ICIO database for the base year 2015 (OECD, 2025*c*). Our sample includes the ten largest subsidizers as estimated during 2015-23, with EU member states aggregated into a single entity. Trade flows are further aggregated to calculate total expenditures by sector and country (X_{n}^{j}). Value-added flows from the same input-output tables are used to measure factor income in the initial period ($w_i L_i^j$). Aggregate trade balances are treated as exogenous and held constant at their 2015 levels.

Based on the definition of equilibrium, we require estimates of sectoral trade elasticities (θ^j), scale elasticities (ψ^j), country-sector level expenditure shares (α_i^j), country-sector level value-added shares (β_i^j), and country-sector level input-output shares (γ_i^{sj}). Country-sector expenditure shares (α_i^j), value-added shares (β_i^j), and input-output shares (γ_i^{sj}) are calculated from the OECD ICIO data. The calibration of sectoral trade and scale elasticities is crucial for the model simulations, since their distribution across sectors drives the trade and welfare effects of policy shocks. As shown in the decomposition of trade effects (see equation (8)), higher elasticities produce stronger export effects in the sector targeted by the subsidy shock. As for welfare, Bartelme et al. (2025) and Lashkaripour and Lugovskyy (2023) have shown how in theoretical frameworks with increasing returns to scale, unilaterally optimal production subsidies are proportional to the sector-specific scale elasticity.

We source the trade and scale elasticities from Bartelme et al. (2025), who use a model with external economies of scale and perfect competition similar to the one we adopt. The values of the sectoral trade elasticity are from Giri, Yi and Yilmazkuday (2021) — who use micro price data and a simulated method of moments estimator developed by Simonovska and Waugh (2014), and are used by Bartelme et al. (2025) in their estimation of scale elasticities. Their estimated trade elasticities θ^j range from 2.9 to 8.9 for manufacturing sectors — the median value is assigned to agriculture, mining and services. For scale elasticities, we use values from Bartelme et al. (2025),

[27] Baseline tariff and subsidy rates are used to adjust bilateral trade values in the OECD ICIO data (OECD, 2025*c*), which are measured at producer prices, whereas the model operates with trade flows at purchasers' prices.

who obtain them through structural estimation of the gravity equation. We source the estimates that correspond to the version of their model with input-output linkages since it is most similar to the one we use in the analysis.[28] Their estimated scale elasticities ψ^j range from 0.06 to 0.22 and are set to zero for non-manufacturing sectors (see column (6) of Table A.1 in Appendix). The values of the scale and trade elasticities correlate negatively across sectors — a pattern that has important implications for the efficiency and welfare effects of industrial policy (Lashkaripour and Lugovskyy, 2023).[29]

The scale elasticities are on average higher in strategic sectors (i.e., with at least one HS product included in the ATP list), and they correlate with the 2015-23 changes in subsidy rates that we use in the model simulations. As shown in Figure A.3 in Appendix, while global subsidy rates by sector correlate poorly with scale elasticities in 2015, the 2015-23 changes increase with the size of the elasticities. This correlation is more pronounced for China's subsidies than for subsidies by the EU and the US, where subsidy rates increase strongly in sectors with low (mineral products) or zero (agriculture) scale elasticities — see Figures A.4, A.5 and A.6 in Appendix. These patterns contribute to the simulated trade and welfare effects of subsidy policies.

The model is solved in changes using an iterative algorithm developed by Ju et al. (2024), which simultaneously solves the equilibrium conditions for price indices, sectoral employment, labor market clearing, and sectoral goods market clearing. This is achieved through a contraction mapping over changes in equilibrium variables — prices, wages, employment, and expenditure. At each iteration, we update the guesses for these four variables until the values computed from the equilibrium equations converge sufficiently to the updated guesses. Once convergence is reached for $\hat{w}_i$, $\hat{P}_n^j$, $\hat{L}_i^j$, and $\hat{X}_n^j$, we calculate the unit cost index using equation (3) in changes, which then allows us to derive changes in trade shares from equation (7) and determine trade flow levels in the counterfactual scenario.

4 Results

In this section, we present the results from simulating our calibrated model and examine how trade flows adjust in the new steady state in response to changes in subsidy rates during 2015-23, and to recent tariff actions. We also examine the welfare implications of these policies, from unilateral and global perspectives. Given the absence of frictions — specifically, the free reallocation of factors of production across sectors —

[28] These are reported in column (2) of Table B7 in Appendix of their paper. Their model differs in two assumptions that affect the way they estimate scale elasticities. In their model, preferences have a two-tier CES structure, whereas in our setup the upper tier is Cobb-Douglas. Moreover, they have two factors of production, capital and labor, while in our model there is a single factor.

[29] In our model, efficient subsidies that target sectors with high ψ expand output and exports. If these sectors have also low θ and hence high dispersion of productivity across countries, the policy worsens the terms of trade as it increases exports where the country has stronger market power.

our simulation results should be interpreted as long-run responses to industrial policy, likely to materialize years after the initial policy changes. We concentrate on the effects for the three largest exporters of strategic products — China, the EU, and the US — while also analyzing subsidy shocks for these countries alongside other economies.

4.1 Trade effects of subsidies

The trade effects in the model work through the following mechanism. The simulated 2015-23 changes in subsidies reallocate resources towards targeted industries and away from others. Consequently, production and exports in the more heavily subsidized sectors increase, while imports decline. The opposite pattern holds in less subsidized sectors, where production and exports fall and imports rise. Crucially, these effects are magnified by the presence of economies of scale, as targeted sectors with higher scale elasticities experience a productivity surge, generating higher production and exports and drawing further resources away from less subsidized sectors. These within-economy dynamics also have spillover effects on third countries as they alter international prices.

Figure 5 presents the effects on exports and imports in both strategic and non-strategic sectors following subsidy changes from 2015 to 2023 by China, the EU, the US, and collectively by these three countries alongside the other largest subsidizers and ROW. Detailed country-level trade changes are reported in Table A.3 in Appendix. China's subsidies generate the largest trade impacts. In a scenario where only China changes its subsidies, exports in strategic sectors rise by 12 percent, while imports in the same industries drop by 8 percent. Driven by subsidy incentives and productivity effects, resources shift toward strategic sectors, causing China's exports in other sectors to decline and imports to increase.

Subsidies by the EU and the US produce qualitatively similar effects — exports increase and imports decrease in strategic sectors, with opposite trends in other countries. As increases in their subsidies affect similarly non-strategic sectors, EU and US exports in those industries also increase. Overall, the trade effects from EU and US subsidies are smaller than those from China's subsidies. When all the ten largest subsidizers and ROW simultaneously adjust subsidies, the trade effects are qualitatively similar to those in the China-only scenario, underscoring the role of the trade responses to China's subsidies.

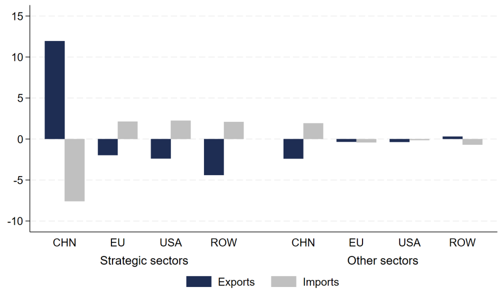
Subsidies tend to generate cross-border spillovers on exports of non-subsidizers. As shown in Figure 5, exports by the EU and the US in strategic sectors decline by around 2 percent following increases in China's subsidies. Table A.3 further reveals that among other countries, the ROW aggregate — which includes important exporters in strategic sectors such as Korea — experiences the largest percent contraction in exports in strategic sectors under a scenario with China's subsidies only. Non-subsidizing countries increase their imports by up to 3 percent. Table A.3 confirms that trade effects under a scenario where all countries implement the 2015-23 subsidy changes broadly track those observed under a China-only subsidy scenario for most of the countries in the sample. Australia and Canada are notable exceptions, as their large percent increases in subsidies targeting strategic sectors boost exports in those sectors.

The counterfactual changes in subsidies can significantly reshape global markets. As shown in Figure 6, China's share of world exports in strategic sectors rises from 27 percent at baseline to 29 percent under the subsidy counterfactual, while the shares of other countries decline.[30] This substantial export increase by China is also reflected in counterfactual shifts in sectoral trade balances: China's trade surplus in strategic sectors is 30 percent higher at 0.7 trillion USD in the counterfactual than at baseline, while the US and ROW trade deficits in the same sectors widen. As the results in Figure 5 suggest, the expansion in China's net exports in strategic sectors is counteracted by a decrease in the trade surplus in other sectors, as resources are reallocated in response to the subsidy shock. While policy shocks have (by construction) no effect on aggregate trade balances in the model, these responses in sectoral net exports highlight the potential impact of such industrial policies on sectoral trade balances.

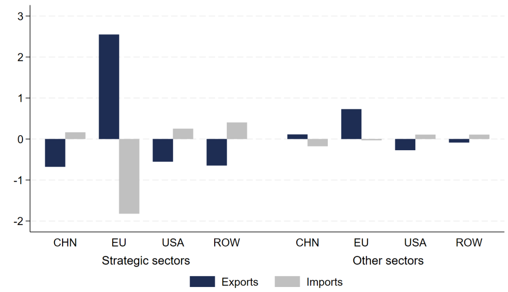
[30] Differences between the baseline shares in Figure 6 and those in Figure 1 arise from variations in the measurement of strategic sectors (HS 6-digit products in 1 versus aggregated sectors with at least one strategic product in the OECD ICIO data in 6) and the time periods considered (2012-2023 in 1 versus 2015 in 6).

Figure 5: Simulated trade effects (in %) of subsidies by:

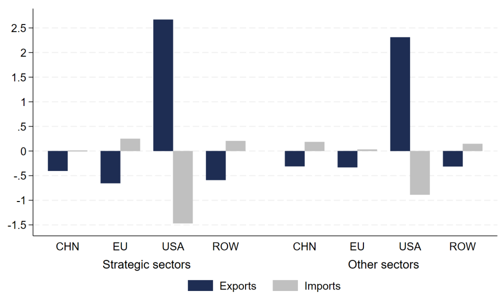
(a) **China**



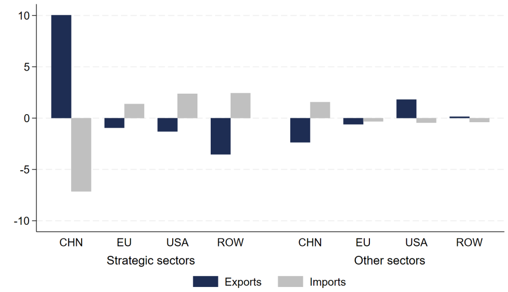
(b) **EU**



(c) **USA**



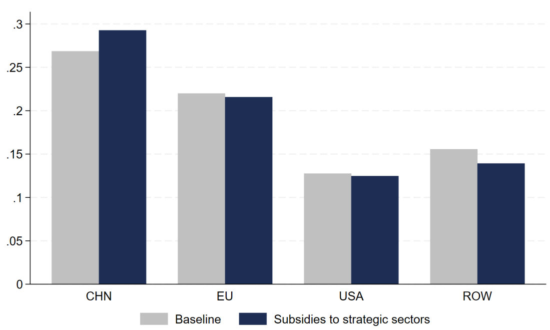
(d) **ALL**



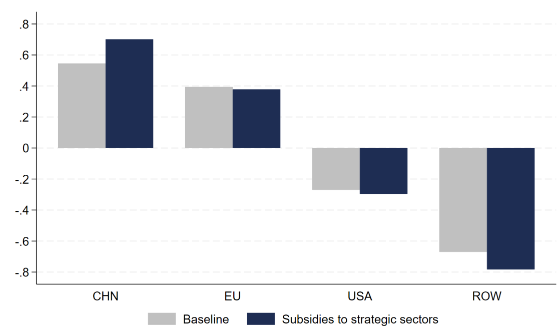
Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under scenarios where (i) only China implements the estimated 2015-23 sectoral subsidy changes ("China"); (ii) only the EU implements the subsidies ("EU"); (iii) only the US implements the subsidies ("USA"); and (iv) all the ten largest subsidizers and ROW implement the estimated 2015-23 subsidy changes ("ALL").

Figure 6: World markets in strategic sectors at baseline and under a counterfactual with subsidy changes by all countries

(a) Share of world exports



(b) Net exports (in trillions USD)



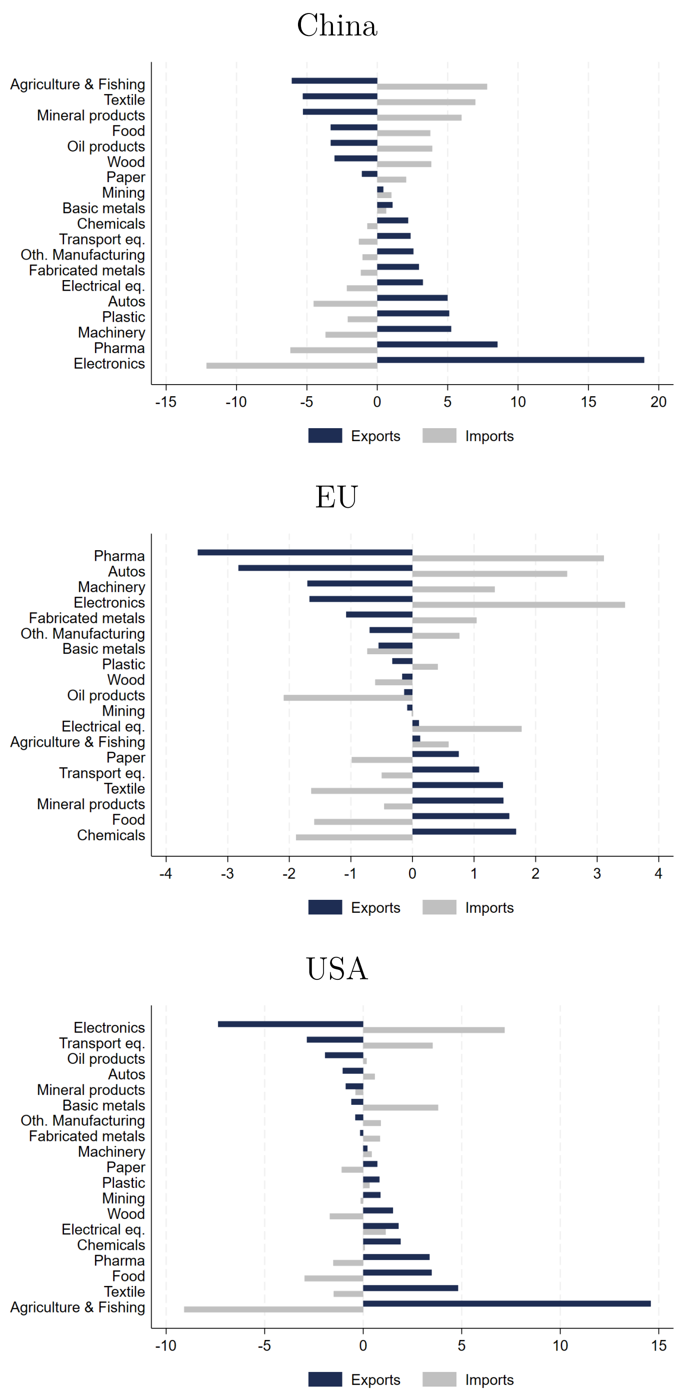
Note: Values at baseline are computed from the OECD ICIO data for the year 2015. World exports and net exports are computed adding flows for the 8 sectors that have at least one product classified as strategic.

We next examine how subsidies affect international trade at a more disaggregated level. As illustrated in Figure 7, the overall increase in China's exports in strategic sectors, even when all countries implement the 2015-23 subsidy changes, is driven by the electronics industry, whose exports increase by around 20 percent. China's exports in all other strategic sectors also increase, while imports move in the opposite direction. These subsidy-induced changes lead to specialization in China, with resources shifting away from other sectors toward strategic industries. Due to economies of scale, the sectors contracting most to release resources for the expansion in strategic sectors are less subsidized and yet relatively significant at baseline, such as textiles and agriculture.

Under this scenario where all countries implement the 2015-23 subsidy changes, the EU and the US experience substantial reductions in electronics exports, while exports in some of the other non-strategic sectors expand. This expansion is supported by the countries' own subsidies and by China's smaller role in global markets for certain non-strategic sectors. Among other countries, Australia, Canada and India experience the largest percent increase in exports of electronics — as reported in Table A.4 in Appendix, supported by significant increases in their respective subsidy rates. The US, Japan and ROW are instead the countries that face the largest decline in exports of electronics.

To better illustrate the magnitude of sectoral trade effects, Figure A.8, Panel (a) in Appendix displays the major countries' shares of world electronics exports at baseline (2015) and under the counterfactual scenario where all countries implement the estimated 2015-23 subsidy rate changes. China's share increases from 39 to 45 percent of global electronics exports. Meanwhile, all other countries lose market share. Correspondingly, China's net electronics exports surge from 0.2 trillion to approximately 0.3 trillion USD, contributing to the overall increase in China's trade surplus across all strategic sectors.

Figure 7: Simulated changes in trade flows (in %) by sector under a counterfactual with subsidy changes by all countries



Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under a policy scenario where the ten largest subsidizers and the ROW aggregate implement the estimated 2015-23 subsidy changes in all goods sectors.

4.2 Mechanisms

We use the decomposition of log changes in sectoral exports between the counterfactual and baseline scenarios, as presented in Section 3, to explore the underlying mechanisms driving our results. Figure 8 illustrates the contribution of each term in equation (8) to changes in sectoral exports for China, the EU, and the US under a scenario where all countries implement the 2015-23 subsidy rate changes. It is important to note that log differences may poorly approximate percentage changes, particularly given the large export shifts observed between counterfactual and baseline.[31] Consequently, Figure 8 provides an indicative view of the relative importance of each channel in driving sectoral export responses to subsidies, while Figure 7 presents the overall magnitude of counterfactual changes.

The direction of each component's influence aligns broadly with theoretical expectations (see Section 3) and depends on the relative magnitude of the subsidy shocks across sectors and countries. Besides their direct effect through lower prices, subsidy changes drive important indirect adjustments, especially through productivity responses. In China, the 2015-23 subsidy changes reallocate resources toward the electronics sector. Because of the strong economies of scale, the productivity growth in the sector accounts for the majority of the rise in China's electronics exports. As firms in this sector become more productive — reflected in a 5 percent decline in the before-subsidy sectoral producer price — lower input prices through intra-sector input-output linkages further bolster export growth. Lower foreign wages contributing to stronger competition abroad only slightly dampen the pro-export impact of China's subsidies in electronics. In other sectors, the direct partial equilibrium effect of subsidies — amplified by input-output linkages — tends to dominate the positive overall exports impacts.

In the EU and the US, productivity effects are most pronounced in sectors experiencing the largest relative export changes. In electronics, spillovers from China's export expansion lead to employment declines of 6 percent in the US and 2 percent in the EU, which lower productivity through economies of scale and decrease exports. Meanwhile, resources shift toward other non-strategic and relatively small sectors such as textiles. Input-output linkages support export expansions, but play a less significant role in the EU and US compared to China under the subsidy scenario. This muted effect reflects smaller changes in sectoral price indices and a lower share of intermediates in total production costs.[32] The competition effect on exports is large and negative, as lower wages in most other countries indicate stronger competition in foreign markets. This shows that shifts in foreign conditions play a more prominent role than domestic

[31] The Törnqvist aggregation of bilateral export changes across destinations (Appendix A.1) also introduces minor approximation errors, but these are negligible in the data.

[32] In China, the average share of intermediates in total costs across sectors is approximately 75 percent. In contrast, the average share of intermediates in total costs is 65 percent for the EU and 58 percent for the US.

channels in explaining export changes in the EU and US, underscoring the importance of general equilibrium cross-border spillovers from subsidies.

To further appreciate the importance of economies of scale and productivity responses, we perform three additional exercises varying the values of the scale elasticities. First, we simulate the effects of the 2015-23 subsidy changes in a version of the model without external economies of scale — this corresponds to setting the scale parameter $\psi_j = 0$ for all sectors j. In such a setting, subsidies can affect trade flows by directly lowering consumer prices in targeted sectors, and indirectly through input-output and other general equilibrium effects, without any effect on productivity. The results in Figure A.9, panel (a) in Appendix show how the trade effects of subsidies are weaker than in the baseline model with external economies of scale (shown in Figure 5, panel (d)). For example, the increase in China's exports in strategic sectors under the subsidy scenario is 5 percent, indicating that as much as half of the export response to China's subsidies can be explained by the induced productivity changes.

As a different robustness check on the values of the scale elasticity, in Figure A.9, panel (b) in Appendix we report the simulated changes in exports and imports under the all-subsidy scenario with different values for the sectoral scale elasticities, which are still from Bartelme et al. (2025), but are obtained under their baseline model specification without input-output linkages.[33] While this adds a difference with respect to our theoretical framework, considering this alternative set of elasticities further illustrates the importance of economies of scale. As shown in Table A.1, these scale elasticities are higher than the ones used in the baseline calibration. The trade effects in Figure A.9 under an all-subsidy scenario are qualitatively similar to the baseline results in Figure 5, but the magnitudes are larger as the stronger scale elasticities increase the productivity effects across sectors and countries in response to subsidy changes. For example, China's exports in strategic sectors increase by more than 40 percent, while in other sectors they go down by 30 percent. The strong specialization by China toward strategic sectors reduces exports from other countries in those industries by more than 10 percent.

A third check involving the calibration of elasticity parameters consists in adopting the trade and scale elasticities estimated by Lashkaripour and Lugovskyy (2023) — see Table A.1 in Appendix. They use transaction-level import data from Colombia to identify separately trade and scale elasticities, based on a framework with monopolistic competition and (internal) economies of scale. While their use of data from a specific country and different theoretical framework might not generalize to our application, adopting their elasticity values is a valid robustness exercise since their method identifies separately the scale and trade elasticities.[34] Under this alternative set of elas-

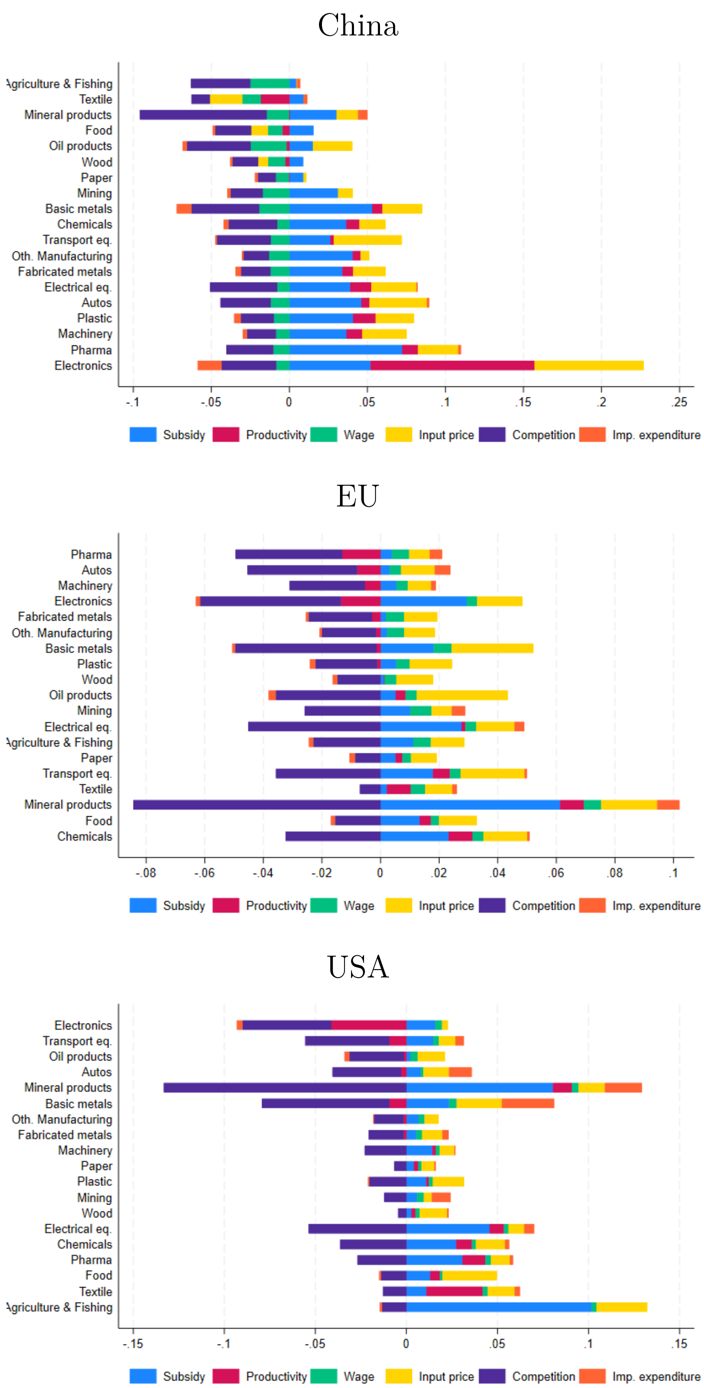
[33]See column (2) of Table 1 in Bartelme et al. (2025).

[34]Unlike Bartelme et al. (2025), Lashkaripour and Lugovskyy (2023) estimate a scale elasticity also for Agriculture and Mining as a single sector (point estimate equal to 0.14). The estimates of Lashkaripour and Lugovskyy (2023) are more dispersed across sectors than those of Bartelme et al.

ticities, the trade effects shown in panel (c) of Figure A.9 in Appendix are qualitatively similar to ones obtained with the baseline elasticity values.

(2025). While the averages of the trade and scale elasticities are approximately equal across strategic and other sectors (see Table A.1 in Appendix), dropping the estimates for the oil sector, which is an outlier and not statistically significant in Lashkaripour and Lugovskyy (2023), lowers the average scale elasticities for other sectors to 0.19, below the average for strategic sectors.

Figure 8: Components of simulated log differences in exports by sector under a counterfactual with subsidy changes by all countries



Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under scenarios where all countries implement the estimated 2015-23 subsidy changes. The components are defined and computed as in equation (8).

4.3 Trade effects of recent tariff actions

In the period starting in 2015, world trade has been shaped by two main episodes of changes in trade policy. First, a major increase in bilateral import tariffs between the US and China occurred in 2018 and 2019. The tariffs were largely unchanged after the two countries reached an agreement in 2020. Starting in February 2025, the US has intensified its tariff hikes on imports from China — which China retaliated against, and further extended increases in import tariffs to all trading partners and across most sectors. Other US trading partners, with the partial exception of Canada, have not retaliated against the most recent US tariffs.

Figure 9 shows the import-weighted bilateral US-China tariffs by sector in 2015 (our baseline), in January 2025 (i.e., after the 2018-19 trade tensions) and as of March 2026 (i.e., after the escalation in US tariff actions and China's retaliation since February 2025). Using import weights at baseline (in 2015), US average tariffs on imports from China increased substantially from 3 percent in 2015 to 16 percent as a result of the US-China trade tensions in 2018-19, and even further to 31 percent as of March 2026. Over the same period, China's average tariffs on US imports went up from 6 percent to 27 percent.[35] In the US, the increases in bilateral import tariffs are biased toward strategic sectors. While average US tariffs on imports from China are higher in non-strategic than strategic sectors, the difference has shrunk over time (from 7 percentage points in 2015 to 3 after the latest tariff escalation in 2025). By contrast, in China the tariff shock was stronger for non-strategic sectors: import-weighted average tariffs on US imports in non-strategic sectors increased from 8 to 34 percent, while for strategic sectors the increase was from 4 to 22 percent.

A key difference between the 2018-19 and 2025 episodes of tariff actions is that in the latest one US tariffs increased across most trading partners and sectors. Figure A.11 in Appendix shows the import-weighted average US tariffs by sector on all imports at baseline, after the 2018-19 US-China tensions, and as of March 2026. The bias toward strategic sectors observed for the US-China tariff increases is confirmed when looking at US tariffs on all trading partners. While average US tariffs were lower for strategic sectors in 2015, they increased to roughly the same level as that of other sectors (4.5 percent), and reached 16.4 percent as of March 2026, surpassing the average tariffs for other sectors (at 13.7 percent).[36]

Important to assess the trade and welfare implications of these tariff actions, US tariff hikes correlate with scale elasticities across sectors. This is shown in Figure A.10, panel (b) in Appendix: with the notable exception of metals sectors, US tariff hikes are higher in sectors with stronger scale elasticities — the correlation coefficient being

[35] Using more recent import weights as of 2024 gives lower import-weighted average tariff rates, as trade flows have adjusted in response to the 2018-19 tariff hikes — see e.g. Rotunno and Ruta (2026).

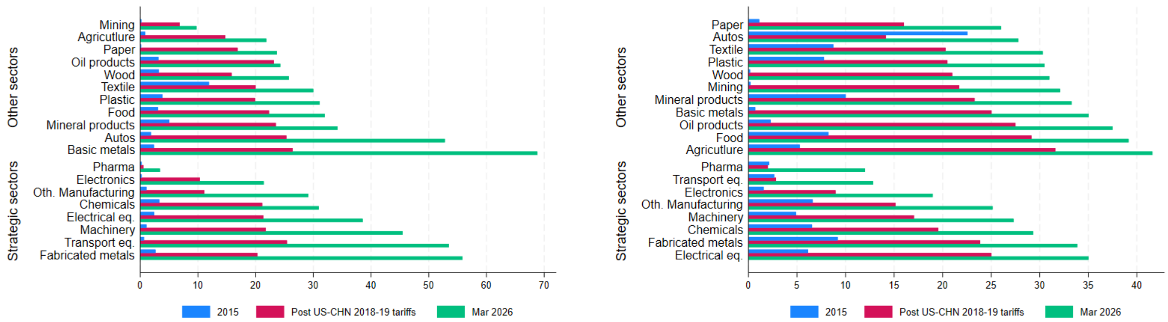
[36] This bias in US tariffs toward strategic sectors in the OECD ICIO data is confirmed if we drop Fabricated metals, which has the highest import-weighted average tariff as of March 2026 and is classified as a strategic sector even though it has only a few products that appear in the ATP list.

equal to 0.22. Panel (a) of the same Figure shows that instead there is zero correlation between increases in China's import-weighted average tariffs and scale elasticities across sectors.

Figure 9: Import-weighted US-China bilateral import tariffs by sector (in percent)

(a) US tariffs on China

(b) China tariffs on the US



Note: Simple average applied tariffs at the HS 6-digit product level are aggregated using import weights from the CEPII BACI database in 2015.

In this section we assess how the tariffs interact with subsidy policies in shaping trade patterns in strategic sectors. We simulate two tariff scenarios: in the first one, the US-China bilateral tariffs change as in the 2018-19 episode; in the other scenario, we bring the tariffs to their levels as of March 2026.[37] In both scenarios all countries implement the estimated 2015-23 changes in subsidy rates. Figure 10 displays the simulated changes in exports and imports for both strategic and non-strategic sectors under the two tariff scenarios, compared to the previous scenario without tariff changes, for China, the EU, the US, and a Rest of the World (ROW) aggregate. Figure A.13 in Appendix instead shows the changes in sales from China and the US across destination markets, under the subsidy-only scenario and the two tariff scenarios.

US-China 2018-19 tariffs. Consider first the impact of the 2018-19 shock. The US-China tariffs of 2018-19 lower China's export growth in strategic sectors, and deepen the drop in China's imports in the same sectors relative to a scenario with subsidies only, as shown in Figure 10. Importantly, US tariffs on China fail to raise US exports in both strategic and other sectors, while imports go down. As the increase in China's exports in strategic sectors is attenuated, the EU and other countries limit the declines in their export values in the same sectors. Overall, the US-China 2018-19 tariffs contain the rise of China's global market share in strategic sectors, as shown in Figure A.12 in Appendix, with the decline relative to the only-subsidy scenario mostly picked up by the EU and other countries.

[37] To isolate the effects of tariff increases, counterfactual China's tariffs under the 2018-19 and 2025 scenarios include only the changes in tariffs on imports from the US, while tariffs on other countries are kept at their 2015 levels.

To better understand the trade effects of the tariffs by the US and China, in Figure A.13 in Appendix we dissect the effect of the 2018-19 US-China tariffs on sales by destination market. The tariff hikes prove effective in curbing US-China trade. For instance, the 12 percent increase in China's exports to the US in strategic sectors under the subsidy-only scenario reverses to a 30 percent decline once the tariffs are included. Similarly, the modest decrease in US exports to China deepens to roughly a 30 percent drop when the 2018-19 tariff changes are accounted for. The change in sales in strategic sectors across other destinations is only mildly impacted by the 2018-19 tariffs. The increase in China's exports toward non-US destinations reflecting trade deflection and the rerouting of supply chains — as noted in the empirical literature (Fajgelbaum et al., 2024; Freund et al., 2024) — is attenuated in the model by the negative shock in external demand from the US, limiting economies of scale for China's exporters.

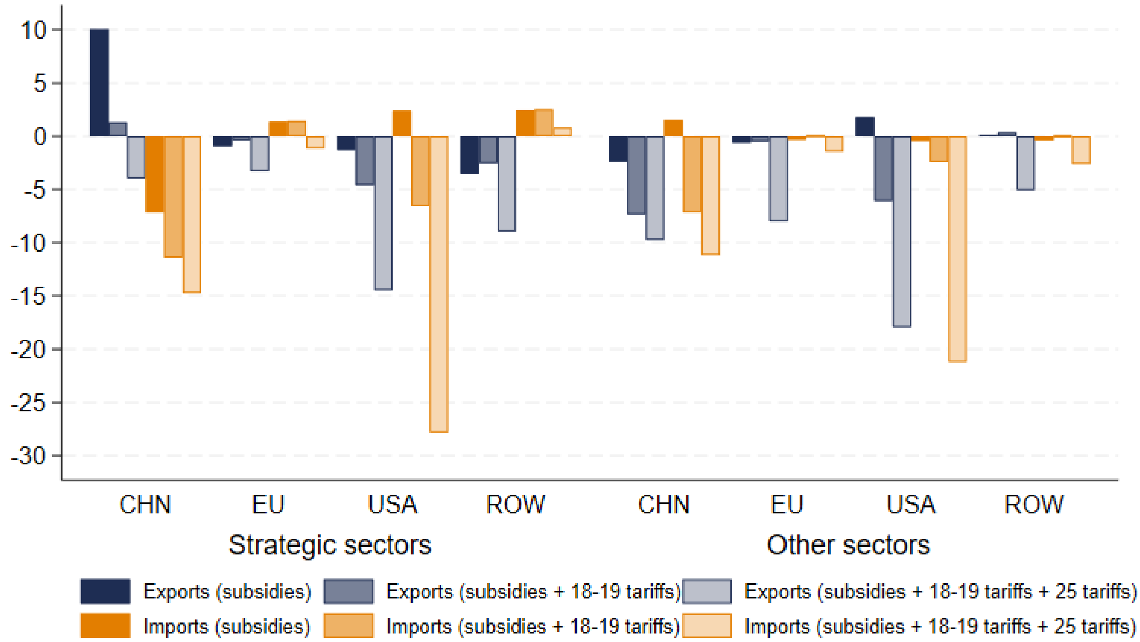
Tariff actions in 2025. The most recent tariff actions compound the impact of the 2018-19 tariff increases. As shown in Figure 10, China's exports in strategic sectors decline by 4 percent under a scenario with subsidies and US and China's tariffs as of March 2026. US imports in strategic and other sectors plummet by around 25 percent with the 2025 tariffs, while exports drop relatively less. This asymmetry in the export and import effects comes from the sectoral structure of US tariffs coupled with economies of scale — as shown in Figures A.11 and A.10 in Appendix. As a result, the US trade deficit in strategic sectors is reduced under the March 2026 tariff scenario (see Figure A.12 in Appendix). Biased toward sectors with higher scale elasticities, US tariffs push down the domestic prices of US products, partly offsetting the increase in prices from the standard general equilibrium response of local factor prices.[38]

Two other notable differences with respect to the 2018-19 tariff scenario affect the distribution of the trade effects for China and the US across destinations. First, in the US, sales in strategic sectors are redirected toward the domestic market: domestic sales increase by around 13 percent, while the decrease in exports is driven by a drop in sales to China. The other result is that the 2025 tariff actions lead to a less pronounced (1 pp lower) increase in China's exports to non-US markets in strategic sectors. The negative demand shock caused by higher US tariffs dampens China's resource reallocation toward strategic sectors such as electronics. This results in a weaker productivity boost from economies of scale, leading to a smaller expansion in sectoral exports that outweighs any terms-of-trade benefits from US tariffs driving down Chinese wages.[39]

[38] In their seminal paper, Bhagwati and Ramaswami (1963) show that an import tariff is equivalent to a production subsidy combined with a consumption tax. The 2025 US tariffs together with the assumption of a zero scale elasticity for the services aggregate sector lead to a significant reallocation from services to goods sectors in the US. While aggregate trade deficits are fixed by assumption, under the 2025 tariffs scenario the US reduces its trade deficits in goods (driven by the deficit in non-strategic goods sectors), as well as its trade surplus in services. We refer to Cuñat and Zymek (2025) for a model of endogenous aggregate trade balances with external economies of scale.

[39] This result is driven by the external economies of scale, and their correlation with the policy

Figure 10: Simulated trade effects of subsidies (in %) to strategic sectors and US and China tariff actions



Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under a scenario where all countries implement the estimated 2015-23 subsidy changes, a scenario where the US and China apply import tariffs at their post 2018-19 levels, and another scenario where the two countries apply import tariffs as of March 2026 (see Figure 9).

4.4 Efficiency and welfare implications

In models with economies of scale, policies that affect relative prices such as subsidies and import tariffs have ambiguous effects on efficiency and welfare. Production subsidies proportional to the sectoral scale elasticities are first best since they target the production externalities (Lashkaripour and Lugovskyy, 2023; Bartelme et al., 2025). However, any deviation from the optimal distribution of subsidies can create misallocation and reduce welfare (see e.g. Garcia-Macia et al. (2025)). Unilateral subsidies can create positive terms-of-trade spillovers, especially if targeted sectors have high scale elasticities and low trade elasticities (Lashkaripour and Lugovskyy, 2023). Positive import tariffs can be unilaterally optimal if they maximize terms-of-trade gains. As for subsidies, any deviation from the unilaterally optimal tariff level can, however, lead to distortions that outweigh the terms-of-trade gains. Furthermore, any unilateral gain

shocks across sectors. Using a similar model without economies of scale, Rotunno and Ruta (2026) find that China's exports are diverted toward non-US destinations under a scenario with the recent US tariff hikes.

from import tariffs is realized through imposing negative terms-of-trade externalities on tariffed countries, therefore reducing global efficiency.

We assess the efficiency and welfare implications of the 2015-23 changes in subsidy rates and the 2018-19 and 2025 tariff actions. In Figure 11, we display the simulated percent changes in real wages as a measure of aggregate efficiency, and real income — i.e., the welfare-relevant measure in the model, which includes changes in net government expenditure.

Welfare decreases globally under the subsidies scenario, as the fiscal costs of the policies outweigh any efficiency gains. Real wages go up in most countries as shown in panel (a), since the 2015-23 changes in subsidy rates correlate with scale elasticities, while subsidies at baseline in 2015 do not (see Figure A.3 in Appendix).[40] The increase in real wages is stronger for countries that implement larger subsidy increases in strategic sectors, since those are also the sectors with higher scale elasticities, which generate stronger productivity gains. However, real income and, hence, welfare decreases globally and for most countries under the subsidies scenarios, suggesting that the observed recent industrial subsidies are far from being optimal. Since trade and scale elasticities correlate negatively across sectors, subsidies that target sectors with stronger production externalities create more negative terms-of-trade effects on the implementing country, aggravating welfare losses.

Adding recent tariff actions deepens global inefficiencies and creates asymmetric effects across countries. Production and consumption distortions as well as negative terms-of-trade externalities on third countries lead to a decrease in average real wages under a scenario that includes the most recent tariff actions, thus outweighing any efficiency gains from subsidies. Similarly, counterfactual losses in global welfare widen. US welfare increases slightly under the 2025 tariff scenario, as the higher tariff revenues more than offset the reduction in real wages, moderated by the distribution of tariff hikes toward sectors with higher scale elasticities. This result clearly hinges on the lack of retaliation against US tariff hikes by all countries except China. Therefore, welfare losses deepen for all tariffed countries under the subsidy-and-tariff scenario.[41]

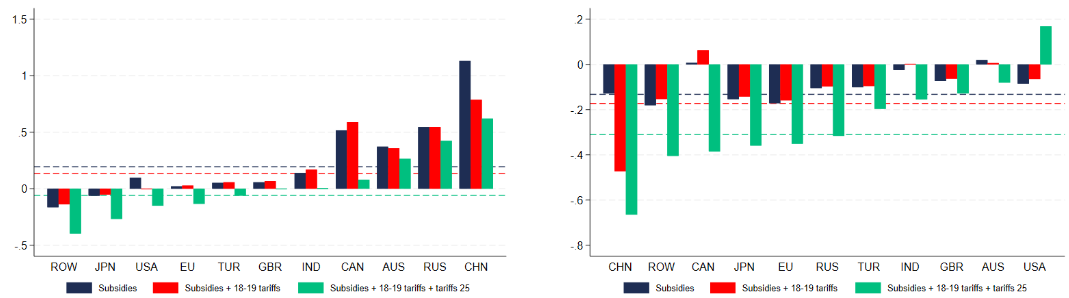
[40] The assumption that net government expenditure is financed by, or rebated through, lump-sum transfers to and from consumers overstates the impact of subsidies on real wages, relative to a framework where the government balances any deficit through distortionary income taxation.

[41] The global efficiency and welfare implications of subsidies and tariffs are qualitatively confirmed with different values for the scale elasticities, although the impacts differ across countries. Without external economies of scale, there are no production externalities, and welfare decreases under the subsidy scenario for all countries, as shown in Figure A.14 in Appendix. In the same version of the model, the efficiency costs of the tariffs for the US are deeper since scale elasticities are set to zero for all sectors. Therefore, tariffs are welfare reducing also for the US, confirming the results of Rotunno and Ruta (2026). In simulations with higher scale elasticities whose results are displayed in Figure A.15, the efficiency gains from subsidies are stronger for countries like China and Canada, which subsidize more strategic sectors. Globally however, subsidies are both inefficient and welfare-reducing. Adding recent tariff actions deepens global inefficiencies as in the baseline, even if the US realizes stronger gains by increasing tariffs more in sectors with higher scale elasticities. Finally, using trade and scale

The results on real wages and welfare underscore how unilateral industrial policies can create inefficiencies. Even in a theoretical framework (as the present one) that could justify government intervention, ill-targeted and uncoordinated subsidies are costly. Recent tariff actions compound these global inefficiencies, highlighting the negative effects of a subsidy-tariff spiral.

Figure 11: Simulated changes in real wages and income (in %)

(a) Real wages (b) Real income



Note: Horizontal dashed lines are world averages, computed using real GDP in 2015 as weights.

5 Conclusion

In this paper, we investigate the trade effects of subsidies by major economies during the period 2015-23. Using novel estimates of subsidy rates derived from observed policy measures and a quantitative general equilibrium trade model with external economies of scale, we analyze how these industrial policies reshape global trade patterns. Our findings highlight the trade impacts of China's subsidies in strategic sectors, especially electronics, through productivity responses. In contrast, subsidies by the EU, the US, and other major subsidizers exert relatively smaller trade spillovers. The model captures significant cross-border effects, with countries subsidizing less experiencing export losses in targeted sectors, while some reallocate resources toward sectors where China contracts. The US-China 2018-19 tariffs and the tariff actions in 2025 moderate these dynamics. Both subsidies and tariffs however come at the cost of lower welfare globally. Subsidies during 2015-23 are higher in sectors with stronger production externalities, thus increasing real wages. But their fiscal costs and terms-of-trade effects are still found to outweigh any efficiency gains. Tariffs deepen further efficiency losses by exerting negative externalities on tariffed countries.

Looking ahead, several avenues for future research appear promising. First, exploring the role of other industrial policy instruments, such as tax incentives and preferential financing, could provide a more comprehensive picture of government inter-

elasticities from Lashkaripour and Lugovskyy (2023) in Figure A.16 confirms the overall effects on efficiency and welfare.

ventions. Second, incorporating dynamic elements and frictions to capture adjustment costs would enrich insights into the transition to the long-run changes that we highlight. Third, as calibration of the scale elasticities plays an important role in determining endogenous responses in the model, more work is needed to understand the importance of externalities in non-manufacturing sectors and, especially, in services. Finally, as policy responses by trade partners are endogenous and would likely respond to changes in trade flows, modeling these interactions would provide further insights.

References

Aiyar, Shekhar, Anna Ilyina, Jiaqian Chen, Alvar Kangur, Juan Trevino, Christian Ebeke, Tryggvi Gudmundsson, Gabriel Soderberg, Tatjana Schulze, Tansaya Kunaratskul, Michele Ruta, Roberto Garcia-Saltos, and Sergio Rodriguez. 2023. "Geo-Economic Fragmentation and the Future of Multilateralism." *Staff Discussion Notes*, , (001).

Bartelme, Dominick, Arnaud Costinot, Dave Donaldson, and Andrés Rodriguez-Clare. 2025. "The textbook case for industrial policy: Theory meets data." *Journal of Political Economy*, 133(5): 1527–1573.

Barwick, Panle Jia, Hyuk-Soo Kwon, Shanjun Li, and Nahim Zahur. 2025. "Drive Down the Cost: Learning by Doing and Government Policies in the Global EV Battery Industry." National Bureau of Economic Research Working Paper 33378.

Becko, John Sturm, and Daniel O'Connor. 2024. "Strategic (dis) integration." Working paper.

Bhagwati, Jagdish, and Vangal K Ramaswami. 1963. "Domestic distortions, tariffs and the theory of optimum subsidy." *Journal of Political economy*, 71(1): 44–50.

Boullenois, Camille, Agatha Kratz, and Daniel Rosen. 2025. "Far From Normal: An Augmented Assessment of Chinas State Support." *Rhodium Group*, 17.

Bown, Chad P. 2021. "The US–China trade war and Phase One agreement." *Journal of Policy Modeling*, 43(4): 805–843.

Bown, Chad P. 2024. "Modern industrial policy and the World Trade Organization." *Annual Review of Economics*, 16(1): 243–270.

Caliendo, Lorenzo, and Fernando Parro. 2015. "Estimates of the Trade and Welfare Effects of NAFTA." *The Review of Economic Studies*, 82(1): 1–44.

Cesa-Bianchi, Ambrogio, Andrea Ferrero, Luca Fornaro, and Martin Wolf. 2026. "Industrial policies, global imbalances and technological hegemony."

Choi, Jaedo, and Andrei A Levchenko. 2025. "The long-term effects of industrial policy." *Journal of Monetary Economics*, 103779.

Clayton, Christopher, Matteo Maggiori, and Jesse Schreger. 2023. "A framework for geoeconomics." National Bureau of Economic Research.

Clayton, Christopher, Matteo Maggiori, and Jesse Schreger. 2024. "A theory of economic coercion and fragmentation." *Available at SSRN 4767131.*

Clayton, Christopher, Matteo Maggiori, and Jesse Schreger. 2025. "Putting economics back into geoeconomics." National Bureau of Economic Research.

Cuñat, Alejandro, and Robert Zymek. 2025. "Unbalanced Trade 2.0."

Dekle, Robert, Jonathan Eaton, and Samuel Kortum. 2007. "Unbalanced trade." *American Economic Review*, 97(2): 351–355.

Ethier, Wilfred J. 1982. "Decreasing costs in international trade and Frank Graham's argument for protection." *Econometrica: Journal of the Econometric Society*, 1243–1268.

European Commission. 2025. "State Aid Scoreboard 2024." European Commission, DG Competition.

Evenett, Simon, Adam Jakubik, Fernando Martín, and Michele Ruta. 2024. "The return of industrial policy in data." *The World Economy*, 47(7): 2762–2788.

Evenett, Simon, Adam Jakubik, Jaden Jonghyuk Kim, Fernando Martín, Samuel Pienknagura, Michele Ruta, Sandra Baquie, Yueling Huang, and Rafael Machado Parente. 2025. "Industrial Policy Since the Great Financial Crisis."

Fajgelbaum, Pablo, Pinelopi Goldberg, Patrick Kennedy, Amit Khandelwal, and Daria Taglioni. 2024. "The US-China trade war and global reallocations." *American Economic Review: Insights*, 6(2): 295–312.

Fang, Hanming, Ming Li, and Guangli Lu. 2025. "Decoding China's industrial policies." National Bureau of Economic Research.

Fernandes, Ana Margarida, and Tristan Reed. 2026. "Industrial Policy for Development: Approaches in the 21st Century." *Policy Research Reports. World Bank*.

Freund, Caroline, Aaditya Mattoo, Alen Mulabdic, and Michele Ruta. 2024. "Is US trade policy reshaping global supply chains?" *Journal of International Economics*, 152: 104011.

Garcia-Macia, Daniel, Siddharth Kothari, Yutong Li, and Yifan Tao. 2025. "Industrial Policy in China: Quantification and Impact on Misallocation." IMF Working Paper.

Giri, Rahul, Kei-Mu Yi, and Hakan Yilmazkuday. 2021. "Gains from trade: Does sectoral heterogeneity matter?" *Journal of International Economics*, 129: 103429.

Goldberg, Pinelopi K., Réka Juhász, Nathan J. Lane, Giulia Lo Forte, and Jeff Thurk. 2024. "Industrial Policy in the Global Semiconductor Sector." National Bureau of Economic Research.

Gourinchas, Pierre-Olivier, Gene Kindberg-Hanlon, Manasa Patnam, Lorenzo Rotunno, and Michele Ruta. 2026. "Global Imbalances, Industrial Policy and Tariffs." International Monetary Fund.

Graham, Frank D. 1923. "Some aspects of protection further considered." *The Quarterly Journal of Economics*, 37(2): 199–227.

Grossman, Gene, and Esteban Rossi-Hansberg. 2010. "External economies and international trade redux." *The Quarterly Journal of Economics*, 125(2): 829–858.

Grossman, Gene M, and Alan O Sykes. 2025. "Industrial policy and subsidies: Assessment of current rules and possible reforms." *Journal of World Trade*, 59(4).

Hirschman, Albert O. 1945. *National power and the structure of foreign trade.* Univ of California Press.

Hodge, Andrew, Roberto Piazza, Fuad Hasanov, Xun Li, Maryam Vaziri, Atticus Weller, and Yu Ching Wong. 2024. "Industrial policy in europe: A single market perspective." International Monetary Fund.

Huang, Yueling, Sandra Baquie, Florence Jaumotte, Jaden Kim, Yucheng Lu, Rafael Machado Parente, and Samuel Pienknagura. 2025. "Do Industrial Policies Increase Trade Competitiveness?"

IMF. 2025. "World Economic Outlook." *October 2025.*

Itskhoki, Oleg, and Dmitry Mukhin. 2025. "Global Imbalances: A Progress Report."

James, Gareth, Daniela Witten, Trevor Hastie, Robert Tibshirani, et al. 2013. *An introduction to statistical learning.* Vol. 112, Springer.

Juhász, Réka, Nathan Lane, and Dani Rodrik. 2024. "The new economics of industrial policy." *Annual Review of Economics*, 16(1): 213–242.

Juhász, Réka, Nathan Lane, Emily Oehlsen, and Verónica C. Pérez. 2022. "The Who, What, When, and How of Industrial Policy: A Text-Based Approach."

Ju, Jiandong, Hong Ma, Zi Wang, and Xiaodong Zhu. 2024. "Trade wars and industrial policy competitions: Understanding the US-China economic conflicts." *Journal of Monetary Economics*, 141: 42–58.

Ju, Jiandong, Yuankun Li, and Shang-Jin Wei. 2026. "The United States as an Active Industrial Policy Nation." National Bureau of Economic Research.

Kalouptsidi, Myrto. 2018. "Detection and impact of industrial subsidies: The case of Chinese shipbuilding." *The Review of Economic Studies*, 85(2): 1111–1158.

Krugman, Paul R. 1979. "Increasing returns, monopolistic competition, and international trade." *Journal of International Economics*, 9(4): 469–479.

Kucheryavyy, Konstantin, Gary Lyn, and Andrés Rodríguez-Clare. 2023. "Grounded by Gravity: A Well-Behaved Trade Model with Industry-Level Economies of Scale." *American Economic Journal: Macroeconomics*, 15(2): 372412.

Lane, Nathan. 2025. "Manufacturing revolutions: Industrial policy and industrialization in South Korea." *The Quarterly Journal of Economics*, 140(3): 1683–1741.

Lashkaripour, Ahmad, and Volodymyr Lugovskyy. 2023. "Profits, scale economies, and the gains from trade and industrial policy." *American Economic Review*, 113(10): 2759–2808.

Lyn, Gary, and Andrés Rodríguez-Clare. 2013. "External economies and international trade redux: Comment." *The Quarterly Journal of Economics*, 128(4): 1895–1905.

Machado Parente, Rafael, Sandra Baquie, Yueling Huang, Florence Jaumotte, Jaden Kim, and Samuel Pienknagura. 2025. "Industrial Policies and Firm Performance: A Nuanced Relationship." International Monetary Fund.

Manelici, Isabela, and Smaranda Pantea. 2021. "Industrial policy at work: Evidence from Romanias income tax break for workers in IT." *European Economic Review*, 133: 103674.

Mattoo, Aaditya, Michele Ruta, and Robert W Staiger. 2024. "Geopolitics and the world trading system." National Bureau of Economic Research.

Mavroidis, Petros C. 2025. *Industrial policy, national security, and the perilous plight of the WTO.* Oxford University Press.

Mearsheimer, John J. 2014. *The tragedy of great power politics (Updated edition).* WW Norton & Company.

Mohr, Cathrin, and Christoph Trebesch. 2025. "Geoeconomics." *Annual Review of Economics*, 17.

OECD. 2025*a*. "How Governments Back The Largest Manufacturing Firms." *OECD Trade Policy Papers*, , (289).

OECD. 2025*b*. "The Market Implications of Industrial Subsidies." *OECD Trade Policy Papers*, , (296).

OECD. 2025*c*. "OECD Inter-Country Input-Output Tables."

Rotunno, Lorenzo, and Michele Ruta. 2024*a*. "Trade Implications of China's Subsidies."

Rotunno, Lorenzo, and Michele Ruta. 2024*b*. "Trade spillovers of domestic subsidies." International Monetary Fund.

Rotunno, Lorenzo, and Michele Ruta. 2026. "Trade partners responses to US tariffs." *IMF Economic Review*, 1–38.

Simonovska, Ina, and Michael E Waugh. 2014. "The elasticity of trade: Estimates and evidence." *Journal of International Economics*, 92(1): 34–50.

UNCTAD. 2019. *International classification of non-tariff measures.* UN.

WTO-IMF. 2026. "Methodology Note for the WTO-IMF Tariff Tracker." World Trade Organization and International Monetary Fund.

Zhang, Ping. 1993. "Model selection via multifold cross validation." *The Annals of Statistics*, 299–313.

A Appendix

A.1 Quantitative model

Equilibrium conditions

Equation (5) in the main text shows the sectoral price index (P_n^j) in equilibrium. Sectoral employment satisfies

$$\text{(A.1)}\quad w_i\, L_i^j \;=\; \beta_i^j \tilde{s}_i^j \sum_{n=1}^{N} \frac{X_{in}^j}{\tilde{t}_{in}^j},$$

such that subsidies increase the labor income in the sector and country receiving the subsidy by increasing the demand for its goods from all countries in the economy. The labor market clearing pins down the wages such that total employment demand across all sectors in a country equals to total labor supplied:

$$\text{(A.2)}\quad \sum_{j=1}^{J} L_i^j \;=\; \bar{L}_i.$$

If sector j is subsidized in a country, the demand for workers increases in that sector. But since the labor supply is constant and labor is immobile across countries, workers from other sectors k will be reallocated to sector j for equation A.2 to hold.

The total income in country i (with production subsidy collected before import tariffs) is a sum of labor income across all sectors, transfers from the government, and exogenous trade deficit. Since the wages are equalized across sectors, the total labor income $\sum_j w_i L_i^j = w_i \bar{L}_i$. Government transfers are a sum of revenues earned on import tariffs net of lump-sum taxation to fund production subsidies. This can be written as

$$\text{(A.3)}\quad Y_i \;=\; w_i\,\bar{L}_i \;+\; R_i + D_i, \qquad R_i \equiv \underbrace{\sum_{j=1}^{J}\sum_{k=1}^{N} \frac{t_{ki}^j}{\tilde{t}_{ki}^j}\,X_{ki}^j}_{\text{Import Tariff Revenue}} \;-\; \underbrace{\sum_{j=1}^{J} s_i^j \sum_{n=1}^{N} \frac{1}{\tilde{t}_{in}^j}\,X_{in}^j}_{\text{Production Subsidy Expenditure}}$$

The final consumption price index is Cobb-Douglas aggregate across sectors:

$$\text{(A.4)}\quad P_n \;=\; \prod_{j=1}^{J} \left(P_n^j\right)^{\alpha_n^j}.$$

Sectoral expenditure is:

$$\text{(A.5)}\quad X_i^j \;=\; \alpha_i^j\,Y_i \;+\; \sum_{s=1}^{J} (1-\beta_i^s)\;\gamma_i^{sj} \sum_{n=1}^{N} \frac{X_{in}^s}{\tilde{t}_{in}^s}.$$

Given parameters $\left(\theta^j, \psi^j, \alpha_i^j, \beta_i^j, \gamma_i^{sj}, \bar{L}_i,\, t_{in}^j,\, T_i^j,\, D_i,\, \tau_{in}^j\right)$, an equilibrium is a set $\left(w_i,\, L_i^j,\, P_i^j,\, X_i^j\right)$ such that:

1. Sectoral price indices (P_n^j) satisfy (5);
2. Sectoral employment satisfies (A.1);
3. Labor market clearing holds via (A.2);
4. Sectoral goods markets clear via (A.5).

Under this equilibrium using 1, 2, 3, and 4, we solve for $3 \times \text{N} \times \text{J} + \text{N}$ equations and $3 \times \text{N} \times \text{J} + \text{N}$ unknowns.

Model in Differences

Inspired by the exact hat algebra introduced by Dekle, Eaton and Kortum (2007), we can write this system of equations in differences, as in Ju et al. (2024). For any variable x, let $\hat{x} \equiv x'/x$ denote the counterfactual-to-baseline ratio.

Sectoral unit costs are Cobb—Douglas in wages and intermediate prices:

$$(A.6)\quad \hat{c}_i^j \;=\; \left(\hat{L}_i^j\right)^{-\psi_j} \hat{w}_i^{\beta_i^j} \left[\prod_{s=1}^{J} \left(\hat{P}_i^s\right)^{\gamma_i^{sj}}\right]^{1-\beta_i^j}, \qquad \sum_{s=1}^{J} \gamma_i^{sj} = 1.$$

Define the cost shifter for shipments from $i \to n$ in sector j:

$$Z_{in}^j \;\equiv\; \left(\frac{\hat{c}_i^j\, \hat{\tau}_{in}^j\, \hat{\tilde{t}}_{in}^j}{\hat{\tilde{s}}_i^j}\right)^{-\theta^j}.$$

Then the changes in the CES price index is

$$(A.7)\quad \hat{P}_n^j \;=\; \left[\sum_{i=1}^{N} \pi_{in}^j\, Z_{in}^j\right]^{-1/\theta^j},$$

where π_{in}^j are baseline trade shares. The counterfactual trade shares update as in equation (7) in the main text. Using that result, total revenue changes are

$$(A.8)\quad \sum_n \frac{\widehat{X}_{in}^j}{\tilde{t}_{in}^j} \;=\; \sum_n \nu_{in}^j\, \frac{\hat{\pi}_{in}^j\, \hat{X}_n^j}{\hat{\tilde{t}}_{in}^j}.$$

where the baseline weights are defined as

$$\nu_{in}^j \;\equiv\; \frac{X_{in}^j/\tilde{t}_{in}^j}{\sum_m X_{im}^j/\tilde{t}_{im}^j}.$$

The changes in sectoral revenues are used to derive changes in sectoral employment:

$$(A.9)\quad \hat{L}_i^j \;=\; \frac{\hat{\tilde{s}}_i^j}{\hat{w}_i} \sum_n \nu_{in}^j\, \frac{\hat{\pi}_{in}^j\, \hat{X}_n^j}{\hat{\tilde{t}}_{in}^j}.$$

With fixed labor supply $\bar{L}_i$, the employment-weighted average of changes in sectoral employment must equal one:

$$(A.10)\quad \sum_{j=1}^{J} \lambda_i^j\, \hat{L}_i^j \;=\; 1, \qquad \lambda_i^j \equiv \frac{L_i^j}{\bar{L}_i}.$$

Changes in nominal income depend on changes in wages, net government revenues and trade deficits:

$$(A.11)\quad \hat{Y}_i \;=\; \zeta_{w,i}\, \hat{w}_i \;+\; \zeta_{R,i}\, \hat{R}_i \;+\; \zeta_{D,i}\, \hat{D}_i,$$

where $\zeta_{w,i}, \zeta_{R,i}, \zeta_{D,i}$ are baseline shares of labor income, net tariff revenue, and deficits. Changes in the consumer price index aggregate the changes in sectoral prices:

$$\text{(A.12)} \quad \hat{P}_n = \prod_{j=1}^{J} (\hat{P}_n^j)^{\alpha_n^j}.$$

The last piece in the characterization of the equilibrium in changes is sectoral expenditure. As shown in equation (A.5), they equal expenditure on good j as final good (from the Cobb-Douglas assumption, a constant share of total income) and expenditure as an intermediate. Using the following definitions:

$$\xi_n^j \equiv \frac{\alpha_n^j Y_n}{X_n^j}, \qquad \kappa_n^{js} \equiv \frac{(1-\beta_n^s)\,\gamma_n^{sj}\,\sum_i X_{in}^s/\tilde{t}_{in}^s}{X_n^j}, \qquad \nu_{in}^s \equiv \frac{X_{in}^s/\tilde{t}_{in}^s}{\sum_m X_{mn}^s/\tilde{t}_{mn}^s}.$$

Changes in sectoral expenditure can be written as:

$$\text{(A.13)} \quad \hat{X}_n^j = \xi_n^j\,\hat{\alpha}_n^j \hat{Y}_n + \sum_{s=1}^{J} \kappa_n^{js} \left[\sum_{i=1}^{N} \nu_{in}^s \frac{\hat{\pi}_{in}^s \hat{X}_n^s}{\hat{\tilde{t}}_{in}^s} \right].$$

Decomposition

We start by substituting the unit cost function in equation (3) into the expression for the trade share in equation (6):

$$\begin{aligned}
\pi_{in}^j &= T_i^j \cdot \left(\frac{1}{\left(L_i^j\right)^{\psi^j}} \cdot w_i^{\beta_i^j} \cdot \prod_s (P_i^s)^{\gamma_i^{sj}(1-\beta_i^j)} \cdot \tau_{in}^j \cdot \tilde{t}_{in}^j \right)^{-\theta^j} \cdot \left(\tilde{s}_i^j\right)^{\theta^j} \cdot \left(P_n^j\right)^{\theta^j} \\
&= T_i^j \cdot \left(L_i^j\right)^{\psi^j \theta^j} \cdot w_i^{-\beta_i^j \theta^j} \cdot \left(\prod_s (P_i^s)^{-\gamma_i^{sj}(1-\beta_i^j)\theta^j} \right) \cdot (\tau_{in}^j \tilde{t}_{in}^j)^{-\theta^j} \cdot \left(\tilde{s}_i^j\right)^{\theta^j} \cdot \left(P_n^j\right)^{\theta^j}
\end{aligned}$$

Taking log differences (with $\Delta \ln x = \ln x' - \ln x$):

(A.14)

$$\begin{aligned}
\Delta \ln X_{in}^j = \Delta \ln T_i^j \, + \, \theta^j \psi^j \, \Delta \ln L_i^j \, - \, \theta^j \beta_i^j \, \Delta \ln w_i \, - \, \theta^j (1-\beta_i^j) \sum_s \gamma_i^{sj} \, \Delta \ln P_i^s \\
- \theta^j \left(\Delta \ln \tau_{in}^j + \Delta \ln \tilde{t}_{in}^j \right) \, + \, \theta^j \, \Delta \ln \tilde{s}_i^j \, + \, \theta^j \, \Delta \ln P_n^j \, + \, \Delta \ln X_n^j
\end{aligned}$$

We set $\Delta \ln \tau_{in}^j = \Delta \ln \tilde{t}_{in}^j = 0$ since bilateral trade costs and tariffs are assumed to be invariant under a subsidy-only scenario. Log changes in aggregate exports from country i in sector j are derived by applying a Törnqvist aggregation across destination markets:

$$\Delta \ln Exp_i^j \approx \sum_{n \neq i} \bar{r}_{ni}^j \, \Delta \ln X_{ni}^j + \epsilon_i^j$$

where $\bar{r}_{ni}^j \equiv \frac{1}{2}\left({r_{ni}^j}' + r_{ni}^j \right)$ are Törnqvist expenditure weights, with $r_{ni}^j \equiv \frac{X_{ni}^j}{\sum_{n \neq i} X_{ni}^j}$ defined as country n's share in total exports of country i. The term ϵ_i^j is a (typically small) approximation error. Using the expression in eq (A.14) and rearranging gives the decomposition shown in eq (8) in the main text.

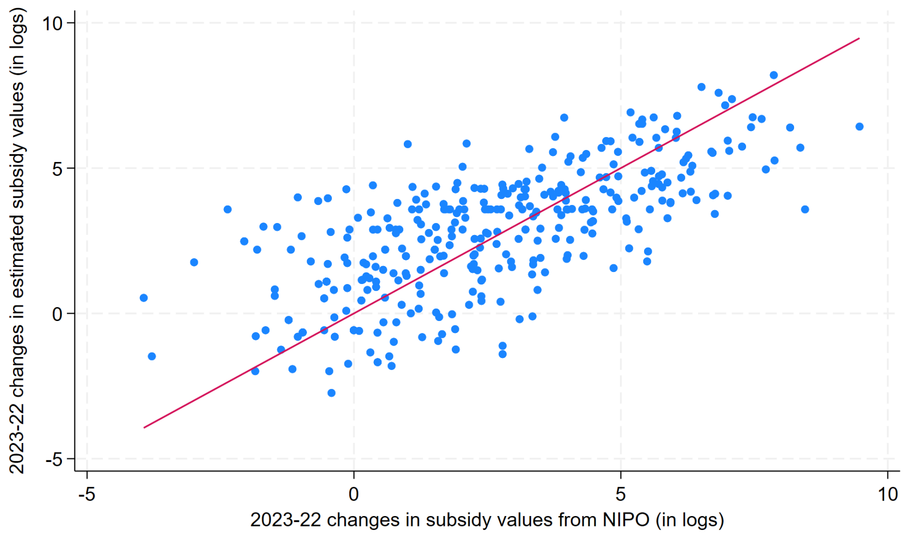
A.2 Additional Tables and Figures

Table A.1: ATP share and elasticities by sector

(1) Sector code	(2) Sector name	(3) ATP share	(4) θ^j (BCDR, 2025) (baseline)	(5) θ^j (LL, 2023) (robustness)	(6) ψ^j (BCDR, 2025) (baseline)	(7) ψ^j (BCDR, 2025) (robustness)	(8) ψ^j (LL, 2023) (robustness)
Strategic sectors							
C20	Chemicals	0.03	3.75	3.97	0.16	0.22	0.23
C21	Pharma	0.15	3.75	3.97	0.16	0.22	0.23
C25	Fabricated metals	0.04	5.07	3.00	0.12	0.18	0.21
C26	Electronics	0.42	3.27	1.24	0.21	0.27	0.55
C27	Electrical eq.	0.06	3.27	1.24	0.19	0.25	0.55
C28	Machinery	0.11	3.27	7.75	0.21	0.26	0.12
C30	Transport eq.	0.25	4.47	2.81	0.14	0.20	0.13
C31T33	Oth. Manufacturing	0.03	4.32	6.17	0.14	0.21	0.15
Other sectors							
A01_03	Agriculture	0	4.32	6.23	0.00	0.00	0.14
B05T08	Mining	0	4.32	6.23	0.00	0.00	0.14
C10T12	Food	0	3.57	2.30	0.17	0.24	0.39
C13T15	Textile	0	4.43	3.36	0.14	0.21	0.22
C16	Wood	0	4.32	3.90	0.12	0.19	0.23
C17_18	Paper	0	2.97	2.65	0.22	0.31	0.32
C19	Oil products	0	8.94	0.64	0.07	0.11	1.22
C22	Plastic	0	4.13	5.16	0.13	0.20	0.14
C23	Mineral products	0	5.14	5.28	0.12	0.19	0.17
C24	Basic metals	0	8.94	3.00	0.06	0.11	0.21
C29	Autos	0	4.47	2.81	0.14	0.19	0.13
S	Services	0	4.32	3.00	0.00	0.00	0.00
Mean (strategic)			3.9	3.77	0.17	0.23	0.27
Mean (other)			4.99	3.71	0.10	0.15	0.28
Mean (all)			4.56	3.74	0.13	0.19	0.27

Note: Sectors are defined as in the OECD ICIO tables (OECD, 2025*c*), with the following changes: Agriculture and Hunting (A01), Forestry Logging (A02) and Fishing (A03) are aggregated into "Agriculture"; "Mining of coal and lignite (B05), Extraction of crude petroleum and natural gas (B06), Mining of metal ores (B07), and Other mining and quarrying (B08) into Mining; Basic iron and steel (C24A) and Manufacture of basic precious and other non-ferrous metals (C24B) into a single "Basic Metals" sector; and Building of ships and boats (C301) and Manufacture of other transport equipment (C302T309) into a "Transport Equipment" sector. Service sectors are aggregated in a single services aggregate (S). The "ATP share" column reports the fraction of HS 6-digit (2012 revision) products within each sector that are classified as ATP. "BCDR, 2025" stands for Bartelme et al. (2025); while "LL, 2023" stands for Lashkaripour and Lugovskyy (2023). The values for the trade elasticity parameters in column (4) are from Giri, Yi and Yilmazkuday (2021) for manufacturing sectors, used by Bartelme et al. (2025). For non-manufacturing, the median value is chosen. The elasticities in column (5) are from Lashkaripour and Lugovskyy (2023). The scale elasticity values in columns (6) and (7) are from Bartelme et al. (2025) (see column (2) in their Table B7 in Appendix for "baseline" values in column(6), and column (2) of Table 1 of their paper for values in column (7)). The scale elasticities in column (8) are from Lashkaripour and Lugovskyy (2023).

Figure A.1: Predicted and observed subsidy changes in 2023



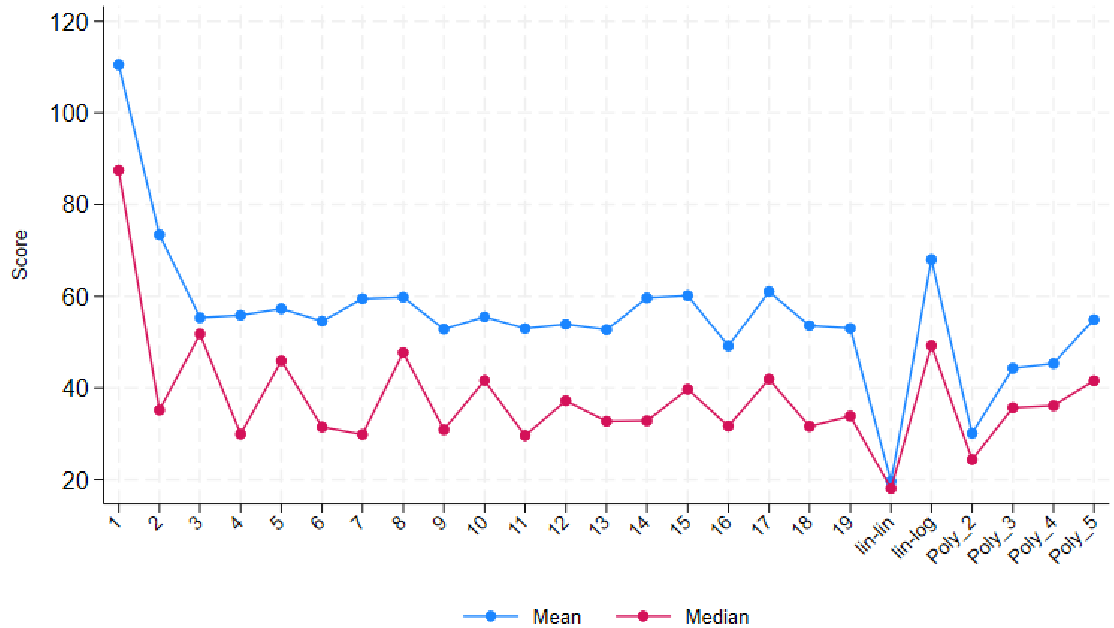
Note: Changes in subsidies predicted using subsidy counts in GTA data for 2023 on the vertical axis. Subsidy changes in 2023 as observed in NIPO data on the horizontal axis are as reported for the year 2023 — i.e., assuming no subsidy was disbursed in 2022. Both variables are in logs to attenuate the influence of outliers and exclude observations where both series have zero values. Each dot is a country-sector combination in the raw data — i.e., with all countries (including EU members) and all available OECD ICIO goods sectors.

Table A.2: Predicted and observed subsidy changes in 2023 — regressions with fixed effects

	(1)	(2)	(3)	(4)
Dep. variable	ΔS GTA	ΔS GTA	ΔS GTA	ΔS GTA
Model	No FEs	Sector FEs	Country FEs	Sector FEs + Country FEs
ΔS NIPO	0.594***	0.526***	0.543***	0.407***
	(0.034)	(0.088)	(0.046)	(0.057)
Obs	341	341	334	334
R^2	0.48	0.61	0.69	0.80

Note: Changes in subsidies predicted using subsidy counts in GTA data for 2023 as dependent variable. Subsidy changes in 2023 as observed in NIPO data as regressor and as reported for the year 2023 — i.e., assuming no subsidy was disbursed in 2022. Both variables are in logs to attenuate the influence of outliers and exclude observations where both series have zero values. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% level.

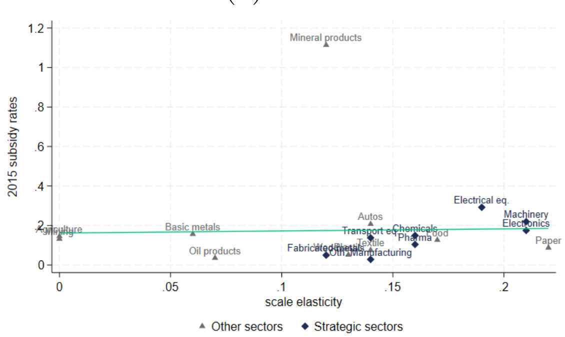
Figure A.2: Mean and median of median absolute deviations of prediction errors from 10-fold cross-validation — without fixed effects



Note: Mean and median of MAD values from 10-fold cross-validation exercises applied to different functional forms of a regression of the changes in the dollar value of subsidies on the changes in the count of subsidy measures, without fixed effects. Models are labeled along the horizontal axis. The labels “1” to “19” denote the number of dummies for quantiles of the count variable (the first quantile being always the excluded category).

Figure A.3: Global subsidy rates and scale elasticities

(a) 2015



(b) 2015-23 changes

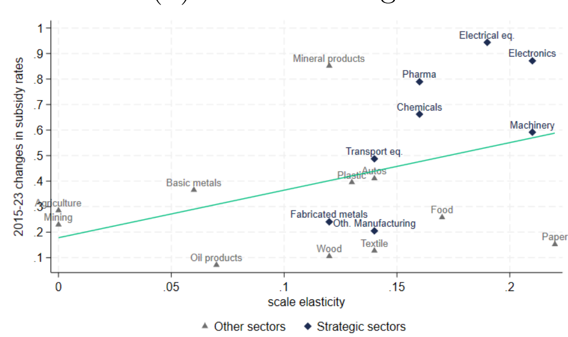
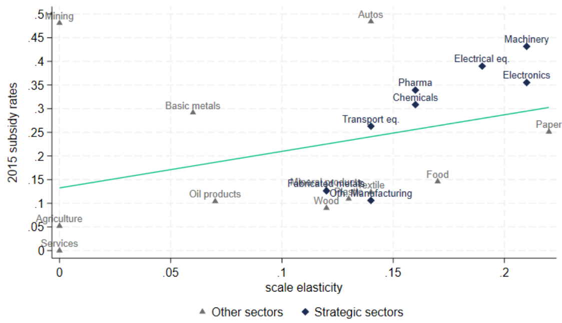


Figure A.4: China subsidy rates and scale elasticities

(a) 2015



(b) 2015-23 changes

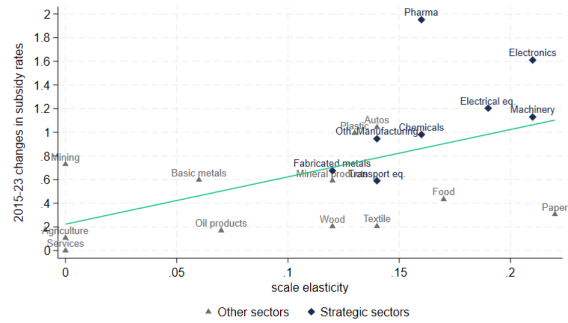
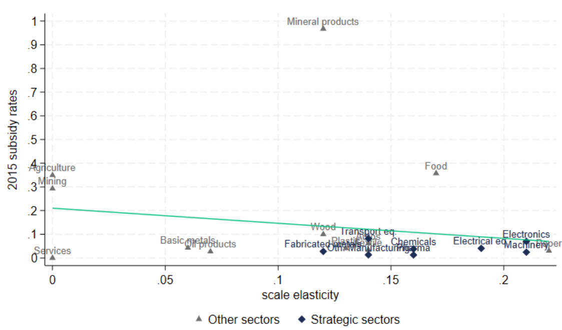


Figure A.5: EU subsidy rates and scale elasticities

(a) 2015



(b) 2015-23 changes

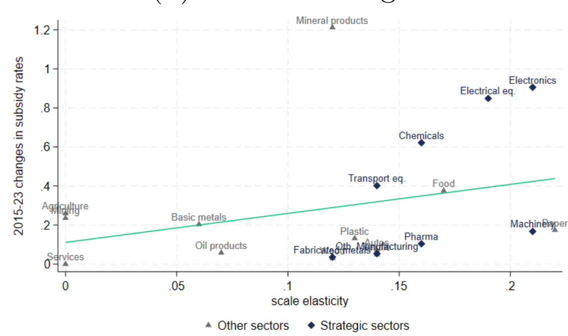
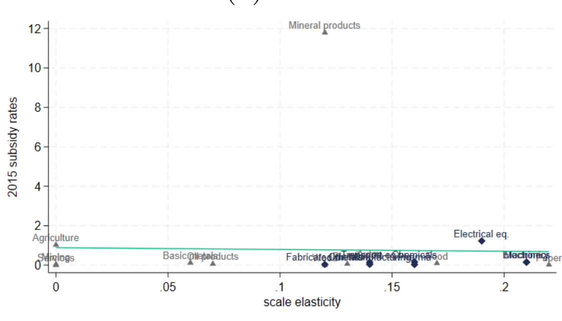
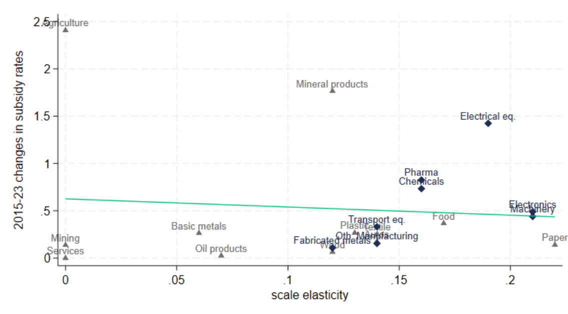


Figure A.6: US subsidy rates and scale elasticities

(a) 2015



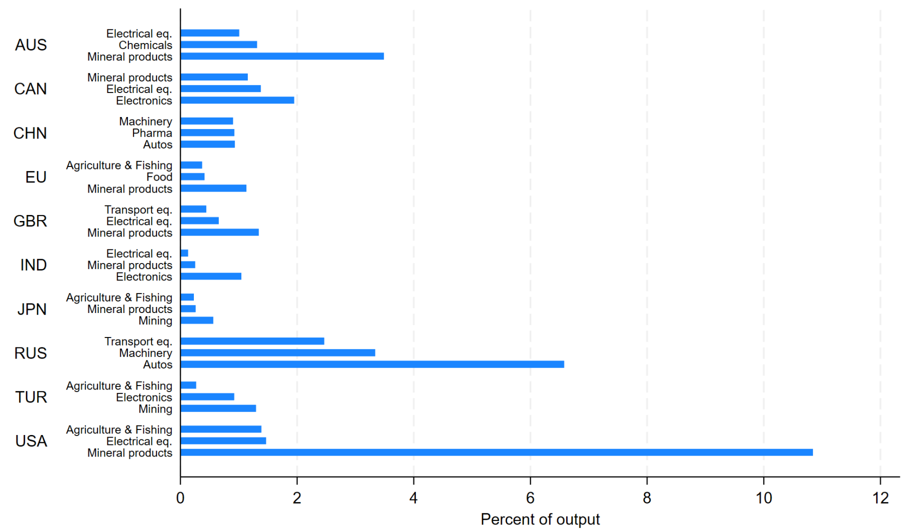
(b) 2015-23 changes



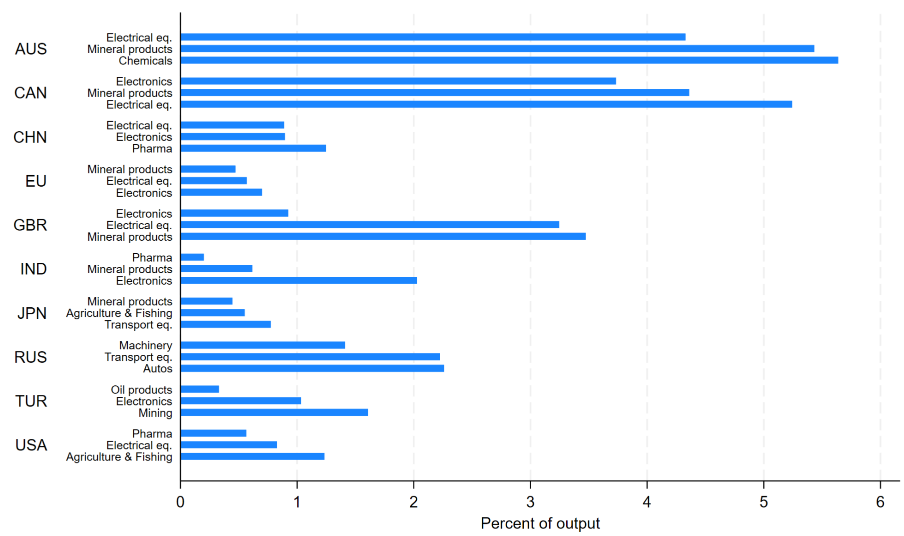
Note: Subsidy rates computed using gross output in 2015. Sectoral scale elasticities as in Bartelme et al. (2025) reported in Table A.1.

Figure A.7: Predicted subsidies as a share of gross output

(a) 2015-23 average



(b) 2015-23 changes



Note: Ten countries with the largest estimated subsidy values during 2015-23. Subsidy values are estimated applying a coefficient of 35.8 to yearly changes in counts of subsidy measures from the GTA data, and taking a cumulative sum over time. For each country, the three sectors with the highest levels of (panel (a)) and changes in (panel (b)) subsidy rates during 2015-23 are shown. Values are divided by sectoral gross output obtained from the OECD ICIO, and estimated for 2023 applying yearly GDP growth rates by country.

Table A.3: Counterfactual changes in exports and imports (in percent)

	Strategic sectors							
Subsidizers:	CHN		EU		USA		ALL	
Flow:	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp
AUS	-3.1	1.7	-0.4	0.1	-0.5	0.1	30.4	-3.1
CAN	-1.7	0.2	-0.4	0.1	-1.6	0.4	17.0	0.2
CHN	12.0	-7.6	-0.7	0.2	-0.4	0.0	10.0	-7.1
EU	-2.0	2.1	2.5	-1.8	-0.7	0.3	-0.9	1.4
GBR	-1.6	0.5	-1.2	0.9	-0.9	0.1	1.4	0.6
IND	-1.8	2.3	-0.4	0.2	-0.5	0.1	2.0	-0.2
JPN	-3.3	2.7	-0.4	0.1	-0.4	0.1	-2.2	2.2
ROW	-5.7	2.5	-0.7	0.4	-0.5	0.3	-7.4	3.7
RUS	-1.8	1.8	-1.2	0.6	-0.5	0.0	3.1	0.3
TUR	-1.7	0.6	-1.0	0.5	-0.2	-0.1	-2.7	1.4
USA	-2.4	2.2	-0.6	0.3	2.7	-1.5	-1.3	2.4
	Other sectors							
Subsidizers:	CHN		EU		USA		ALL	
Flow:	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp
AUS	-0.5	0.1	-0.2	0.0	-0.3	0.0	-1.4	0.2
CAN	-0.5	-0.1	-0.1	0.0	-0.4	0.4	2.5	1.7
CHN	-2.4	1.9	0.1	-0.2	-0.3	0.2	-2.4	1.6
EU	-0.3	-0.4	0.7	0.0	-0.3	0.0	-0.6	-0.3
GBR	-0.9	-0.1	-0.2	0.2	-0.4	0.0	1.0	0.1
IND	0.0	-0.2	-0.2	0.0	-0.4	0.0	-1.5	0.4
JPN	0.1	-0.7	-0.2	0.0	-0.3	0.1	-2.0	-0.5
ROW	0.7	-1.2	0.0	0.2	-0.3	0.2	0.4	-0.6
RUS	-0.3	-0.2	-0.1	0.2	-0.2	0.0	-0.4	-5.8
TUR	-0.5	-0.1	0.0	0.0	-0.3	0.0	0.0	-1.0
USA	-0.4	-0.1	-0.3	0.1	2.3	-0.9	1.8	-0.5

Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under scenarios where (i) only China implements the estimated 2015-23 subsidy changes ("China"); (ii) only the EU implements the subsidies ("EU"); (iii) only the US implements the subsidies ("USA"); and (iv) all countries and the ROW aggregate implement the estimated 2015-23 subsidy changes ("ALL").

Table A.4: Counterfactual changes in exports and imports by strategic sector (in percent)

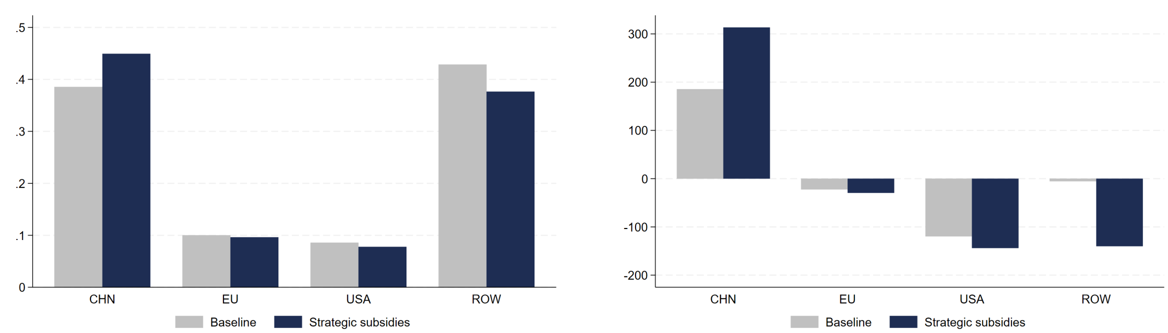
				Export changes				
Sectors:	Electronics	Transport eq.	Machinery	Electrical eq.	Chemicals	Pharma	Oth. manuf.	Fabricated Metals
AUS	16.6	1.4	-3.5	50.8	90.1	-4.3	-3.1	-2.1
CAN	61.8	8.4	7.5	77.2	7.0	23.6	-3.2	-1.9
CHN	19.0	2.4	5.2	3.2	2.2	8.5	2.6	3.0
EU	-1.7	1.1	-1.7	0.1	1.7	-3.5	-0.7	-1.1
GBR	-2.8	3.1	-1.0	25.3	-2.8	-0.7	-1.6	-1.0
IND	40.8	-3.4	-2.0	-3.5	-2.6	-1.3	-1.2	-0.7
JPN	-6.8	5.1	-1.5	-3.0	1.0	-1.9	-0.3	-1.0
ROW	-13.7	-1.8	-2.3	-6.9	-3.3	-0.3	0.3	0.6
RUS	-6.0	23.5	19.2	-1.9	-3.4	4.2	6.0	-0.3
TUR	5.4	-6.0	-3.4	-4.5	-3.4	-3.4	-1.7	-2.0
USA	-7.4	-2.9	0.2	1.8	1.9	3.4	-0.4	-0.2
				Import changes				
Sectors:	Electronics	Transport eq.	Machinery	Electrical eq.	Chemicals	Pharma	Oth. manuf.	Fabricated Metals
AUS	0.3	0.4	1.9	-9.1	-23.6	1.6	3.0	2.9
CAN	2.7	-1.0	-0.6	-8.5	0.5	-2.7	3.4	4.0
CHN	-12.1	-1.3	-3.7	-2.2	-0.7	-6.2	-1.0	-1.2
EU	3.5	-0.5	1.3	1.8	-1.9	3.1	0.8	1.0
GBR	2.5	-1.7	1.0	-5.5	2.2	-0.3	1.4	1.2
IND	-6.5	3.0	2.0	4.7	1.5	3.3	1.2	0.9
JPN	5.2	-3.0	1.5	2.8	-0.4	-0.3	0.3	0.9
ROW	10.7	1.4	0.8	3.7	2.9	-0.5	-0.4	-0.6
RUS	6.1	-14.4	-6.8	3.9	3.7	-1.9	-2.8	3.1
TUR	0.9	2.0	1.2	3.5	1.2	1.0	1.3	1.2
USA	7.2	3.5	0.4	1.1	0.1	-1.5	0.9	0.9

Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under a scenario where all countries and the ROW aggregate implement the estimated 2015-23 subsidy changes.

Figure A.8: World markets in electronics at baseline and under a counterfactual with subsidy changes by all countries

(a) Share of world exports

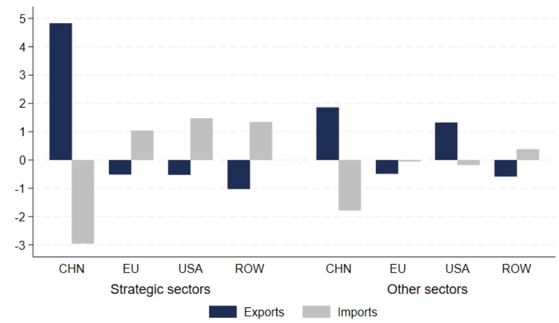
(b) Net exports (in billions USD)



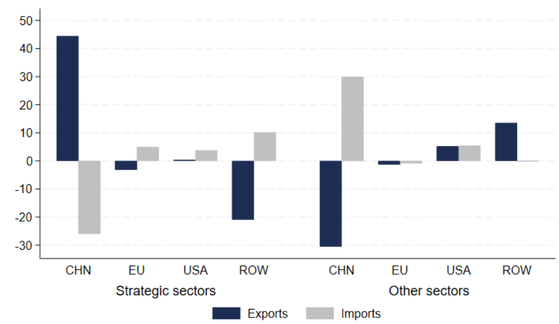
Note: Values at baseline are computed from the OECD ICIO data for the year 2015. World exports and net exports are computed for the electronics sector only.

Figure A.9: Simulated changes (in %) in exports and imports — alternative elasticities

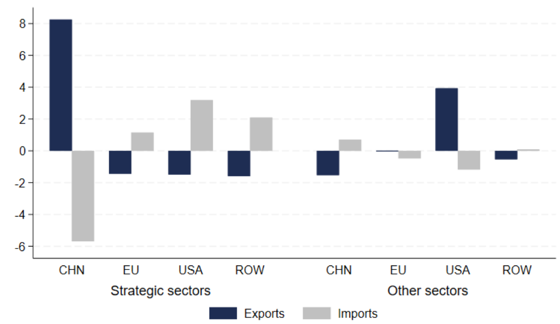
(a) No economies of scale



(b) Higher scale elasticities from Bartelme et al. (2025)



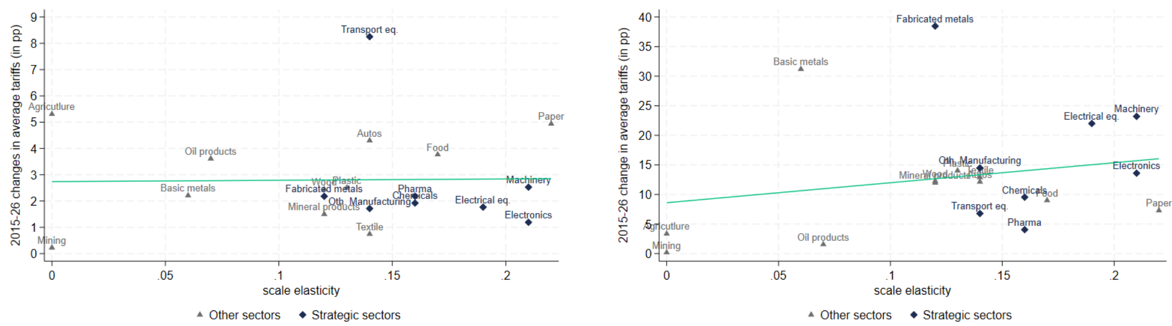
(c) Scale and trade elasticities from Lashkaripour and Lugovskyy (2023)



Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under a scenario where all the ten largest subsidizers and ROW implement the estimated 2015-23 subsidy changes. In Panel (a), scale elasticities are set to zero for all sectors. In Panel (b), scale elasticities are as in column (7) of Table A.1, and Table 1 in Bartelme et al. (2025). In Panel (c), trade and scale elasticities are as in columns (5) and (8) of Table A.1 and Lashkaripour and Lugovskyy (2023).

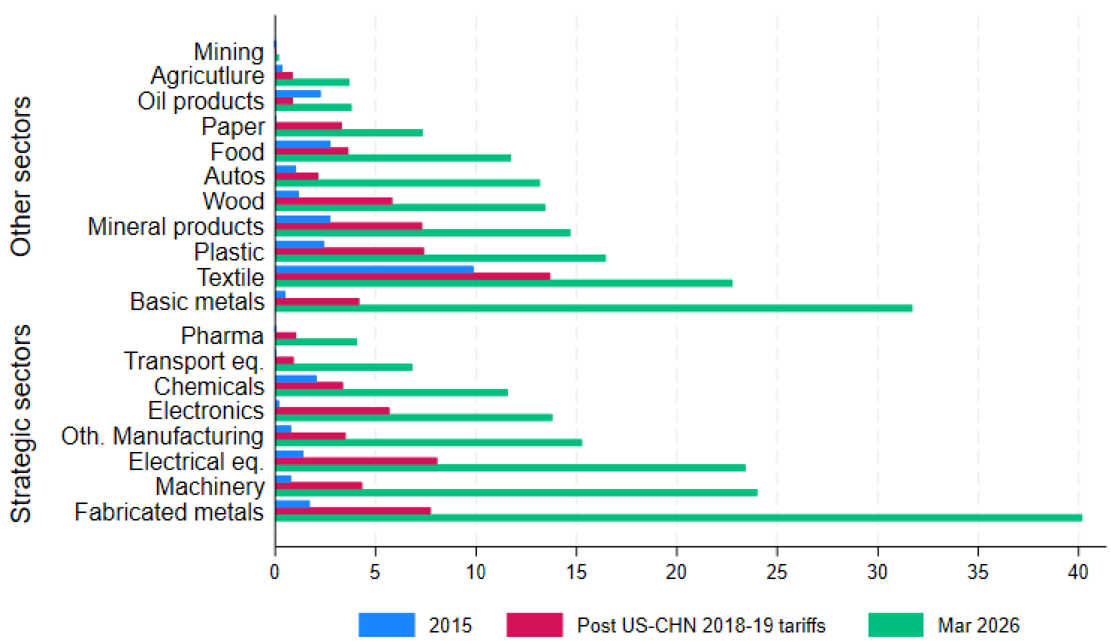
Figure A.10: 2026-2015 changes in import-weighted average tariffs and scale elasticities

(a) China's tariffs (b) US tariffs



Note: Import-weighted average tariffs using 2015 import values as weights. Tariffs on imports from all countries. For China, only tariffs on imports from the US have been updated to their levels as of March 2026.

Figure A.11: Import-weighted US import tariffs by sector (in percent)

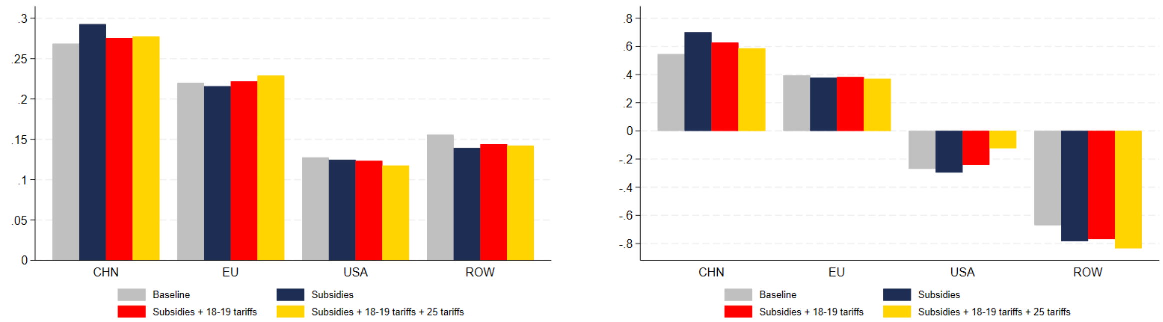


Note: Simple average applied tariffs at the HS 6-digit product level are aggregated using import weights from the CEPII BACI database in 2015.

Figure A.12: World markets in strategic sectors with China and US tariffs

(a) Share of world exports

(b) Net exports (in trillions USD)

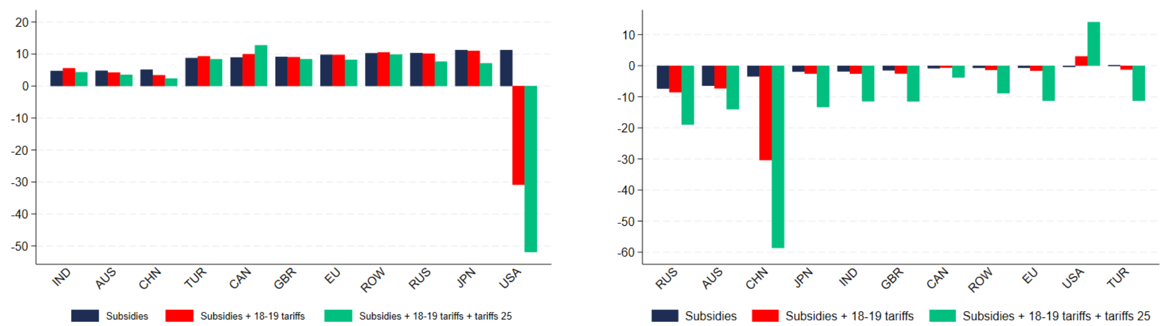


Note: Baseline values are computed using data from the OECD ICIO for the year 2015. The "subsidies" scenario includes the estimated 2015-23 subsidy changes by all countries. The "subsidies + 18-19 tariffs" scenario adds bilateral US-China import tariffs changes as during the 2018-19 US-China trade tensions. The "subsidies + 18-19 tariffs + 25 tariffs" further adds US and China tariff changes since February 2025, so that the counterfactual US and China tariffs are as of March 2026.

Figure A.13: Simulated changes in China's and US sales by destination (in %)

(a) China's sales

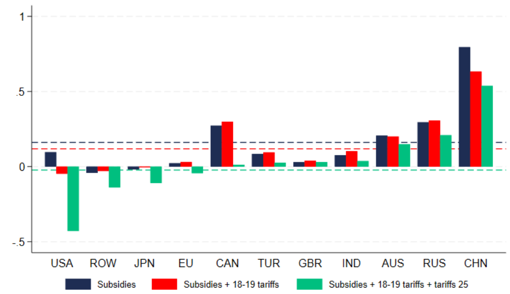
(b) US sales



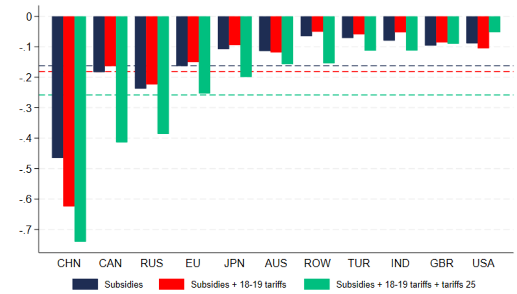
Note: Percent changes in trade flows in goods sectors evaluated at producer prices (net of tariffs and subsidies), under a scenario where all countries implement the estimated 2015-23 subsidy changes, a scenario where the US and China apply import tariffs at their post 2018-19 levels, and another scenario where the two countries apply import tariffs as of March 2026 (see Figure 9).

Figure A.14: Simulated changes in real wages and income (in %) — No economies of scale

(a) Real wages



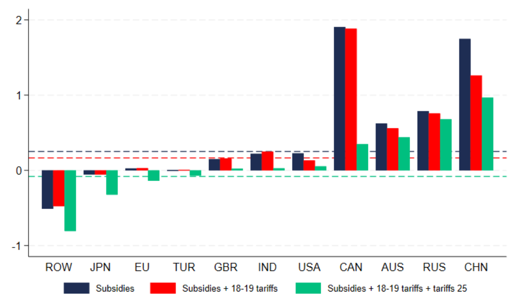
(b) Real income



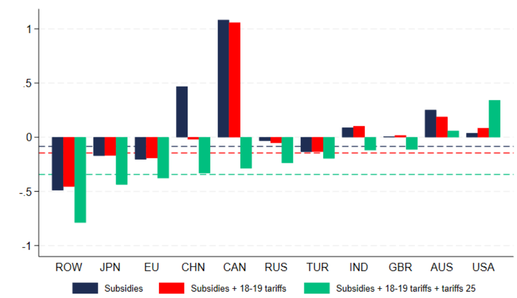
Note: Model calibrated with scale elasticities set to zero for all sectors. Horizontal dashed lines are world averages, computed using real GDP in 2015 as weights.

Figure A.15: Simulated changes in real wages and income (in %) — Higher scale elasticities

(a) Real wages



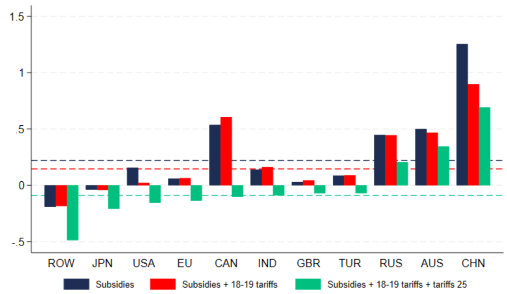
(b) Real income



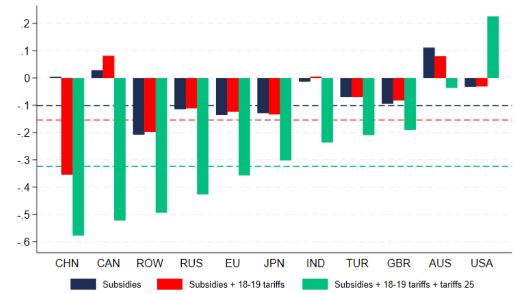
Note: Model calibrated with scale elasticities as in column (7) of Table A.1, sourced from Table 1 in Bartelme et al. (2025). Horizontal dashed lines are world averages, computed using real GDP in 2015 as weights.

Figure A.16: Simulated changes in real wages and income (in %) — Trade and scale elasticities from LL (2023)

(a) Real wages



(b) Real income



Note: Model calibrated with trade elasticities as in column (5), and scale elasticities as in column (8) of Table A.1, sourced from Lashkaripour and Lugovskyy (2023). Horizontal dashed lines are world averages, computed using real GDP in 2015 as weights.

PUBLICATIONS

Industrial Policy and Trade Tensions in Strategic Sectors
Working Paper No. WP/2026/154